

Public Engagement and Science and Technology Policy Options (PESTO)

Final Report

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Summary and Contents

The research project, Public Engagement and Science and Technology Policy Options (PESTO), SOE1-CT96-1016, has been conducted from July 1996 to January 1999 with the support of the European Commission, through its program in targeted socio-economic research (TSER). The project was carried out by research teams in Denmark, Italy, Lithuania, the Netherlands, Norway, Sweden and the United Kingdom.

Our objective in the project has been to examine both the new social networks that are being constructed in science and technology in different European countries, particularly in pursuit of a more sustainable development, and to see how the broader public interest is being taken into account.

This report presents a summary of the results of the project, drawing on two published volumes of PESTO Papers and a large number of works in progress. A full list of publications and working papers is appended to this report.

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Chapter One

Introduction: Issues and Concepts

I. Background¹

Throughout Europe, science and technology policy is in a process of reconstitution. On the one hand, there is a general trend towards international collaboration and coordination, along with decreasing direct national state control. There is also a growing commercialization and privatization of research and development activities, as well as the emergence of what has been termed a new, externally-determined "mode" of knowledge production, which transcends traditional disciplinary and institutional boundaries (Gibbons et al 1994).

On the other hand, there has been a doctrinal shift in many areas of science and technology to the new tasks of "sustainable development", which often involve new combinations of corporate, governmental and non-governmental actors. Emphasis is increasingly given in many national and international research and development (or R&D) programs to the institutionalization and development of environmental management procedures and so-called cleaner technologies. As such, environmental R&D is no longer the responsibility of a delimited sector; rather, environmental concern has begun to be diffused across the entire realm of science and technology policy in relation to a variety of different, and often conflicting, projects of "ecological transformation".

In a schematic form, environmentally related science and technology policy can be seen to have gone through six main phases since the 1960s (see box).

Phases of Environmental Science and Technology Policy	
<i>Period</i>	<i>Emphasis</i>
1) pre-68: awakening	public education and debate
2) 1969-74: sectorization	institution building
3) 75-80: public mobilization	energy policy
4) 81-86: professionalization	environmental assessment
5) 87-92: internationalization	sustainable development
6) 93-: integration	ecological transformation

In the 1960s, a range of new societal problems were identified, from chemical risks to automotive air pollution, which gave rise to widespread public debates and eventually

¹ This section has been written by Andrew Jamison

to a number of policy responses. The postwar mode of techno-economic development, with its dependence on science-based innovations and its relatively unproblematic view of science and technology, was shown to have serious "side effects"; and the 1960s ushered in a period of questioning, criticism and reexamination of the dominant socio-economic development and science and technology policy doctrines (Salomon 1977).

By the end of the 1960s, the period of questioning had inspired both the emergence of new activist groups, as well as a process of policy reform and institution building. In this second phase, most European countries established new state agencies to deal with environmental protection and other newly-identified social problems, and environmental research and technological development were organized in new settings. Many national parliaments enacted more comprehensive environmental legislation and, at the United Nations Conference on the Human Environment in Stockholm in 1972, the environment was recognized as a new area of international policy concern.

In this period, there was, more generally, a reorientation of science and technology policy to a societal agenda. In the influential report, *Science, Growth and Society* in 1971 (the so-called Brooks report), the Organization of Economic Cooperation and Development (OECD) proposed a range of new societal areas for state support for scientific research and technological development, as well as a new kind of "assessment" activity that was suggested to be included in science and technology policy (cf. Elzinga and Jamison 1995). One of the most important new science and technology policy *sectors*, as they came to be called, was environmental protection.

From the first oil crisis until about 1980, there was a shift in environmentally related science and technology policy, as energy issues moved to the top of many national political agendas, especially in relation to nuclear energy. An important result of the energy debates of the 1970s was a professionalization of environmental concern and an incorporation by the established political structures of what had originally been a somewhat delimited political issue (Jamison 1996). As a result, there was a both a specialization and transformation of knowledge production.

When nuclear energy was removed from many national political agendas in the early 1980s, there was thus a range of expertise that had previously not existed. In many European countries, there were university departments and research institutes, as well as substantial state bureaucracies and non-governmental organizations, which had an institutional interest in environmental and energy issues. But there was also, in this period, an ideological shift in the world of science and technology policy, from a social orientation to a more economic emphasis. A new language of deregulation and strategic research, and new programs that stressed the importance of "university-industry collaboration", came to replace the notions of societal assessment and many of the sectorial programs that had been established in the 1970s.

In the mid-1980s, however, environmental concern emerged once again, but in a new more, "global" guise. A range of new environmental problems - climate change, ozone depletion, biodiversity - replaced local problems as the main areas of concern, and the solution to these problems came to be characterized in the vocabulary of *sustainable development*, following the report of the World Commission on Environment and Development in 1987, which drew on terminology previously articulated by the World

Wildlife Fund (WWF). Environmental protection, and approaches to other societal challenges, were reconceptualized in economic terms. The environmental discourse, in particular, was reframed in more constructive, or reformist language (Hajer 1995).

The idea of sustainable development showed itself to be filled with contradictions, and it has, in the intervening decade, proved notoriously difficult to realize in practice. Following the so-called Earth Summit in Brazil in 1992 (the UN Conference on Environment and Development), many of the central actors in environmentally related science and technology policy have come to characterize their activities as part of a more explicitly defined environmental industrial policy, which has come to be termed "ecological modernization" (Rinkevicius 1998).

A growing number of business firms have adopted new methods of environmental management, including environmental auditing, recycling of waste products, and more efficient uses of resources and energy in production processes, while new forms of regulation and policy making have developed at the national and transnational levels (see box).

Principles of Ecological Modernization

- "pollution prevention pays"
- academic-industry interaction
- flexible, or soft regulation regimes
- economizing of ecology
- faith in advancement of science and technology
- dialogue and consensus in decision-making
- international cooperation

For some, the shift is seen as a change in production paradigm, while for others it is primarily a shift in rhetoric and public relations. Increasingly, however, environmental concern is being integrated into corporate planning and innovation strategies, while many management and engineering schools have begun to provide training in environmental economics, as well as in the new methods of "cleaner" production.

In many respects, these shifts can be seen as a convergence of interests between environmental organizations, governmental agencies and business firms. The shifts in orientation have manifested themselves both on a discursive level, where new principles of environmental science and technology are being formulated, as well as on a practical level, where "networks of innovators" are serving to link universities,

business and government agencies in new configurations. In between, at an intermediary institutional level, policy-makers seek to design appropriate programs and policy measures to move science and technology in more strategically "ecological" directions.

What is often lacking, however, is sufficient understanding of the relevant factors that shape and/or constrain effective policy response. It can therefore be valuable, both for practitioners and policy makers alike, to compare national experiences in a more systematic fashion, as well as investigate the cultural dynamics of the transformation processes. It has been our project's point of departure that culture, particularly in the form of national policy styles, historical experiences and idea traditions, works as a kind of filtering mechanism, by which transnational processes are appropriated into particular contexts (Hård and Jamison 1998). The PESTO project has sought to apply this perspective to the world of ecological transformation.

II. Discursive dissonance: Ecological modernization vs risk society²

Throughout the OECD countries, it was at some point in the 1980s that environmental concern ceased to be a living source of collective identity for a relatively small number of "movement" activists and became instead a much broader society-wide discourse. The apocalyptic tones, the "bad news" that had characterized so much of the environmental debate up till that time was gradually transformed into the encouraging, good news rhetoric of sustainable development, which has since then become a highly variegated source of inspiration for very different kinds of social actors.

This discursive shift is, of course, intimately connected to changes in the character of the international political economy. By the mid 1980s, production had become increasingly globalized in many branches, with research and invention often carried out in one part of the world, technological innovation and development in another, and manufacture in still others. Individual firms had increasingly become nodes in transnational corporate networks, and socio-economic, and even many socio-cultural, relations, had come to be governed by international patterns of production and diffusion. Both in terms of production and consumption, the fundamental structures of organization and decision-making had moved to a transnational space, making it increasingly difficult for nation states and governments to impose their own policy agendas.

In Europe, these developments have fed into the efforts to integrate policy making and to develop new kinds of institutions at a European "level". Increasingly, economic activity is conducted across national boundaries, and the key policy functions have been taken over by European regulations, commissions, authorities, and agencies.

For environmentalism, and environmentally related science and technology policy, there has been a shift in substantive focus - from the local and national to the global, when it comes to the issues to be dealt with - as well as a shift in location - from

² This section draws on Andrew Jamison and Brian Wynne, "Sustainable Development and the Problem of Public Participation," in Jamison, ed 1998

national bodies to intergovernmental and international organs, when it comes to policy making and implementation. But the quest for sustainable development has also led to its own contradictions and tensions. Two main discursive options, or bonding narratives, have come to be articulated: ecological modernization, on the one hand, and risk society, on the other.

Ecological modernization can be considered a pragmatic narrative of societal adjustment: the aim is to integrate the solution of environmental problems into "business as usual", to translate environmental improvements into the instrumental language of the marketplace. Its proponents contend that the new policy agenda requires a kind of management expertise to complement the traditional kinds of scientific-technical expertise that had previously dominated the worlds of environmental science and technology. What is needed, at various levels and in various ways, is an expertise in societal adjustment, environmental management, life-cycle analysis, risk assessment.

The other grand narrative has come from sociology, and is often referred to as the risk society thesis. Originally formulated in the 1980s by Ulrich Beck in Germany, it has since been developed further by a number of sociologists throughout Europe, most influentially perhaps by the British social theorist Anthony Giddens.

The Risk Society Thesis

In his 1986 book, *Risikogesellschaft*, the German sociologist Ulrich Beck described processes of individualization going on in the mainstream institutions of modern society, fragmenting them from within and destroying the individual's identification with them - the institutions of work, family, education, politics, etc. Against this backdrop the further factor of environmental risks intensified these dynamics, according to Beck, and gave them their fundamentally new and distinctive form. These risks, he argued, are generated by modern science and technology, and yet are no longer contained and controlled by them. Modern science, the epitome of modernity, has created a monstrous and comprehensive risk situation, yet cannot manage it. Even worse, according to Beck's thesis, scientific institutions cannot summon the integrity or maturity to acknowledge and take responsibility for this dire and historically new predicament (Beck 1992; cf Beck 1995).

Faced with this central breakdown of the scientifically-inspired maintenance of civil security, as Beck describes it, citizens at large have withdrawn identification, trust and legitimacy from modern scientific and expert-led institutions. Modernity as such has taken a reflexive turn, as ordinary people question the basis of political and technical authority. People instead identify with new informal, extra-institutional forms of political activity often focused around issues previously defined as unpolitical, like lifestyle, health, and cultural practices; hence the growth of new "subpolitical" spheres and movements and cultural interest-groups of myriad kinds actively hostile to conventional institutional politics and policy.

Anthony Giddens' version of this reflexive process of sociocultural change in what he calls "high modernity", contains some key differences but also similarities with Beck's account (Giddens 1990 and 1991). He emphasizes more the rise, in every walk of life, of expert disagreement and uncertainty, and the lay public's unprecedented encounter with a radical existential need to make life-identity choices (including, crucially, "which experts shall I trust?"), choices that were previously taken care of by monolithic - and according to Giddens, trusted - expert institutions. Giddens shares Beck's account of the globalization, severity and irreversibility of risks, but stresses not so much the role of ignorance (unanticipated environmental effects) in generating public mistrust, but the self-reflexive knowledge, as he sees it, of the modern scientific temper as it has diffused more widely in modern society.

For Beck and Giddens, and many of the new environmental sociologists whom their writings have inspired, the type of knowledge that is called for in this risk society is thus a more reflexive science, a critical socially-informed environmental science (Macnaghten and Urry 1998). Rather than being based on the instrumental, or technological, rationality of science and engineering, it should be based on the interactive, or communicative, rationality of the social and cultural sciences. And rather than being limited to experts and professionally certified scientists and engineers, it can and should be able to be practiced by all. It should be a participatory form of knowledge, a "citizen science" (Irwin 1995).

This bifurcation of the quest for sustainable development can be seen in different ways throughout the world. But it is perhaps especially when we look into the world of science and technology policy, where priorities for knowledge production are made, that the discursive dissonance becomes most apparent. Research programs in engineering, economics and management, often appear to pull in one direction, while programs in the human or social dimensions of environmental change pull in another. It has been the aim of the PESTO project to explore this new "dialectics of environmentalism" as it has developed across Europe.

III. A Cultural Approach to Science and Technology Policy³

Our research strategy has been to move from the general doctrinal level to an explorative investigation of some of the emerging practices in the environmental field. We have tried to transform the general structural model of a national policy system, or realm, that is drawn from the literature on science and technology policy, into socio-cultural terms (cf Lundvall 1992; Nelson 1993).

While most analysts - and most of the TSER projects - have focused on the economic aspects of science and technology, or innovation, policy, our interest is directed to the socio-cultural dimensions.

Our framework characterizes science and technology policy as a dynamic social process; it has been developed in order to complement approaches that emphasize the economic, or management, elements in science and technology policy. The general approach is socio-

³ This section has been written by Andrew Jamison

historical, and is based on the assumption that participants, or actors, in policy processes are, to a large extent, shaped or influenced by the contexts in which they work.

The framework identifies the main actors in science and technology systems in terms of four ideal typical *policy cultures*, or policy domains: academic, bureaucratic, economic and civic (cf. Elzinga and Jamison 1995). Each domain represents a particular constituency, a particular cluster of networks and organizations. The making of science and technology is seen as a process of interaction among the policy cultures. In PESTO we have come to refer to these interactions as "cultural tensions" and we think of these tensions working themselves out in relation to different levels, or dimensions, of policy making (see figure).

The Cultural Dimensions of Science and Technology Policy				
	Policy Culture			
	<i>Bureaucratic</i>	<i>Economic</i>	<i>Academic</i>	<i>Civic</i>
Dimension				
<i>Principle</i>	order	growth	innovation	accountability
<i>Steering mechanism</i>	planning	profitability	peer review	public assessment
<i>Ethos</i>	formalistic	entrepreneurial	scientific	participatory

On the one hand, there is the macro, or societal level, where the basic doctrines or principles of science and technology policy are formulated. Each domain has its own dominant conception of science and technology policy, and it is not always easy to reach agreement at this level. The bureaucratic domain sees science and technology primarily as means to achieve various policy objectives: here we can speak of *science and technology for policy*. The academic domain, on the other hand, is concerned with the development of science and technology for their own sake: there is a fundamental interest, among scientists and academic engineers, in *policy for science and technology*.

The economic and civic domains represent broader private and public interests, respectively, which are primarily interested in the applications of science and technology. Policy making for science and technology is thus connected to other kinds of policy making. The economic domain is interested in science and technology, or innovation, policies that are directly integrated with economic, industrial, and financial policies, while the civic policy culture, as represented by local government and non-governmental organizations, generally seeks an integration of science and technology policy into social, cultural and environmental policies.

At a meso, or intermediary, level, the negotiation, or tensions, among the various actors revolves around the choice of relevant steering mechanisms. Again, each culture has its own favored types of policy instruments or measures. The academic domain, in general,

seeks to retain control over the research process; here the favored mechanisms consist of various forms of what is called peer review. In policy terms, this means that scientists and engineers are interested in seeing their own representatives take part in the making of priorities and in the development of new institutional forms. The bureaucratic culture, the domain of the state ministries and departments and agencies, wants to coordinate the various efforts, while, for the economic culture, profitability is the main concern. Projects should be selected that have a reasonable chance of leading to marketable products.

It is from the civic culture, as represented by an international, non-governmental and intergovernmental community, and nationally organized among environmentalists and other voluntary organizations, that the call for sustainable development, public assessment and social accountability has been raised. The tensions among the policy cultures at the meso level are thus manifested primarily as a set of negotiations over particular policy proposals.

The micro, or practitioner, level is where the cultural tensions can perhaps be seen most directly. Here, the various norm or value systems - what Max Weber referred to as the dominant *ethos* of a particular group of social actors - often come in conflict over the implementation of particular projects. A cultural analysis can often provide a better understanding of these conflicts than economic analyses; in any case, a cultural analysis can certainly help clarify the disagreements and difficulties that arise in the process of combining different policy objectives.

In the PESTO project, this model has been applied to science and technology policy in the environmental field, and in the related field of transportation. We have examined the interactions among the different constituencies in particular national settings. Our range of countries includes Britain, where the academic domain has traditionally been dominant in science policy and where technology policy has largely been left to the private sector, or economic domain; Sweden and Norway, where the bureaucratic and economic interests have been historically dominant; Denmark and the Netherlands, both with strong civic traditions, but with different combinations of bureaucratic, economic and academic influences; Italy, with a characteristic balance among the four policy domains; and Lithuania, struggling to emerge from the bureaucratic order and reinvent academic, economic and civic traditions. By investigating experiences in such a wide range of countries, we have sought to distinguish those factors that are nationally, or culturally specific from general historically convergent factors that are at work throughout Europe.

Our overall aim in PESTO has been to explore the relations between sustainable development and public participation, what we have come to refer to as the cultural politics of sustainable development. With disciplinary backgrounds in sociology, history and the theory of science, we have examined science and technology policy through a cultural lens. Rather than assess policy options on the basis of their managerial effectiveness or their technical efficiency, we have sought to bring in the "actors" and see what is actually going on in the name of sustainable development. We have tried to elucidate the cultural dimensions of science and technology policy: the human tensions and conflicts that are central to the making of policy, but which are rarely examined explicitly.

Our research strategy has involved three main thematic components, or "work packages":

- 1) **the public/policy interface,**
- 2) **networks and brokers,** and
- 3) **transnational linkages.**

In the following chapters, we present the main results of our research. Since we have already presented the results of work package one in published form (Jamison, ed, 1998), we present the results of work packages two and three in somewhat more detail.

Chapter Two

On the Public/Policy Interface

I. The Resistance of the Established⁴

At a time when the role of the state is being diminished in many areas, thus calling into question traditional notions of democratic process and representation, the quest for sustainability has led to an array of new modes of public participation in knowledge production. Indeed, a broader public involvement has come to be seen as fundamental to the effectiveness of many of the new policy proposals and measures.

Despite a certain rhetorical association between environmental sustainability and democratic renewal, however, the dominant forms of public policy discourse continue to serve as obstacles for broader participation. On the one hand, there has been a transfer of responsibility in many areas of environmental science and technology policy from the public to the private sectors, and a decrease in direct state involvement in research and innovation. Privatization has tended to limit public access to decision-making and to the setting of policy agendas. On the other hand, the typical form of policy making privileges technical expertise; in problem formulation, as well as in policy implementation, an instrumental and objectivist mind set delimits human agency, and tends to reduce social and political issues to matters of technical measurement and expert evaluation. Even non-governmental organizations are often affected by this scientific cultural bias, seeking niches in the policy arena for instrumentalized and professionalized versions of environmentalist ambitions.

The instrumental forms of knowledge which are virtually a defining feature of policy and expert advice embed and reproduce existing implicit conceptualizations of the human subject and our instrumental relationship with nature. This instrumentalism does

⁴ From Andrew Jamison and Brian Wynne, "Sustainable Development and the Problem of Public Participation," in Jamison, ed 1998.

not only pertain to natural-scientific or technological forms of knowledge, which have been defined by the epistemic principle of instrumental prediction and control at least since the scientific revolution. It also pertains to many of the social sciences, especially economics, which plays a dominant role in the realm of public policy. Instrumental and behaviourist social sciences, such as most of psychology and political science, geography, economics, demography and many others, are epistemically correspondent with the natural sciences in these respects, humans being analytically constructed as objects which follow deterministic laws of behaviour.

Public policy discourse can never be purified of human correspondences which take on normative dimensions, but those normative dimensions should be rendered more transparent and publically accountable. It seems that problematic representations of the human are being exercised but, at the same time, buried from open view in modern expert-led policy discourse about environment and risk. Moreover, the kinds of tacit assumptions, projections and representations of the human are not simply hypothetical models which are cast upon the waters of public debate and response to be tested and, if inadequate, revised or replaced. They are typically not even recognized as existing and influencing public self-understandings, because scientific discourse is vehemently defended as exempt from any such human dimensions. By default they become not merely representational errors, but an ontological program which in effect imposes itself as normatively authoritative definitions.

If such tacit human representations are inadequate, they are not open to correction by purely intellectual means because they do not identify themselves in this way. Because they are tacit, they are perhaps not even conscious or deliberate, but merely reflect available cultural resources in the prevailing policy and disciplinary realms. Thus public reactions to the possible inadequacy of such human representations are also likely to be indirect, and cultural/practical rather than intellectual. They are most likely to take the form of disaffection, alienation, lack of moral identification, mistrust and practical self-differentiation without necessarily being explicitly rationalized, deliberated, and "chosen" through conscious decisions. The result is a culturally rooted, humanly engendered response to what may often (though not always) be a diffuse sense of profound alienation from the implicit representations of the human in dominant discourses.

Such an interpretation of a basically cultural process of public recoil and alienation from expert-led rational policy making and surrounding debate (for example in the ways the public is represented in debate of public understanding of science, or in surveys of attitudes to environmental risks and science) is entirely consistent with the widespread research finding and common experience of public mistrust of and disaffection from modern forms of policy discourse on risks, environment and related issues (cf Macnaghten and Urry 1998). Open recognition of the ultimately conditional nature of their scientific knowledge by expert institutions would be a prior condition of their public authority and legitimacy. Yet they still appear to exercise a contrary cultural instinct, in the often implicit assumption that their public authority depends upon the concealment of any such indeterminacies underlying their explicit expertise.

The actual modes of "public participation" that have emerged in recent years - from local Agenda 21 activities to hearings and consensus conferences and innovative

approaches to technology and environmental impact assessment - are highly fragile and, in many countries, appear to be disconnected from the real sources of power and decision-making. While serving to construct new forms of consciousness and raising awareness about connections between different environmental problems, as well as between environmental and broader social welfare issues, the participatory experiments are often temporary. At the same time, seeds for new forms of representation are being planted, but their implications are highly ambiguous. Embryos of new public interest are perhaps developing in green lifestyles, new cultural identities of "deep ecology" and animal liberation, as well as new forms of local-based "subpolitics" which have not yet had any meaningful connections with formalized, established forms of politics. What "publics" are actually being represented is, however, still largely indeterminate.

In the following sections, we approach these issues by attempting to problematize the roles of the public in relation to sustainable development. Public participation, or civic engagement, are terms that are often invoked by policy makers, but seldom reflected upon in a particularly serious or systematic fashion. The public is supposed to be involved in decision making: such is the rhetoric of democracy. It is on behalf of the public, however amorphous or abstract that public might actually be in reality, that decisions are made, agendas and new doctrines are formulated and programs and projects are implemented. But how does the public manifest its multifaceted interests in the making of policy decisions?

In academic discourse, the public is a vague, even contradictory, entity, continually reinventing and redefining itself, organizing itself in new constellations - movements, interest groups, political parties, non-governmental organizations - and repeatedly imagining new "roles" for its own various component parts to play. What is to be meant by participation? What influence, if any, is the public allowed to have over the deliberations of governments and parliaments? What forms of involvement are culturally acceptable and which are not? These are extremely difficult, but at the same time extremely important, questions to try to answer. At a time when policy decisions in many areas of public life are becoming ever more "globalized" and the distance between the public and the policy makers is generally increasing, it is a central democratic task to address the issue of participation.

In relation to science and technology policy, the public has an especially difficult time, for this is an area usually reserved for "experts", and the opportunities for the public to make itself heard are even more limited than in other areas of policy making. In order to analyze these processes, we have drawn on different kinds of theories and conceptual frameworks and explored different examples of public participation, or civic engagement.

II. On Policy Entrepreneurs⁵

Policy entrepreneurs can be seen as a particular type of entrepreneur, who establishes connections where none existed before among actors with different backgrounds, or

⁵ From Marco Giuliani, Leonardas Rinkevicius and Arni Sverrisson, "Making Participation Happen: The Importance of Policy Entrepreneurs," in Jamison, ed 1998

develops existing weak relations, changing their content, with the express aim of influencing policy. Such strategically placed entrepreneurs who create, amplify and maintain links among groups located within different policy domains, creating what we can call sustainable technology networks, are needed exactly because the "normal" networking is insufficient. Put more simply, activists, academics, corporate leaders and politicians tend to talk to or even at each other and not with each other.

The linking activity may be pursued explicitly, trying to attract the support of diverse interests in order to establish a firm network, or implicitly, simply providing the means for mutual recognition and sharing of information by clusters of actors otherwise weakly connected. Thus, the introduction of environmental standards may not need this type of coordinating activity, but their implementation in a variety of contexts does. The adoption of programs like, for example, the implementation of the Agenda 21 goals at a national or local level is also favored by broader webs of relationships.

Example: Waste Policy in Milan

An interesting case of political entrepreneurship is the recent restructuring of the solid waste policy of the municipality of Milan, after a severe crisis due to the closure of the main garbage dump near the city, which left uncollected garbage in the streets for around twenty days. With an optimal timing, the councilor responsible for the environment, a former environmentalist with a technical background, managed to introduce a few simple policy measures, mainly regarding recycling, which rapidly increased the percentage of sorted and separately collected garbage from around 5% to around 30%, among the highest in Europe. At the same time, consensus about this solution was created thanks to the mediation of the leader of the Green party in the regional assembly. Now in opposition, he had earlier been in charge of the local environment agency. Both actors had an expertise in the field due to their professional careers and both were (or used to be) insiders of the administrative machine. They could also rely upon the support of the local environmental groups. In virtue of this, they were able to address both the concerns of the citizenry and those of the bureaucratic organizations involved. They were also both deeply engaged in the effort of tackling the problem they were facing. Thus, though with distinct aims, they both interpreted the demands of varied actors for a solution to the garbage crisis in a similar way, and used the opportunity to introduce a solution which was already known elsewhere and somewhat overdue in their own context.

Because policy-making is both a strategic/organizing and cognitive/discursive activity, the outcomes are strongly dependent upon the capacity of leading actors to tie together an adequate number of supporters - politicians, bureaucrats, interest-groups, stake-holders, etc. These interpretations or story-lines (Hajer 1995) must, in order to be effective, draw together experts and policy-makers, activists and lay-people. Policy entrepreneurs consequently act at both these levels by constructing alliances *and* molding policy discourses. Their contribution appears particularly relevant whenever they dismantle petrified (op)positions and open the road to new alliances through the reinterpretation of long standing dilemmas. Hence, policy entrepreneurship becomes particularly important in providing paradigms for policy making which reconcile the need for regulation and the profit motive, state control and market mechanisms. This is

typical of the new types of environmental policies now emerging, which address the ways in which companies manage production and distribution processes, and the development of technologies used in such processes. Demonstrating that zero-sum games can be positive-sum games, that 'green and clean' can be cheaper as well, thus neutralizing old cleavages, is among the main functions of policy entrepreneurship in the environmental field today.

Let us briefly summarize the characteristics of policy entrepreneurs. First, they are *leaders* who are recognized as such by other actors. Second, they are *innovators*: they do not administer routine processes but foster reforms and advocate change. Third, they are *catalysts*, who mobilize latent and manifest networks. Lastly, they are *public debaters*, interpreting the issues as well as the discursive consensus within particular coalitions to their own ends.

The first step for policy entrepreneurs is to acquire credible positions, to be taken seriously, as it were. Although a policy entrepreneur will probably derive her credibility from one of the policy domains referred to above - namely the bureaucratic, the economic, the academic and the civic domains - her legitimate authority to speak on environmental issues and their implications for science and technology policy will have to be recognized by a wider public. No single resource is likely to be sufficient to establish a legitimate position but below we discuss a number of resources which can be drawn upon for this purpose.

First of all, though holding some *formal position* of responsibility is neither a defining nor a necessary condition for entrepreneurship, still it may reveal itself as a powerful resource which can be activated and exploited by policy entrepreneurs. Top executives, like the Minister for the Environment, or the Head of a regional department for environmental affairs, are certainly bound to the bureaucratic organization of their office. Nevertheless it is possible to observe the innovative turn impressed on their office by top executives highly committed to conservationist goals.

The same may happen in the economic domain. New generations of business-people and engineers exhibit a growing concern with the environmental effects of their industries, manifested in a concrete interest in finding a "third way" between "economical but polluting" products and "clean though expensive" ones. Looking for this compatibility - which is not a simple trade-off between the two extreme solutions - they perform exactly the cognitive and strategic functions which are typical of policy entrepreneurs in the environmental field.

A second type of resource which can be activated by policy entrepreneurs are *personal links*. These contacts may date back to their professional formation, to the university period, or to some other experience made in their youth (belonging to the same association or simply attending similar events). Since one of the features of policy entrepreneurs is the capacity to build transversal alliances, the possibility of relying upon solid personal links is a useful resource. These ties allow a quick circulation of information and innovation and, most of all, are based upon a degree of mutual trust, which favors a cooperative attitude. Hence, policy entrepreneurs develop into brokers between different universes - e.g. environmentalists and academicians, politicians and

interest groups - translating their special languages and becoming a sort of guarantee for the integrity of the bargaining.

Example: Policy Institutionalization in Lithuania

The institutionalization of environmental policy in Lithuania provides several illustrative examples of policy entrepreneurship. Some of this entrepreneurship is reflected in the intra-domain type of policy change. One example is the recombination in the bureaucratic domain of the separate organizational units in charge of water, air and land protection, and creating a single regulatory body. This process to a large extent depended on the entrepreneurship of actors formally rooted in the governmental agencies, but also on a new type of policy entrepreneur who did not have a formal post in the public administration. The new policy entrepreneurs, often coming from the academic domain, were developing and defending new approaches to environmental policy and administration. Their entrepreneurial activity can be also viewed as aiming at developing a new paradigm. Besides institutionally recombining the control of air, water and soil pollution, their entrepreneurship was aimed at integrating an eco-modernist approach based on “polluter pays” principle into the new body of public environmental administration which later became the Department of Environmental Protection. Moreover, they opened up opportunities for a younger generation of environmental economists, landscape planners and other “eco-modernists” to get established at the Department (transformed into the Ministry in 1994) of Environmental Protection. Initially being the general practitioners gradually fostering a new environmental S&T policy approach, these younger actors have become important policy entrepreneurs not just defending the new regulatory regime, but also actively developing new networks which lead to new policy initiatives and innovations. This type of policy entrepreneurship involves in particular active networking in relation to the Western countries and actors there promoting cleaner production, environmental management systems, eco-labelling, green taxes, ecological investment funds, etc.

A third type of resource which may prove to be useful for the action of policy entrepreneurs is *expertise* and the selective control over *information*. Though both these elements seem to be peculiar of the activity of experts and academicians, the range of policy-makers who nowadays have a conscious access to relevant data and information has increased. Environmental associations have their own think-tanks and research institutes, and often conduct their own monitoring of the state of the environment. Private enterprises, if big enough, produce their own innovations in order to find new production technologies. Each country has its own national research organization explicitly devoted to science and technology which, together with several expert groups, produce the sort of knowledge which public administrations look for. Free-floating intellectuals and opinion-makers can also on occasion be the catalysts needed for changing the direction of policy making. Finally, universities tend to produce their own wisdom which, not being necessarily tied to specific problems or needs, may represent alternative ways of looking at concrete problems. In this context, policy entrepreneurs may be unable to compete directly in the academic domain according to the mores of knowledge production, but they can favor the promotion of particular ideas and interpretations in various ways and sponsor suitable projects. They

link separate circuits, encouraging the cross-fertilization of ideas and exploiting the opportunities which open up within different domains.

III. Public Participation in Infrastructure Projects: The Case of the Dutch InfraLab⁶

Most European countries are facing a similar dilemma, or contradiction. On the one hand there is a pressing need for more effective transportation systems to keep the wheels of industry, trade and especially tourism rolling. The big infrastructure projects that are being put in place are central components in a new project of modernization that is aimed at the economic integration of Europe. Increased mobility - for workers, for students, for companies, for tourists and for products - is seen by many policy makers as the key to a European strategy to compete successfully with North America and East Asia in an ever more intense regionally-based market competition. In a global world, we have to travel more and make ever more use of our transportation infrastructure if we are to retain our prosperity and affluence.

On the other hand, environmental problems, especially those caused by transportation, are highly visible and appear, by all accounts, to be increasing. And in many countries, but perhaps particularly in Britain, awareness of these problems has aroused a new wave of citizen protest and activism. The so-called anti-roads campaigns have been dramatic, highly contentious, and quite well publicized.

Throughout Europe, a new phrase has thus begun to work its way into the policy discourse: sustainable transport. Like sustainable development, there has emerged the vision of a "win win" strategy in relation to transportation as part of a broader discourse of ecological modernization. According to the doctrine of sustainable transport, not only can mobility increase, but environmental problems can be taken care of, as well. What is needed are new forms of constructive or pro-active environmental and technology assessment, including new kinds of citizen involvement or public participation in decision making.

Even if these social experiments have not yet found their most effective or appropriate form, they have been important in other respects, both in terms of broadening the idea and the practice of democracy, but also in terms of what we might call a social process of evaluation or assessment. In that sense, they might well be thought of as seeds for a new phase of modernity, which the social theorist Ulrich Beck has given the name reflexive modernity. The experiments in citizen involvement in infrastructure projects, like the well known Danish experiments in consensus conferences and pro-active technology assessment, can perhaps be considered policy "instruments" of a more reflexive kind of development, in which decisions are scrutinized in public both before, during and after they are made.

One of the distinctive features of the kind of infrastructure projects that dominate transportation policies is the scarcity of formal mechanisms through which organized

⁶ From Patrick van Zwanenberg, Robbin te Velde and Per Østby, "Roads to Sustainable Transportation? On Public Engagement in Infrastructure Projects," in Jamison, ed 1998. Slightly modified by Andrew Jamison

civic interests can participate in core aspects of the policy-making process. One consequence is that the civic domain finds itself having to engage with pre-existing policy agendas, agendas that have been defined and framed by prevailing understandings about both the role and nature of policy and about what is actually at stake in any particular policy.

These official framings typically reduce what are complex technical, political and human problems to narrowly defined scientific and administrative issues that are seemingly uniquely suited to expert and managerial control. That reductionist process tends to exclude or suppress less powerful and less well articulated human concerns. Furthermore, because the scientific pretensions of the process are inconsistent with wider democratic control and deliberation, closure is effectively enforced around official framings that can and do conflict with civic concerns and understandings. In effect, whilst there may be channels that allow civic participation in some, non-core, aspects of the policy process these effectively require participants to conform to a set of non-negotiable technocratic rationalities and values.

In recent years, processes of state disengagement from several dimensions of the policy-making process are becoming evident across Europe as a consequence of the rapid spread of market values throughout the public sector - the privatization and deregulatory initiatives of the last decade or so - and the growth in importance of transnational forms of governance. In most countries, these shifts have acted so as to further disenfranchise the civic domain, since many crucial policy decisions have become less amenable to parliamentary oversight. At the same time, however, these shifts have engendered new opportunities for civic engagement, since the private sector and institutions such as the European Union play a more influential role in policy formation and thus become potentially more significant sites at which to attempt to engage with policy.

One of the more interesting experiments that we have studied in the project is the Dutch Infrastructure Laboratory, or Infralab, which is an attempt to establish a new kind of space for citizen involvement in infrastructure decisions.

InfraLab was established in 1994 as a special division of the Ministry of Transport. It is significant that it came into being when a new government came into office - that is, there was a new political opportunity space. But it also worth pointing out that it was the result of policy entrepreneurship within the ministry, by a senior official who had experienced the limitations and drawbacks with the traditional ways of making decisions. From a PESTO perspective, an innovation like the Infralab required a policy entrepreneur who could mediate between the different policy domains, and open up new channels of communication and interaction. We might say that for citizens to be meaningfully drawn into infrastructural decisions, we need enlightened civil servants to make participation happen. As in so many other areas of social life, innovation in the policy arena requires agents of change, personal commitment and risk-taking: breaking with the established routines.

Structure of the Infralab process

1. The Voice of the Customer - Problem identification

discussions between users of the infrastructure and local residents with planners on the problems with the proposed project, leading to priority lists, and larger hearings

2. The Agora (Greek word for market) - Solution negotiation

experts, users and residents come together for a workshop to negotiate and discuss relevant solutions to the problems identified

3. The Action phase - Implementation

the experts and planners take over, with ongoing public consultations and monitoring.

Source: van Zuylen 1998

The Infralab was created both because there was a noticeable lack of public support for infrastructural projects and a need for winning public acceptance, but also because, as elsewhere, the procedures for decision-making on large projects were seen to be in need of reform. The Infralab's mission has thus become to try to narrow the gaps between the authorities, the experts, and the larger society.

The working method of Infralab is to organize dialogic processes among the planning authorities and other groups in society, thus bringing more creativity into planning while making more effective the process of decision-making. The working method starts - and this is a new component - with defining the problem together, in direct dialogue, with eventual users. In order to have an open dialogue, Infralab treats participants as individual persons, rather than as representatives of organizations. The second and third steps of the working method of Infralab are also different from the traditional procedures. From the problem definition of users, experts are invited to come up with relevant options and in the third step possible actions are defined.

During the last decade, five large infrastructure projects have been started in which this method has been gradually integrated. From a very weak citizen involvement in the first projects, the use of the lab and its dialogic methods have improved and intensified.

Several trends are thus converging in the most recent, the *Tweede Maasvlakte* project, the expansion of Rotterdam harbor. First of all, the cognitive space within the policy-making arena on large infrastructure projects has changed. The Infralab procedures, especially the first phase of problem identification, has over time gained more importance. As for the social networks, in every subsequent project, more people and groups have been included in the decision-making process who do not belong to the official policy making system. In the *Tweede Maasvlakte* project, professional organizations, pressure groups, the environmental movement and individuals have formally been included in the planning process. For the first time, the fundamental question whether to build the project at all, is seriously being addressed. Thus, both by learning from the mistakes of the past and by gaining experience in using new methods of dialogue and citizen involvement, the InfraLab is taking on more importance in the Netherlands.

IV. New Roles for Environmental Organizations⁷

As has been noted by many observers, the social movement organizations that were so prominent in the 1970s, when environmentalism represented for many an emerging alternative mode of knowledge production, based on an ecological world-view and democratic organizational forms, have given way in the 1990s to institutionalized and highly professionalized "non-governmental organizations" (Lash et al 1996). Among other things, these NGOs provide professional expertise for research and public education programs, lobby for legislative and policy reforms, and carry out international development assistance projects.

The confrontational strategies of the past have tended to be replaced by more conventional, and consensual, forms of activity on the part of environmental organizations. In many European countries, representatives of major environmental groups are granted access to formal policy bodies and procedures, such as hearings or ministerial committees. Provision of expertise and advice to state agencies and private companies, either through formal or informal channels, has also become increasingly important. In programs of eco-labelling and sustainable transport, for example, environmental organizations often play an important advisory role, as they do in many local Agenda 21 projects. In order to be successfully conducted, these activities require respectability on the part of environmental groups, and a more professional mode of operation.

This process has been characterized in terms of a transition from "participatory protest organizations" to "public interest lobbies" (Diani 1997); voluntary activists have been largely replaced by professionals, at least in the incumbency of key roles within environmental NGOs; consistently with this change, environmental groups seem to secure most of their resources through mass advertising, direct mailing, etc. rather than through their activists' work in the local community; direct action and protest activities, often of a confrontational type, which were so popular among political ecology and anti-nuclear campaigns of the late 1970s-early 1980s, seem to have largely given way to conventional lobbying techniques.

However, this transformation from oppositional movements to heterogeneous clusters of established non-governmental organizations has differed from country to country, and has had different consequences on the mobilization potential on environmental issues. At times, the rise to respectability has tended to weaken the capacity of environmental groups to wage nationally significant political campaigns - as it has been suggested for the Italian case by Donati (1996). In other countries, on the other hand, there has been a resurgence of activism as a kind of reaction to the new roles that the more established NGOs are playing. Particularly in Britain, but also in Sweden, environmental protest has become a part of a new, anti-establishment sub-political lifestyle, as activists reinvent, in the opposition to highway building and animal experimentation, the personal politics that were so central to the protest movements of the 1960s and 1970s.

⁷ From Kees Dekker, Mario Diani, Andrew Jamison and Lise Kvande, "Representing the Public: New Roles for Environmental Organizations," in Jamison, ed 1998

Yet other times, organizations have floated along the continuum from participatory protest groups to "participatory pressure groups". In those cases, the gradual dismissal of protest has not been matched by a similar lack of interest in the active involvement of one group's rank-and-file members. Participatory structures have remained in place - eg in the form of local branches of nationally based organizations - and have kept attracting direct contribution from members and sympathizers. Rather than to protest activities, members' participation has been mostly aimed at voluntary work and in support of ordinary pressure activities such as membership mail campaigns or personal contacts with local politicians. It should also be noted, however, that transformation has sometimes taken an opposite path, from non-protest to protest-oriented styles. Local branches of groups like WWF have for instance shown increasing availability to get involved also in protest activities, along more traditional styles of campaigning (Diani 1995).

These processes are, to a large extent, dependent on the ways in which public participation has been organized, and more specifically, on the relative openness and transparency on the part of state and corporate actors. In the social movement literature, this is referred to as the "political opportunity structures" that affect particular outcomes. But the processes are also rooted in history, ie, the behavior of non-governmental organizations is based on the somewhat different histories of environmentalism in each particular country, and the forms that activism has taken. In Sweden, for instance, where the debates over nuclear energy were highly politicized in the 1970s, and led to a deep polarization in the political culture, environmental NGOs have been given new, but highly circumscribed, roles to play in the new programs of sustainable development. The more radical local activism that is to be found in Sweden can be seen in part as a reaction to the relatively closed opportunity structures, but also to the relatively strong incorporation pressures that have afflicted Swedish environmental activism from the beginning.

In Denmark and Norway, on the other hand, NGOs are able to play a much more variegated set of roles, in large measure because of the comparative effectiveness with which environmental movements in those countries were able to mobilize a broad opposition in the 1970s. By stimulating new industrial branches (eg wind energy in Denmark) and encouraging new policy doctrines (eg sustainable development in Norway), the movements in both countries have shown their value to the political establishment, and have thus been given more responsibility than in Sweden for the implementation of the new policies.

V. Participation by Mandate: Reflections on Local Agenda 21⁸

Some of the more energetic attempts to involve the public and "stakeholder" groups in policy-making have been taken up by local government under Local Agenda 21 (LA21). Indeed LA21 has rapidly evolved into an umbrella term for a wide range of initiatives organized by local governments throughout Europe in which principles, targets and policy options for local sustainability have been developed.

⁸ From Jose Andringa, Marco Giuliani, Patrick van Zwanenberg, and Magnus Ring, "Participation by Mandate: Reflections on Local Agenda 21," in Jamison, ed 1998

Although LA21 has only had a relatively short life span thus far, a range of questions seem pertinent to any evaluation of this attempt at stimulating public engagement in sustainable development. Firstly, and most straightforwardly, one can ask questions about the scale and nature of the various activities promoted by local government. For example, what sort of projects have been established and how widely have they been taken up? Secondly, one can consider the impact of LA21 initiatives. Do projects result, or appear to be resulting, in a meaningful reallocation of resources or are they more symbolic in effect? If the former, what sorts of actors, policy options and technological changes are being influenced by this process? If the latter, what implications might arise? Thirdly, and perhaps most pertinently, who is becoming involved in the various LA21 initiatives, how are they involved, and why are they involved in LA21?

This last question has three separate components to it. The first part refers to unpacking the public. Are participants, for example, serving as "ordinary" members of the public or are they representatives of community organizations and environmental NGOs who may have been involved in policy-making to some degree prior to LA21? To what extent do participants reflect the existing local population, along lines of class or ethnicity, for example? The second part of the question refers to how, precisely, the public are being constructed through the various institutions and programs that are being developed within LA21.

There appear to exist at least two very different rationales for encouraging greater public engagement in policy-making in the post-Rio world. The first of these starts from the premise that many of the changes that are assumed to be integral to moves to greater sustainability require changes in public behavior as well as government policy. Here public participation is viewed primarily as a procedural good, a means by which the wider objectives of sustainability can be operationalised. This view is typically assumed by national government. For example, the UK launched a campaign called Going for Green in 1995 which targeted individual households, seeking to engender lifestyle changes largely through information provision. It assumes a deficit in public knowledge and understanding of environmental issues which, once filled, will result in changed behavior on the part of the public.

The second rationale tends to see participation as more of a substantive achievement in its own right. It rests on a more radical conception of what sustainable development entails and is more prominently held amongst some environmental NGOs rather than government or business. Initiatives with more deliberative, bottom up forms of participation are, however, in tension with many of the assumptions embedded within dominant approaches to dealing with the environment and sustainable development. Such approaches typically assume, for example, that definitions of what objectives and goals are or are not sustainable can be reliably determined by scientists and other experts and then implemented in conjunction with wider publics. But such an approach conceives of the public in instrumental terms, refusing to acknowledge that what does or does not count as sustainability is a negotiated process. The cleavage between an instrumental and a substantive commitment to participation - between, as it were, the public as consumers versus the public as citizens - has very different implications for

how, in practice, initiatives such as the Local Agenda 21 process actively construct and involve the public in decision-making processes.

The third part of the question refers to how we might understand public responses to those initiatives. If, for example, the public or elements of the public are unenthusiastic about LA21 and sustainability, why might that be so?

Many LA21 activities in Britain have been concerned with integrating sustainability principles into other policy areas such as waste management, transport strategies and, somewhat less so, in sectors such as housing, education and investment strategy. Local government has also embarked on programs of awareness raising using existing communication techniques. For the most part, traditional instruments for incorporating the public's views into local government sustainable development strategies have been relied upon such as public consultation, questionnaires and public meetings.

Yet, a significant interest has been taken, at least by some local authorities, in broadening democratic participation and community involvement in these processes (Young 1997). About 50 to 60 of the 478 local councils in the UK have aimed at a more bottom up strategy in which local communities are actively involved in developing agendas for sustainability rather than the more conventional top down strategies of imparting information and asking for input into a pre-framed policy agenda. These more novel deliberative procedures include, for example, the development of surveys by local residents, arts-based approaches, visioning techniques, the use of round tables and "planning for real" exercises. Many of these bottom up approaches have, however, proved more rhetorical than real, since, when it comes to practical decision-making, councils appear to be reluctant to change their agendas and styles of work. Furthermore, there is a tension associated with these more deliberative processes in which some degree of decision-making power is devolved to local communities. Underpinning such LA21 initiatives is an implicit suggestion that traditional forms of representation (i.e. elected councilors) are not adequate to reflect local interests.

It is difficult to get a reliable picture of which stakeholder groups are actually involved in the LA 21 process. The Local Government Management Board's 1997 review of LA21 activities does not provide that information, although it does conclude that "sometimes it has been difficult to engage the real community beyond the pressure groups" (LGMB, p. 74). Even though surveys of public opinion suggest a consistently high level of concern about the environment across both class and age, the same surveys also suggest that public commitment to making lifestyle changes in favor of the environment has remained at relatively low and constant levels since the late 1980s. Indeed, the concept of sustainable development appears to excite little interest beyond environmentalists; most of the public have never heard of the term.

Some pointers to why many lay people have not been particularly enthusiastic about sustainable development, and thus perhaps why initiatives such as LA21 may have found it difficult to engage with ordinary members of the public, can be found in recent qualitative research on how people feel about environmental issues.

For instance, a study on public responses to proposed "sustainability indicators" in Lancashire that were being piloted in connection with LA21 suggested that people were extremely skeptical as to whether central and local government or business could be trusted to promote sustainability (Macnaghten and Urry 1998). Such indicators (covering a wide range of environment, economy and quality of life areas, for example, with indices such as air quality, levels of recycling, acres of woodland, crime levels, employment and so on) are designed as a managerial tool that allows local government to monitor performance in service delivery. They are also intended to play a role in political objective-setting insofar as they can assist in foregrounding environmental questions in decision-making processes. Finally, and perhaps most significantly, they are also intended to promote public communication and participation. The study suggested that indicators were unlikely to command public confidence unless they reflected local people's own knowledge and were meaningful at a local level. Indeed, many people's concerns did not readily lend themselves to measurement. Thus indicators were most likely to be effective if they were developed in consultation and negotiation with the public rather than as a scientific top down procedure in which publics are treated only as consumers of environmental and social information.

In general, we can discern two strategies in relation to LA21 in the municipalities that we have studied. The first is to try to create a "grass-roots" movement, a strategy corresponding to the attempt at decentralizing Agenda 21, as well as the aim of engaging the citizens. The main efforts are geared towards education and information, which are in turn supposed to produce environmentally adjusted, thus sustainable, behavior among the citizens (especially in terms of consumption). The second strategy is to "adjust" the municipalities' activities in order to lead the way for other areas of activities and agents in the society, especially companies, and at the same time to accumulate knowledge regarding the transition to a more sustainable development.

We also want to emphasize the importance of the informal networks which are being constructed as a result of Agenda 21. Within the process itself contacts develop, most noticeably between environmental organizations and politicians and implementing agents, such as local authorities, which are often mediated by "professional" environmentalists working for various organizations. These agents make use of contacts they have developed during their activities with the environmental organization or environmental movement. They often remain a part of their organizations while at the same time they work for instance as Agenda 21 coordinators within the municipalities. This can be seen as different types of representation: on a formal level with the organizations and authorities, and in an informal level with networks of contacts which have been developed in the broader environmental movement.

Further, in terms of the work in Agenda 21 implemented in the municipalities, which individual person is responsible becomes a key factor. The individual's own network of contacts has been of major importance for how activities have been carried out and whether endeavors have been successful. If the Agenda 21 coordinators are part of a well-developed contact network among the various environment organizations and experts, they utilize these partly to access information, partly to influence local politicians. If, on the other hand, the coordinator is a novice in this kind of situation, for instance appointed as part of some sort of unemployment measure, or coming from

within the municipal organization with a pronounced bureaucratic background, he/she often feels isolated from other actors (not least environmentalists) and faces more difficulties when trying to access necessary knowledge and contacts.

The position within the municipal organization is also of importance. If Agenda 21 activities take place within the pre-existing municipal organization dealing with environmental issues, some gains can be made in terms of efficiency. There is already a developed organization with a certain network to utilize, but the work is secondary in relation to the current structures. If, on the other hand, the work is set up as a new organization within the municipality, as has been the case in Lund in Sweden, one of the cities we have studied in detail, there is more independence in relation to the current structures, but the decision-process within the administration becomes problematic. It thus becomes a question of seeking a position which can be both independent and flexible, as well as have access to the established structure of power within the municipal administration.

Chapter Three

On Networks and Brokers⁹

I. Concepts and levels of analysis

In workpackage two, Networks and Brokers, we have sought to identify how environmentalism is being translated into practical orientations, both within academia, in industry, in the state apparatus and among civic organisations of various kinds, but also in interactions among people from these different spheres. We have focused particularly on industry-academic cooperation and how it affects technological change and the construction of relevant policy options.

We have chosen to understand the transformation from visions to practical, if partial, solutions as processes of translation and interpretation, which simultaneously involve connecting people with different competencies, interests and agendas, and, as it were, explaining themselves to each other. We refer to these processes as "pragmatisation", and in this section we discuss what this term implies.

⁹ This summary of workpackage two results was written by Arni Sverrisson, and edited by Andrew Jamison, on the basis of research conducted and reported by Jose Andringa (Netherlands), Pål Næsje (Norway), Leonardas Rinkevicius (Lithuania), Mauro Tebaldi (Italy), Patrick van Zwanenberg (United Kingdom), and, in Sweden, by Sverrisson, assisted by Magnus Ring and Per Lindqvist. A longer presentation of workpackage two results, written by Arni Sverrisson, is sent along with this report. The quotations from interviews are not attributed to particular interviewees, since, in most cases, the interviewees spoke to us under the assurance that they would not be identified.

First we want to introduce a distinction between two levels of analysis, a discourse level and a network level. Maarten Hajer has implied this distinction in his work on ecological modernisation, where he writes that environmental politics is

... a struggle between various unconventional political coalitions, each made up of such actors as scientists, politicians, activists or organisations representing such actors, but also having links with specific television channels, journals and newspapers, or even celebrities. These so-called discourse coalitions somehow develop and sustain a particular discourse, a particular way of talking and thinking about environmental politics. These coalitions are unconventional in the sense that the actors have not necessarily met, let alone that they follow a carefully laid out and agreed upon strategy. What unites these coalitions and what gives them their political power is the fact that its actors group around specific story-lines that they employ whilst engaging in environmental politics. It can be shown that although these actors might share a specific set of story-lines they might nevertheless interpret the meaning of these story-lines rather differently and might each have their own particular interests. (Hajer 1995:12-13)

However, analysis of discourse coalitions united around particular "story-lines" does not include the problems involved when actors do actually meet (if not very often) and cooperate (if not very closely), which is what we are concerned with here. The main difference between the two situations is the leeway they provide for establishing and maintaining different interpretations of the common story line. In relevant face-to-face interaction, interpretations do not simply co-exist, they are compared, contradicted and negotiated.

A partial aim of the research reported here has been to identify and explore the different types of *brokerage*, which occur in the diffusion of environmentally oriented paradigms for technological development, and how environmentalism - through the activities of "brokers" - is translated into concrete action. Pragmatisation, as we have come to understand it, is part of the process of ecological modernisation, which implies the continuous adaptation of "sustainability" to "business as usual." Whatever radical critiques may have been behind the development of the environmental movement earlier on, the agenda has increasingly been turned to issues the definition of which presupposes the continued existence of the basic structures of society.

In a sense this is a process which can be observed in any practice aiming at social or political change. The task then becomes to identify the mechanisms of this process and document how they are played out in the particular area of science and technology policy. One part of this is to elucidate the new social networks which increasingly, and in variable ways in different countries, influence science and technology policy making.

Hence, we focus on the intersections between science and technology policy, on the one hand, and environmental movements, organisations, and government agencies concerned with environmental issues, companies working in "green" niches, and

academics involved in applied, strategic and basic research relevant to environmental issues, on the other. More specifically, we want to understand how these intersections are created, and the forms of network building and brokerage that take place.

The broker concept is central for our analysis. Brokers create what Johan Schot has called a technology nexus, they bring together people with different competencies, and orchestrate their efforts for their own ends in particular projects (Schot 1992). We should not let the business connotations of these terms confuse us here. Brokers can be found in all walks of life. In the process of creating new combinations of people they build networks, sometimes simple, often complex, through which ideas, solutions and goals are negotiated.

The social space in which the idea of sustainable technology has been formulated and spread is not, we contend, constituted by a single unified network or coherent "system". What we have been able to observe is rather a field in which heterogeneous, network clusters of actors interact contingently among themselves. In this process new networks are created and old ones are dissolved continuously. This, we should note, implies a conception of science and technology policy as a fragmented field of interaction, which can lead to difficulties in identifying important brokers, although they will all be located in some sense between science and technology networks and environmentally oriented networks.

In what follows we consider different aspects of brokerage. We first look at brokers as organisers; secondly, we discuss brokers as translators/interpreters of the "story line" of sustainability, which can be seen as their main role among other actors in the environmental business. Thirdly, we look at forms of brokerage in business and explore some of the ways in which environmental management and technology development is creating the basis for new emergent professions. These are, it should be emphasised, three different types of practices which imply somewhat different ways of relating to the wave of environmental modernisation, although some people can and do combine two or more of these in the course of their activities.

II. Brokers as organisers of networks

Currently, much "green" investment takes the form of designing routines for identifying and managing the effects of the activities concerned on the environment, and in training personnel in those new routines, rather than the common form of putting money into new equipment. Substituting certain inputs and reusing (or selling off) waste is the common result, whereas redesign of entire processes, calling for investment in new plant, is comparatively rare. This, after all, happens at considerable intervals in most manufacturing operations, which makes wholesale changes aiming at radical process innovation unattractive, as noted by several respondents. Hence, major paradigmatic shifts such as moving from chemical treatment of waste to biological treatment are difficult and the main area of innovation tends to be in what one of our English interlocutors called "gadgets": diagnostic kits and the like.

This problem is confounded by the well known paradox that radical innovations, environmental and other, tend to originate outside or in the periphery of established

production systems and their diffusion is correspondingly delayed until ways and means are found to either integrate them into the existing structure or they can replace it without threatening vested corporate interests.

However, introducing environmental management implies more than just sharpening existing routines for directing work-flow and quality control. The implications are also likely to be different for small and medium sized companies on the one hand and large corporations on the other. One of the more manifest differences between countries and regions in Europe is the extent to which they are dominated by one company type or the other, and the consequent differences in how people reason about technology, growth and environmental management of technical change.

In small and medium sized companies which are making money and otherwise doing well there are few immediate incentives to proceed with environmental management: why change a winning team? Generally, there is little or no redundant capacity within the company to devote to something that may or may not generate cash-flows in the future during periods when the order books are filled and excessive overtime looms larger in the minds of managers than environmental problems and possible future savings from waste reduction. In such periods, they may also find it difficult to devote resources to developing sustainable processes simply because everyone is otherwise fully occupied.

In periods when orders are stagnating another logic is at work. The extra costs of installing an environmental management system and the prospect of having to carry the cost of the measures this eventually leads to is not tempting for companies the first priority of which is to keep its head above water. If such periods are prolonged, redundant capacity tends to become excessive capacity and be dispensed with, rather than put to use preparing for a future in which the company may not survive.

This paradox explains why the presence of some kind of externally originated incentive is essential for environmentally oriented technological change in small and medium sized companies. In what follows we will analyse how such incentives are transmitted through existing networks or networks put in place specifically to diffuse environmental orientations to technological change. These mechanisms are, as we contended above, different from the discursive mechanisms identified by Hajer and others, and closely interwoven with the existing social structure of economic life.

A number of studies have focused on pressures from customers downstream in the production chain or from distributors, concerned with their image, to adhere to EMAS or ISO 14001 standards and be certified as such. This is not always explicit or above board, e.g. in the form of written contract stipulations, although it sometimes is. The presence of this mechanism is also evident in our interviews, but it works itself out differently depending on how companies are placed in production chains. This is how it was described by one of our interviewees when we asked about the role of a large engineering corporation vis-à-vis its suppliers:

There is not much on the trucks and equipment side, on the automobile side they are tougher. These more heavy equipment people (machining components), they have not felt the same

pressure. Rather, there they want them only to put a quality control system in place, still. They have started to mention this, but not put on any pressure as yet.

In this case (of a fairly structured production chain) the implied source of the pressure for participation in ISO 14000 and EMAS initiatives is consumer markets: where they are close to a particular firm, their effect is more keenly felt and the resulting concern with environmental credibility is quickly transferred upstream in the product chain. Some of our interviewees indeed maintained that consumer interest and willingness to pay should determine the pace of environmental adaptation of production (rather than say centrally decided corporate policy or government regulations): in cases where companies make some products which are labelled as "environment-friendly" by a certifying organisation as well as products which are not, the product mix offered must obviously be adapted to consumer demand.

For the automobile industry it has become a major strategic problem how to handle "green" consumers, particularly as the environmental issue can be constructed as savings for consumers in this particular instance. This creates a multiplication effect as the influence of central actors spreads through production and distribution networks, and this has of course to be facilitated by someone somewhere. However, the kind of brokerage we have put in focus here, the management of weak ties, is not in evidence within the production network in this case. Rather, these certification efforts are embedded within the structure of the production network itself, i.e. embedded in a network of strong ties. However, as we shall see, brokerage opportunities arise when companies within the network respond to these pressures.

In other, less structured, production chains the problem may appear differently:

Anyway, this varies, if we look at Coatings, their motive, I suppose, to go in and environment-certify themselves was that they had a product which was promoted as an environmentally better alternative to the usual traditional paints. They suspected that they would get demands from customers as time went by, because they sell to the vehicle industry among others.

In this case anticipation of demands from downstream rather than actual demands are the manifest incentive, which also implies that companies, particularly those which have many different customers and are not wholly integrated into particular product chains must, as it were, read the signs. This implies active strategic thinking, which can be coupled to new product development. This is not always the case though. A packaging firm which participated in a certification project did so because demands from their customers, large retail chains, were anticipated, but here it was more a question of being able to show the certificate, and the actual change taking place was very small. However, in both cases the certification pressure was, as it were, embedded in the production network rather than independent from it, and the role of brokerage in transmitting these demands is limited.

Product chains can be organised in basically two different ways: as a succession of legally independent units usually owned by different conglomerates or small

proprietors, or they can be integrated under a single ownership. This latter is rather unfashionable nowadays, which presents us with a problem: companies can be integrated in corporate structure which is not based on product chains as such but rather unites companies working in somehow similar activities (the similarity sometimes, one could add, being limited to the generic activity of making money), but who are not directly or mainly customers/suppliers to each other. Because the links of ownership can potentially carry with them great authority, it is also of interest to consider how the situation is in these instances.

As can be expected the stories told by our interviewees vary. In smaller companies which are parts of diffuse conglomerates the initiative may actually rest with local management, which reads its own particular market, and may come to the conclusion that they should be moving faster than the corporation in general. The first concrete steps may even come from people at lower levels with the organisation. In other instances, the initiative comes from above: Corporate leaders apparently can fairly easily transfer their strategic environmental commitment to local management, but the translation process only begins when this commitment is turned into practice and people with many different backgrounds become involved.

III. Horizontal and vertical networks

The type of networks discussed in the previous section is very different from the horizontal networks which some brokers we interviewed in Sweden had built among companies as part of their activity. Horizontal in this case refers to networking across different production chains, conventionally denoted vertical (as in "vertical integration"). The aim of these horizontal networks is to institute a process known as peer learning in academic circles, i.e. that companies are supposed to share experiences among themselves and interpret the dominating "story line" (in Sweden that would be "sustainable development") for each other. Although it is implied that most of those who participate are striving towards whatever is the current definition of a sustainable company (and at the moment EMAS and ISO 14000 loom large there) there are no formal demands on the participants in this regard. Not only do companies learn from such experiences, but the brokers themselves learn as well how to approach companies and build bridges between academic and corporate environments.

An important observation in our context is the fundamental difference between this type of horizontal networks on the one hand, and horizontal networks built around technology development projects on the other. In a peer-learning network, the degree of consensus needed to make the network work as intended is limited to a general interest in environmental issues and the implications of ecological modernisation. In technology development networks, the sharing of information and exchange of competencies is bounded by the specific goals of the project.

The peer learning networks we observed were usually initiated by bureaucratic or academic actors acting as brokers and this type of activity is undoubtedly a prime area for environmentally oriented brokerage. The ways in which this activity influences

technical change are diffuse and indeterminate but this accounts for the relative success of such networks: it is up to the recipients of the message to adopt and adjust whatever they find useful to their own operations, and skip the rest. In this way these networks also resemble educational institutions strongly. The more successful ones in pragmatic terms (meeting often and being considered useful) have been initiated by municipal environmental co-ordinators and established in areas where companies are small, although many of them may be subsidiaries or distributors/franchisees of large corporations.

Indeed, one of the explanations of the success of these networks in many smaller Swedish cities is probably that the environmental co-ordinators of large corporations are routinely invited to come and speak about corporate policy. Thus when it is, for example, the turn of the Volvo authorised distributor and repair shop to host a network meeting someone from the corporation will come, either the environment coordinator or someone working closely to him. In areas where large companies have headquarters, such as Stockholm, or even Lund or Malmö, this type of networking has much less tradition. Basically we are seeing a rerun here in the small towns of the Lions/Rotary/Freemason tradition of concerned and socially minded businessmen and notables meeting over a meal (breakfast in these cases) and discussing the state of the world with the implied agenda of how that affects business. This instance of ecological modernisation spreading through tried and tested mechanisms alerts us to how the type of broker we are analysing here tends to work: by operating within locally constructed social contexts and avoiding any suggestions of major rearrangement of social, political etc. parameters, they ensure success for their initiatives in terms of pragmatic environmentalism.

A more structured form of horizontal networking had been initiated by people from a local college as a part of an environmental management project "sold" to municipal authorities.

We run different projects, we have this here which we did with five companies [which otherwise had little to with each other]. ... I ... hired someone who was sitting there and working directly with them. They had him for a year and what he did was that he did environmental evaluation reports for all of them, then he helped them as an environmental advisor, he built up their environmental management systems and helped them produce parts of the documentation. Then we gathered them together regularly for seminars where we went through the different parts of the environmental management systems and they could exchange experiences. This we have found to be a method that works unusually well.

Hence, what we have here are two basic types of networking among companies and company representatives, one vertical, as it were, created on the basis of production and distribution networks (and which has attracted considerable attention) and the other "horizontal" created by brokers.

It is now possible to identify a major difference between the two kinds of networking. Because the former type is embedded in contractual relationships, either long term delivery contracts or repeated placing/delivering of orders, demands originating from key actors and spreading upstream (eventually originating with "green" consumers whose consciousness has been "raised" by one or another movement organisation) can be backed by concrete sanctions. "Green" distributors such as general store chains want their suppliers to be "green" too, otherwise what we can call a credibility gap appears and their image and marketing strategies cannot be sustained. The suppliers in turn place demands on their subcontractors and so on. In this process the adaptation of EMAS and ISO 14000 routines is instrumental, because it introduces a standardised procedure for reacting to such demands, and establishes a control mechanism the execution of which is entrusted to a third party, the certifying organisation. Hence, this mechanism is closely modelled on the general principles guiding the regulation of contractual relations in general, but at least in theory based on a very different competence, technical and scientific rather than legal/organisational. Another point which it is useful to note is the dependence of such networks on the central corporate actors. Initiatives towards increasing sustainability in such subcontracting/supplier chains are completely dependent on how they act. A group of college-based consultants had attempted to implement this model:

We worked on a project with five companies which had a customer-supplier relationship with each other. ... I work with the customer and my colleague (present) with the other four. ... the idea was that the big company (the customer) should be a little of a mentor .. but as it were it became the opposite ... [because] they have increased their production 40 % ..

In other words implementing the product chain model failed because the central actor which was a customer to the others was unable to develop its environmental management system at the same pace as the others.

Turning to the horizontal networks, these are not embedded in business relationships with each other. They are rather embedded in local superstructural relations among businessmen, municipal leaders and other local notables, who have with more or less vigour decided that their particular patch of the planet needs to join the general trend that has been called ecological modernisation. They build on traditions of collaborative information sharing which goes across production chains, and reinforces the local business environment as such rather than particular sectors or companies. Oriented towards sustaining community life in areas hit by unemployment, outmigration and a general absence of high-tech innovation based dynamism, these networks perhaps embody the essence of ecological modernisation, or at least an important aspect of it, namely the mundane character and strong continuity of response and problem solving methods which has been the result of the socio-political construction of global threats.

However, as we saw above, vertical connections along the product chain can and do become resources in such horizontal and locally embedded networks which leads us to a picture of the process which includes both horizontal and vertical connections, but in which the amount and presumably the quality of information flowing through different channels is highly unevenly distributed. A particular company can mainly take its cue

from peers locally to which they are connected by rather loose, horizontal links and in which sanctions tend to be of an informal and social character, or it may orient itself to sustainability because of influences, often backed by concrete sanctions or at least the threat of sanctions, from central actors in the product chain, or both.

A pendant to these networks are national branch networks, through which professionals meet and which are visible *inter alia* in fairs and shows, and institutionalised in branch organisations which sometimes run their own research institutes, and can be important partners in forming technology development initiatives as well as spreading information about best practice. However, these activities tend to go beyond specific production chains and localities, often revolve around discursive practices rather than practical discourses, and their role for actual networking tends to be the creation of organised frameworks and events within which environmentally oriented technology networks are maintained informally.

IV. Brokers as translators and interpreters

Above, we surmised that novel information primarily is transmitted through weak ties, and that the essence of brokerage is either to be a weak tie or create them. In this section we want to pose the following question: What do brokers do when they operate as a weak tie. The general answer is: they translate, interpret and adapt information gained in one place and used in another.

The translation and interpretation activities of environmental brokers, insofar as they pertain to technology, are typically cast within the framework of academic/industry co-operation, which preceded sustainability as major science and technology policy concern. It is therefore in place to provide some brief points on this here.

Traditionally, universities have two main areas of activity, research and teaching. Cooperation with extramural actors has long been seen as a third activity not quite so important in policy declarations, and much less important in the work actually done at universities. Over the past ten years or so two things have happened in Sweden, for example.

First, co-operating with extra-mural actors society has become translated more and more into co-operating with industry and other commercial interests, something which was not quite so obvious an interpretation earlier when providing input for the social engineering and physical planning efforts of the authorities and for civic organisations, and particularly the trade unions, was seen as an important part of the social mission of the university.

Second, the major loci of modernisation and expansion in Swedish university education have been regional colleges rather than the traditional universities, a trend which has now been elevated to a major policy item by the current government. Of interest here is not mainly the number of students but rather the circumstance that the regional colleges (some of whom are now applying for and receiving university status) are organised differently. Varied problem oriented educational programs and research

groups are established continuously, and colleges compete for students by offering specially niched educational programs. And for these colleges, co-operation with extramural actors is in many cases the reason for their existence, and traditional criteria (such as academic excellence in theoretically motivated research) are less relevant. Similar trends can be observed in other European countries, and in all cases, whatever the form, these can be traced back to the changing role of the university as provider of mass education and “relevant” research and expertise.

Several of the issues which arise appear in the following example of a network constructed in England to facilitate the development and spread of bio-remediation technologies.¹⁰ This network is brokered by an applied biologist who had earlier worked at postdoctoral level with bio-control technologies (the use of living organisms as pesticides) and moved from this type of work to work in biology departments and then to the education department at a local university.

The network was designed to provide a part-time Master’s training programme for people already working in industry with an initial focus on small and medium sized biotechnology companies that cannot afford to lose staff for long periods of training. The course will provide training in biotechnology in general, remediation processes, environmental policy and law, and marketing, economics and sales. The course also draws on the competence of academic partners in France, Italy and Austria, and is mainly funded by EU.

In the UK there only exists one other MSc in environmental biotechnology and this is a very broad and full-time course. There is also a general lack of specialists in environmental biotechnology which many see as the area in biotechnology which holds greatest promise at the moment. The companies interested in developing this area have, however, experienced difficulties in finding people with the appropriate skills.

The skills needed for the “greening of industry” are generally scarce, but in this case the network was intended to solve a more specific problem. Most people working in the environmental technology field in England have a chemical rather than a biological background. As noted by another person working on a different project, the preponderance of chemical engineers who are not part of, and do not understand, the biological world leads to the development of a “mindset” against biological techniques. The course is therefore intended to provide awareness of biological processes for chemists and chemical engineers and enable them to consider what might be cheap and practical low-tech solutions to waste management.

We will have occasion to return to this issue, that is the interdisciplinary character of environmental problems and the contest over “who represents the environment” as well as “who can take care of the environment.” Currently, the mandate to analyse environmental problems and devise solutions to them is contested, and it is by no means clear how and by whom scientific legitimacy will be conferred on one discipline or combination of disciplines in this regard. It is not even certain or particularly likely that such issues will be solved through academic juggling of positions consecrated by academic institutions and higher education policy makers. As the response to

¹⁰ This example is based on material gathered and analysed by Patrick van Zwanenberg

environmental problems is defined in terms of industrial technologies and process adaptation, other interests enter the game, not only at the policy level but at the level of practice as well.

In this particular instance, the training programme was intended to integrate academic and industrial expertise. Tutoring would be provided by the university whereas leadership and lecturing would be provided by people recruited through the network, mainly from large companies. The plan is that students will receive training both at the university and in companies. This particular idea of knowledge transfer, between large companies and their R&D departments and small and medium-sized companies, has also been applied in Sweden, with either university brokers or government based brokers acting as intermediaries. In this instance the course itself is intended to facilitate the formation of a network between SMEs, large firms and academics and academics, facilitating discussion, dissemination of information, and eventually, and technology transfer. This approach is more focused than the horizontal inter-company networks discussed earlier, which had been initiated by local university brokers and municipal environment inspectors. Its scientific and technical content is specified as lying within the boundaries of biotechnology, it is not just concerned with any conceivable savings or waste reduction and waste management.

Several large companies were very interested in the project. A personal acquaintance of the broker in one of them proved useful in arranging the whole thing because he was interested in promoting the development of environmental biotechnology and wanted to pioneer training in that subject. He had studied initially via a day-release scheme from industry and completed a PhD also whilst at work, and wanted to see such opportunities more widely available. This contact was a partner rather than just a participant in the training programme and the networking activities connected with it and had accepted the post of chairing of the network's management committee alongside the academic leader of the project. This is a good example of how brokerage, being the establishment, management and development of network ties, is often carried out by two or more persons rather than one, each contributing their own particular contacts. Hence, modifying the conceptual framework which is based on the distinction between weak ties and strong ties seems imperative: in this instance a number of weak ties are being channelled through a strong tie, as it were, and the express aim of the collaboration is to develop at least some of the weak ties into an array of strong ties, that is an organised ongoing network collaboration between the participants.

It is important to consider what we say below about academic/industry co-operation and the role of brokers in translating the two cultures to each other in this context. When university or college departments take it upon themselves to act as consultants for companies they do so in the context of a policy which is consciously opposed to the inward-looking and discipline bound mode of the traditional universities. Not all departments and programs are equally prepared for this role, and incentives for actively seeking such contacts also differ depending for example on how well funded departments are and how they manage to attract personnel, which can in many cases be rather problematic in competitive professional labour markets.

V. Academic engineering and engineering problems

Within the academic engineering world, which is a major locus of brokers involved in developing new technologies, the work involves among other things translating technology policy terms into concrete engineering problems. When interdisciplinary work is involved, this process can be particularly complicated. This is for instance described as follows by a combustion engineer:

If you talk to a woods person and say bioenergy, he interprets that as a heap of chipped wood. If you talk to bacteriologists, they mean bacteria which produce hydrogen. If you talk to a mechanical engineer they mean a steam turbine in which you burn wood to produce electricity, etc. ... This is the hard part, when you are talking to your contacts, and all the time you must continuously interpret what is being said, even people you have been working with many years, you must interpret everything that is being said.

In this case, the problem is to develop a practicable variant of a general formula, which combines elements of different technologies and therefore tends to draw on many specialised competencies networked together in a particular project. However, the issue is not only to pursue a general understanding of the need for a combined effort. Negotiations and education within the network about what are key features of the co-operation also need to be brought to some kind of closure:

What matters is to get the plant physiologist to understand that it is actually a bit important this with the alkali metal content of the cell. I, as a combustion technician must know how much natrium and kalium there is in the cell to do this well. And if she can influence the alkali content somehow, that makes me happy. What counts is to get her to understand that this is a very concrete problem. If there are six percent alkali in the ashes ... the pan messes up and I can't keep the fire burning ... It's that concrete. ... and this is where I feel that we can't really keep up with our own pace.

However, these interdisciplinary problems are not easy to avoid, and indications are that when environmentally oriented work, with or without active industry involvement, but oriented towards concrete technological change, increases in academia, the problem of interdisciplinarity becomes more acute. Environmental orientation leads logically to a holistic approach. At universities which have deep-set disciplinary structures ramified by all the prestige and pecuniary interests involved in appointments to academic positions and generally in the construction of academic careers, such an approach is bound to lead to difficulties which are not only cognitive but organisational as well, thereby making the cognitive problems harder to solve at least within the university. This in turn can (and has) lead to two different forms of brokerage: In the case of loose disciplinary structures within the university/college the possibility of developing environmentally oriented units or centres with substantial resources within

the university/college is there, and this, along with the expectation that smaller regional colleges interact with their surroundings has also lead to such activities there. At universities with more or less petrified disciplinary structure such brokerage is more likely to take place outside the university. This is how a well placed source described the situation at a large university which recently discontinued its Environmental Science Centre:

... here, what we had was only a couple of people who ... were to make a small catalogue. And it is not enough in a system like this, you must, the only way as I see it to get anywhere is to ... have resources so you can support research with environmental interests.

But entrenched academics are not likely to give up the resources they command, and when departmental positions and other discipline-based positions in research councils etc. are the key to commanding resources, cross-disciplinary initiatives tend to be starved.

... Academic leadership is, I read somewhere, like leading a band of cats. I mean, you can lord it over a dog, but not a cat, you know, they do what they want to do anyway, they have their integrity ... and that is what academic leadership is all about, you cannot have authority in this organisation, you must have carrots and patient work.

The solution in this instance was to place the industry/academic co-operation outside the university in a special "alternative implementing organisation."

There are projects which one wants to be done in society, and then, one way is to do those within the university, using the knowledge that is here. But another way as to see to it that this competence is represented in organisations which are close to the university but are still separate organisations ... They complement the family, because they can do certain projects, which build on the knowledge of the university but without being part of the organisation .

There is a large number of such organisations around the university in question, some located in the science park and oriented towards developing a variety of products, and the science park itself also includes subsidiaries/research offices of large corporations. Another such instance is a foundation specifically concerned with promoting knowledge transfer between the university and companies, that is marketing university services to companies.

Problems of this kind are confounded when extra-mural actors are brought in, at least that is the experience in Sweden according to our interviews. The problem is not so much that corporate actors do not understand the university, or that they tend to construct it in the image of the ivory tower: most engineering students do various kinds of practically oriented work in companies during their education, and whatever problem solving capacities they may acquire in this process is useful when they take up

positions in companies afterwards. Further, many engineering academics work as consultants for corporations and administrative agencies solving specific problems. The problem is rather located in the relation between advanced studies and corporate needs: "what is the use for us, company A, to hire someone who spends half his time doing course work?" asks one academic. From the academic side, a long term perspective and general problem solving capacities may be (and are) emphasised, whereas company needs tend to be specific and in order to be attended to at all, defined in fairly short term perspective.

For environmental concerns to impact on company strategy they must therefore be brought within the normal planning horizon, and formulated with a focus on problems which, if not solved, either imply losing large sums of money or at least foregoing a significant profit potential. An example is the issue of bioenergy cum combustion techniques referred to above: without better control of the parameters of wood-fuel and the conditions of burning, expensive stops for cleaning and restarting power stations will occur and this type of bio-energy cannot diffuse. However, the issue is of course how such problems can be identified. With the exception of obvious bottlenecks and stinking pollutants, ecologically oriented process control is as yet not developed in most companies to the point where it is possible to identify routinely areas where money can be made and environmental regulations and policies adhered to at the same time. This is where a different type of competence comes in, management oriented rather than technical. One consultant related the following story:

We give courses and seminars to these managers and they are all on fire, this is the future, here money can be made and corporate images enhanced, they go back to their companies, they go to the line engineers and say, we need cleaner production, we must reduce pollution, everything must be as environmentally sound as possible; and the engineers answer: we are already doing all we can, every regulation is adhered to here, and energy use and emissions are continuously monitored, what more can we do? And more often than not, that is the end of it.

The path from policy proclamations to engineering practice is apparently in many ways defined by such discursive failures, that is, people are talking past each other. In what exactly does the misunderstanding consist and what are its structural ramifications?

One line engineer suggested to us that in many activities, the limits to what can be done without major technological changes has already been reached due to earlier regulatory efforts. EMAS work and ISO 14000 are a matter of writing down what is already being done in order to avoid trouble with government agencies or neighbouring residents:

... my experience is that at least in the Nordic countries, this does not make much of a difference here, this ISO 14000, because the demands from the authorities have been so high. (Where I worked earlier) it is almost that you write down the process and - there it is. So there have been so high demands

from the authorities, that it is technically very difficult to do any better ...

Let us therefore dwell on this distinction for a moment: an engineer who comes in and looks at a process tends to look at what technical parameters can be changed to increase efficiency, save energy, save on raw materials, and by extension, go upstream and downstream and look at how inputs can be changed to be more suitable or fit better in, technically speaking - this we saw in the combustion technology example above. The same applies when the output is studied. Can waste be reduced, some part of the output recycled in the process? The parameters here are those of the material world: chemistry, physics, biology are utilised to bring about a technically effective system or production network, depending on the organisational form of the process. Inputs of this kind from others tend to be welcomed:

... one gets someone external who comes in looks with fresh eyes, that 'you work like this, there is maybe something you could improve there.' If you work here every day, you become blind ... you do not see what has happened and what can happen and what one could improve. ... It can be some chemistry or something like that which is hazardous, or a health risk or something but I cannot interpret that, then it is something we have had for ten years ... and if a chemist comes and says this is dangerous, use this instead, then it is positive.

Specialists from other disciplines, in other words, can contribute with statements of this form: "use this instead". Reducing their knowledge to this form almost appears as a precondition of making a contribution. We can observe two other interesting issues at work in this particular piece of evidence: first, the competence of the chemist is not evaluated or critically appraised: it is taken as given. "This is dangerous" is assumed to be a statement based on solid evidence and scientific conventions and therefore "fact". The fact that these "facts" are generated in a different discipline does not need to be interpreted so long as they lead to concrete and practical proposals such as substituting one substance for another. Second, it is assumed that a solution exists "on the shelf" and can be applied with a minimum of adjustments in the rest of the process. That such solutions often exist and are not applied out of sheer ignorance is undoubtedly often the case: the entire discussion of ecologically motivated savings as "ripe fruits" waiting to be picked is based on this assumption, and the person quoted above expressed it as follows:

The first 90% , they are easy, the rest, 10% that is very difficult to take away and then the question is should we put 10 million into taking away these 10% or should we look at something else ... where the environmental effects are much larger?

However, this approach is of little use when the issues are more complex. What, for example, is dangerous? A particular substance can be considered dangerous or not depending on the conditions of use. Hence, a substance which is not dangerous when encapsulated in a closed system such as a laboratory experiment becomes dangerous when used in actual field conditions. A substance which is relatively harmless by itself

can become toxic in combination with other substances. The danger can depend on the amounts involved, the duration of exposure, etc. Whether these and other similar issues can be determined at all depends on available measurement technologies:

The problem is that the aims must be measurable, you know, one must be able to measure it somehow, you cannot just have a goal, a fuzzy goal, must have a unit for it, you see. So the emissions become for example grams per utilised megawatthour, which we let out.

We can see here how a specific mode of constructing problems tends to exclude any problems which cannot be stated in the prevailing framework, after a well known model. Or rather, when exact knowledge is not available, recourse to specialist authority takes its place, on the assumption that at least some of the problems which cannot be stated in my framework can be adequately covered in other people's frameworks, generating unequivocal directives for action.

Pragmatisation in other words involves fragmentation, establishment of authority and the creation of networks in which these authorities are recognised as particular jurisdictions and communication between them reduced to practical directives or concrete questions about measurable, single, variables. Hence, it also involves orchestration. In devising simple adjustments to existing processes this orchestration can be done by line engineer relating to and taking advice from a variety of consultants as well as from health and environment inspectors. In analysing entire processes and redesigning new ones, active brokerage conducted by someone outside actual production becomes necessary.

The importance of such "redundancy" in corporate structures for the promotion of environmentally oriented change was previously discussed from the viewpoint of process-adaptation, but more ambitious networking can also be initiated from within companies. One example of this is the network instigated by British Nuclear Fuels Limited (BNFL), one of the major industrial players in the bioremediation field (BNFL's main shareholder is the UK Department of Trade and Industry).¹¹ This research network was initiated in the early 1990s - at which point the firm's involvement in bioremediation was minimal. By 1996 it comprised about fifty persons working in 17 universities, two SMEs and at BNFL itself.

The broker who took the lead had 40 years of experience in industry, 22 of which were in BNFL where he now serves as a Principal Scientist involved in developing process technology and technologies for environmental protection. In the mid 1980s, BNFL contracted researchers at Dundee University for a bio-process for the removal of radioactivity from acid waste streams. The contact at Dundee was himself in contact with academics in the bioremediation field in the UK and overseas.

At the time, engineers working at BNFL were not comfortable with the idea of engineered biological processes. Elementary performance data was also lacking and there were no microbiologists at BNFL. In 1991 the broker invited four academics to

¹¹ This example is based on material gathered and analysed by Patrick van Zwanenberg.

produce a report on the potential of biotechnology businesses to BNFL. This led to a business plan and a 5 million pound investment in a new lab concerned with biodecontamination, land remediation, biosensors and biofundamentals (speculative research). The plan was to move into markets in bioremediation, especially in the use of micro-organisms to remediate metals such as mercury and cadmium as well as radioactive isotopes. The strategy was to build on core competencies in metals remediation and indirectly employ academics in their research activities. However, shortening product life cycles, increased technical complexity and the interdisciplinary nature of R&D programmes implied that in-house expertise was insufficient. Greater efficiency could be achieved by subcontracting research functions. Through the four academics already involved the company became aware of some of the leading researchers in the field. A call for academic contractors was circulated and 12 contractors were initially secured. The Principal Scientist has also made use of government funded programmes for supporting commercialisation of science (one of which he is the chairman) to bring in academics and a small biotechnology company that had been started by academics. Research conducted within this network is also funded by research councils, where the broker leading the network is also involved in his expert capacity, and by AEU research funds. The network also includes contacts in the US and Canada (where the main markets in bioremediation are) and shares in smaller biotechnology companies have been acquired, through which the company plans to market bioremediation services, making money and bettering its poor environmental image and reputation simultaneously.

This far-flung network obviously carries with it weighty benefits. One is that the company can tap resources earmarked for academic science indirectly, and keep abreast of such scientific developments which are relevant for the company's activities. The network had also become a recruitment channel: post-graduate students working in the company as part of their research work could be assessed and eventually offered regular positions, a method far superior to the conventional method of interviewing applicants which would remain strangers until actually employed.

However, academics and industrialists have different agendas, and as indicated in other interviews, the strategic choices industry makes on the basis of perceived profitability or other criteria may mean a sudden end to intellectually exciting lines of inquiry. From the academic point of view this means that alternative sources of funding for such ideas have to be sought, or in other words, academically speaking it is a catastrophe to become too tied to particular industrial interests, which is probably why such networks are likely to remain loose or otherwise lose their relevance for academic careers. From an industry point of view, as suggested by actors with roots there, this implies that time and resources needed to work with academic partners and create good chemistry between people must be there. Otherwise, collaboration will not lead to anything worthwhile for either part. A corollary of this is that academic-industry collaboration, as distinct from industries hiring academics on a consultancy basis for well specified short term tasks, is a reasonable model primarily for fairly long term projects where the exact performance and possibilities of particular approaches are still in doubt.

Another example of this is a Dutch project on Sustainable Technology Development, which was based on a method known as backcasting the essence of which is to create future scenarios and then identify conditions and measures in the present which lead to

the proposed future scenario.¹² The key actors collected by the bureaucratic and academic broker organising this project came from government agencies and industry. In this particular instance, co-operation with government agencies was essential for the legitimacy and credibility of the project, whereas success in more practical terms depended on cooperation from trade and industry. Other target groups were "pioneers" in technological development and leaders of public opinion. The last group was to be involved, however, only when communicable results became available.

In 1991, an interdepartmental preparation group was created, after informal soundings, which wrote a programme proposal eventually accepted by the ministries. The aim was to explore promising lines of technological research in what can be called pre-feasibility studies, and particularly consider the practical aspects of such developments: Would any industries be interested? How would consumer interests and cultural factors affect and be affected by the developments of these technologies? A major concern in other words was to use and develop existing knowledge about the social ramifications of technology development and diffusion to identify social needs, translate them into environmentally relevant terms, and find the techniques which potentially could provide an answer to these needs. The programme was in other words to be demand driven, but within ecologically defined constraints. Spin-offs would be promoted directly, where and when possible. At the beginning, three areas were selected, that is water provision, the environmental office and synthetic proteins (meat-substitutes). Later other areas were added, and the project was divided up into five sectors: Nutrition, Mobility, Housing, Water Management and Chemistry. Early on, however, the simultaneous conduct of cultural and technical studies turned to be problematic and a sixth sector was created to examine interaction between technology, culture and institutional structures, the so-called Culture-Structure-Technology programme.

As the project developed it became apparent that the original socially oriented point of departure was difficult to uphold in practice, and eventually the tables were turned and in the reports from the programme, society and culture are mainly seen as potential obstacles and constraints. The initiators of the programme had not agreed altogether on how to handle this issue at the outset but relegated its resolution to a later time while busy collecting the resources needed for the programme. One of them perceived "structure" (hardware that is needed for the real use of technology, like for instance the road infrastructure is needed for driving cars) and "culture" (the set of values, habits, and beliefs that shapes technology) as barriers to overcome when it comes to implementation of technology. The other's point of departure was the co-evolution of culture, structure and technology, a process with its own distinct dynamics.

One reason for the eventual prevalence of the former point of view was that co-funding from companies was actively sought and a prerequisite for government support and social support from the proposed technologies was therefore quickly equated with industry support. Another was that interdisciplinary communication difficulties came into play as the project developed, and time was spent on discussing fundamentals rather than conducting detailed studies. As this jeopardised efforts towards producing results within the deadlines set for review and decisions on

¹² The following discussion is based on material collected and analysed by Jose Andringa.

continued funding, a division of labour was developed, and the socio/cultural aspects, as a result, somewhat peripheralised.

The first pre-feasibility study was conducted on synthetic meat. The rationale for this is that meat production creates substantial environmental effects in the forms of fertilising, grazing areas which might otherwise be used more productively as measured in calorie production or by other nutritional standards. Synthesising the proteins contained in meat would therefore contribute to solving environmental problems. Another reason related to the negotiations within the program is that such attempts have already been made, and introducing them to markets has been tried (but failed). The technology is therefore past the conceptual stage. The issue as it came to be defined in the project was, in consequence, how to synthesise more palatable substitutes or develop already existing ones in order to facilitate more favourable reception from consumers.

I want to debate concrete matters, so that we can illustrate as clearly as possible what abstract issues are really about. If we come up with a technological design, society can talk about in a meaningful way. We can assess the impact of a given design: is it considered acceptable? Is it democratic?' And: 'Which societal conditions must it meet before we can implement it?

The program was discontinued in 1997, but several project ideas generated by it have been taken up, developed and continued under other auspices, inter alia thanks to connections established by the broker and other personnel before and during the programme.

One of the main conclusions drawn by the broker in this case was the study on behaviour and policy instrumentation in environmental sociology, economics and technology needed to be conducted on a more long term basis, with a perspective of twenty years or more. We will return to this idea, which implies that the locus of such efforts should be institutionalised rather than project based, and the effort can therefore only be conducted on the basis of long term commitment of resources to institutions of higher education and research.

VI. Brokerage as management

In management oriented approaches to sustainable production, different matters tend to take precedence. Is labour effectively used (and not just substituted as engineers tend to do)? Is the work-flow effectively organised (e.g. just-in-time production). Is quality control adequate? Are the current purchasing, marketing and distribution routines effective?, etc. As this type of approach is applied to environmental issues the questions posed tend to be other than those asked by engineers, and the particular conflicts and contradictions the process creates are constructed differently. With respect to organisation and management of environmental aspects, it is:

... very useful if you already have a quality control system. Even if you start with the environment, one can probably use a environmental management system for improving quality also. Whichever, they support each other, because much of this is about using documents to control routines and such, this is useful both ways. Your thoughts work in a certain way so you won't have to go awry too much in all this.

However, this does not mean that implementing environmental control routines such as EMAS and ISO 14001 is something that can be done merely by extending existing quality control systems and related work-flow control routines, although they help in that they establish a culture of following written instructions closely and adhering strictly to given specifications. This was observed in the Swedish firms visited during the project, and Norwegian firms as well.¹³

We had ISO 9000 and hygienic quality control, and in my experience people have got used to this, that one writes documents, and there is always someone running around, asking questions, pointing at things, I think this was a bit difficult five years ago, but now it is OK, that it works fairly painlessly, that nothing dreadful has happened.

Part of this is that quality control and effective work-flow control is something that builds on existing competence in most companies in a way very different from environmental management. Quality control is there to reduce throwaways, which of course makes customers happy but also significantly reduces total production cost. Self-organising worker's groups are there to increase flexibility and thereby efficient use of a given labour time. Mostly it also makes workers happier but that is an extra, as it were. However, with the introduction of environmental management practices, something extraneous to the basics of production has been introduced as the primary goal, although a large part remains to verbalise and systematise tacit knowledge as in the case of quality control systems. The problem is to do it and still make money. Hence, the appropriate measures cannot be deducted from what is already more or less known from experience in quite the same way as in the case of quality control systems, once that they became necessary: in the case of environmental management the extraneous goal has to be translated into the terms of each particular process and then implemented within the constraints set by other goals.

As a result of all this environmental management is still somewhat peripheral in most companies. One person interviewed pointed out that "this has not spread downwards particularly much here, it is in this (environmental management) group we have been talking about this .. later everyone is to be trained, however." Says one environmental coordinator (in a fairly small company owned by a transnational):

Well, one is supposed to take up the problems and one is that we, that is (the university consultant) and I, we have been running this a little bit on our own. We have worked on every

¹³ In Norway, the interviews were conducted and reported by Pål Næsje

bit, so to speak. We wrote the procedures, the appendixes, the work instructions and then we have gone out and talked a little (to workers and line management). We should have done a little more the other way around. This we did with quality, ... but we did it this way because we thought that we could in this way advance more quickly. ... but we missed this about education (i.e. competence development of the existing work force) which could have given us a more conscious work force rather than like now, one does this on the side as it were ... we were going to have courses but then orders just poured in ...

In this case a university consultant (with a background in chemistry and engineering) had worked with a company employee to develop environmental management routines, i.e. as an interpreter of the environmental "story-line." When we asked: "Your relation to the companies, do they simply ask you what to do?" the answer was: "Yes, exactly." The consultant continued:

Well, we try to explain how to go about this, try to interpret the demands of the standard and EMAS and try to, well, we have gone to a number of courses in these private training companies and we try to keep abreast of things, know people who have been involved in evaluations and read the literature which comes within the area, then there is a good deal of common sense also.

Here we see the contours of a new kind of competence emerging and being defined in the practice (i.e. by the common sense) of these consultants. A basic familiarity with relevant natural sciences is coupled with a management competence in this case acquired not through formal university courses, but rather from private companies which have seen a niche for themselves (or a vacuum to be filled). This competence is also formed in interaction with the customers themselves:

Then it also depends on the customer, you work differently, you adapt a to what the customer wants and how they want to work and then you design it in a way that fits just them, in order to facilitate co-operation. Those one has worked with for a long time, those you know well, with them you can speak freely.

The strong pragmatic sense of this description reveals what is being constructed here, namely a situated definition of workable solutions, workable not only or primarily in the physical/technical sense, but rather from the point of view of particular companies and how they are placed in networks of production, linking users, suppliers, subcontractors, and in the end, final consumers. The negotiated character of these solutions is evident, but what do these negotiations consist of? Says the same consultant:

It is really we who do most of the work, but we do not carry out any measurements really, climb chimneys or take water

samples or suchlike, we use what they have or we recommend them if we think for example that they should do particle measurements, then we ask for information about material flows energy flows and so on within the company. Then we put this together and try to find all environmental aspects there are, what effects this process has on the environment. We also try to map which routines they have and which can be changed to handle the environmental work as effectively as possible.

In effect, the consultants are invited in to identify what can be constructed as environmental problems. However, without the wherewithal to conduct specific studies of particular factors ("climbing chimneys") and being management consultants rather than technical consultants, they focus on introducing the routines through which such potential problems can be identified and then eventually handled. If technical consultants are expected to say, this is dangerous, management consultants are expected to say, this can be dangerous, this is how we found out and this is how you can identify more potential dangers.

However, the work is not finished with this, and as the consultant continues, the mixture of traditional disciplines becomes even clearer:

... The environmental control system itself then, with it comes a lot of documentation of different kinds [of routines and decision making rules etc.]. There we help them with which documents they need to produce, what routines they need to handle this, provide viewpoints on their environmental policy for instance. Then we help them identify which laws are applicable to their activity, help them identify which parts of the process they must manage from an environmental point of view. It can be purchasing issues, it can be handling environmentally hazardous waste, it can be certain processes, it depends a lot on what kind of company it is.

This mixture of management and engineering is obviously nothing new in the sense that managers are often engineers. The interesting point is rather that in the case of environmentally oriented process engineering management, the basic competence currently required in Sweden is a basic education in science/engineering (which exactly seems irrelevant) whereas the management component is provided through private training institutes and concrete experience, i.e. mainly in the form of pragmatic formulae rather than academic business management training. This contrasts with the situation in companies visited in Norway where people involved in implementing EMAS usually have a management background.

Another problem which did not loom large in the Swedish interviews but came up more explicitly in Norway was the relation of EMAS to other ways of thinking and acting on environmental problems, such as life-cycle analysis or industrial ecology. The latter represents an effort to develop a more coherent theory of ecological management, with new concepts with which to think about production processes such as "Metabolism", "Cycles", "Flow", "Exergy". However, they remain largely academic

constructions as LCA itself, without a major impact on practical discourses, and this is apparently the case elsewhere as well.

One Norwegian attempt to bridge theoretical understandings and practical concerns has been built up around a university centre otherwise mainly providing courses and arranging seminars aimed at an academic public and thus maintaining and translating the sustainability story-line to the Norwegian context. The centre was set up as the result of a government initiative, and has been constructed by established disciplinary interests as if not a threat then at least as unwelcome and unneeded competition. This is yet one example of how the promotion of sustainability or “green” ideas reactivates long standing conflicts, in this case between government initiatives based on the idea of interdisciplinarity and the resistance of local disciplinary interests.

The centre has put much efforts into LCA, and co-operation with no less than "nine of the largest Norwegian corporations" has resulted in not only a solid knowledge base, but more important a reservoir of "actor capital" to tap into when it comes to advocating sustainability. However, in doing so, varied novel concepts tend to be replaced by conventional and uncontested policy-motivated prescriptions, drawing on current management vogues, rather than practical prescriptions deducted from industrial ecology and life cycle analysis.

This problem has also appeared in other projects aimed at enlightening industry. Here is an example from a Dutch programme, which after six years came up with the following "golden rules":

- Develop your views on sustainability
- Take the future as your starting point
- Cooperation is essential
- Develop a strong support base
- Good results depend on inspiring project leadership.

Of these, the stipulation to think forward turned out to be most difficult to apply. "It appears hard for participants in research in business and other organisations, from government and from environmental or consumer movements to look far ahead," noted the project leader in retrospect.

Networking, of course, implies some kind of convergence, which is the prerequisite of communication, but the issue here is whether academic theories, in this case LCA and IE, can have an impact on industrial practices and then under which conditions. In the various initiatives studied here, the direction of influence ended up being in the other direction in most cases.

At another research organisation which was the research partner in the first Norwegian EMAS implementation, the persons involved have had time to reflect on this and suggested that a clear distinction should be maintained between theory and practical results. His argument was that "we have the theoretical backdrop of environmentalism ... industrial ecology" – and "we have the problem of securing the best possible [green] decisions". The main task is to integrate the management systems of the industrial site, into a healthy organisational environment of learning and securing better products, in

terms of quality and environmental impact. In this way, the sustainability story-line (as perceived by this network) and the day-to-day problems of engineers and middle management can be connected, that is by involving people with the requisite theoretical background and commitment, and developing appropriate measures with their help. Hence, expecting guidelines for action from academic discourses beyond the general methodological prescriptions contained in LCA and industrial ecology, or, for that matter, codified in EMAS and ISO 14000 would only lead the process astray.

Yet, these ideas are but a fraction of the plethora of management ideas which company leaders can select from or avoid while thinking about how to run their companies, and therefore the sanctification implied by the environmental standards and the establishment of the sustainability story-line in general is particularly important. Yet for some, EMAS is no more than the current approach to environmental issues, and one top-manager in a large corporation put forward rather strong objections to EMAS, maintaining that it was "too standardised, therefore locking us to one environmental standard, and endangering development towards my green 'vision' and Quality with a major 'Q'." This informant was convinced that a green industry is both economically and technically feasible, and suggested that the establishment of particular methods or standards companies entailed the risk of locking companies in approaches that might quickly become obsolete.

These considerations obviously have a bearing on the issue of competence creation and professionalisation. But there are also power inequalities involved - the projects discussed here and many others depend on the goodwill of government departments and the industrialists involved. Obviously that does not automatically lead to an adaptive stance on behalf of the academics, but retaining independence in this context is not an altogether straightforward matter either.

However, the issues are likely to be different in companies which have been in the focus of regulatory agencies and their inspectors. In Norway most EMAS-certified companies belong to this category, but expressed disappointment because EMAS certification had not lessened the attention paid to them by the inspectors. It was argued in several cases that EMAS and ISO-14000 were better tools than controls by government inspectors, as EMAS and ISO -14000 ensures continuous monitoring and inspections by their very nature are made at discrete points in time. Official pollution control inspectors, however, tend to see EMAS as an extension of the public control system, intended to facilitate the work of enforcing agencies and not replace it. This construction of the relationship was commonly accepted also by engineers and managers in Sweden.

An engineer working in a Swedish company which had received regular visits from local health inspectors, for instance, stated,

... [ISO 14000] it is not so radical, the environmental regulations have been there and now you only have to document what you do and do a little improvements, and from the point of view of the employees, there is not much change there.

This does not mean that the process is entirely unproblematic, but rather that regular contacts with the environment inspectors and consultants working against a regulatory background rather than on compliance with ISO 14000 and EMAS as such nonetheless prepares companies for this next step, but also tends to encourage the interpretation of environmental management into the compliance paradigm created by regulatory efforts:

... my attitude is, that it is better to do what the authorities say, and if you do it properly, then it perhaps takes you two or three days to fix it, per year, ... you send documentation to the authorities, or whatever you are supposed to do, and that is enough, then it is done. But if you then have too much of something, and they start calling, 'what is this bloody thing' then it takes forever, there are visits day after day, there is someone checking the water going out, and there is someone checking on emissions to the air, and there is someone checking still something else, and that is just trouble.

Coping with environmental regulation creates a particular attitude to the work involved in identifying and defining solutions to certain problematic aspects of industrial processes. However, there are other aspects as well:

The only thing is that if you have an environmental certificate, then you are in the system, you can discuss with customers, yes, sometimes without this you cannot do business with certain customers, .. it is more and more they say that we only deal with certified companies, and that is that, so if you don't [have the certificate] the question comes "why not" and then, kind of, the customers want it and the authorities want it or should we say, it is easier to deal with the authorities if you have it, and the same should we say, with the locals. ... you can say this is how we work.

This implies that sometimes the reception of the message is somewhat perfunctory, and environmental issues tend to be relegated to second rank and even in large companies handled to a large extent by external consultants, and when the fulfilling of regulatory requirements quickly is at stake, this mode of arranging matters may be the only way possible. However, this tends to reinforce the character of environmental issues as external to the process proper:

... it is really dangerous to use external help and consultants, which we have had now and then, because many bosses have so little time that they are unable to sit down and as it were work up these documents, then you use externals. And then they often swallow the content ... without perhaps really understanding what this is all about ... and then, the engagement is lacking, which is supposed to keep this alive, it becomes more or less forced on them and that is not so great.

Again, we meet the construction of environmentally motivated process changes as something primarily externally motivated - someone 'out there' makes demands, with which companies comply, and often by having someone else 'out there' figure out how to do it, while the rest of the company continues as usual. This is a common mode of constructing the relations between companies and their environment: They react to markets, they follow regulations, they apply scientific findings, they do not meddle in politics. Facing minor problems, they get rid of them rather than solving them. Another way to see what actual companies do is to appreciate that companies create markets, construct needs and direct their fulfilment to their products by creating a positive image. They also anticipate regulation and other government initiatives, which they actively seek to influence in the desired direction, they direct research or conduct it themselves in their R&D departments, or collaborate in government sponsored projects in order to get access to the results before the competition. The interesting thing here is not so much what is the correct description of corporate capitalism, but rather the observation that these two opposite constructions refer to different aspects of company life. The technicians and quasi-technical environmental consultants, as we have seen, are mainly concerned with adjusting to environmentalism, in the form of pulling out toxic substances, reducing waste and transport needs, adhering to existing regulations. In this process, well defined jurisdictions and mutual observance of their boundaries forms the basis of co-operation.

Orchestrating this cooperation is what brokers do, and in some case they come from within the companies concerned, in others they are brought in from the outside, or rather, remain on the outside giving advice where and when companies are willing to accept it. On the basis of this activity, a new jurisdiction is slowly taking form, that of environmental management, built on the possession by particular individuals and groups on the perceived capability to create systems and routines which facilitate the identification of environmental problems. This jurisdiction can be seen as an emergent profession, to which we will return later. However, at this point, we want to note that the existence of this group largely depends on the perceived external character of environmental problems, perception that sees them as something brought on the company, by outside pressure, rather than intrinsic to the character of the company's activities themselves.

Summarising, the development of competencies which from the perspective of the existing academic, bureaucratic and professional divisions are "mixtures" or interdisciplinary is an integrated part of environmentally oriented process engineering management. However, this process is fraught with difficulties. People from different disciplines have difficulties understanding the exact content of each other's problems, people from management find engineers difficult to communicate with and the other way around, consultants and regulatory officers are either constructed as incompetent as they are unable to see problems the same way as company officers, or the other way around, the responsibility for adapting the process of the company is off-loaded on external consultants whose recommendations are followed in the same spirit as those of regulatory officers, that is to the letter but without any real interest or concern for what is actually going on, and always with an eye to "the economic side of things."

This means that translating environmental concerns into terms amenable to conducting "business as usual" becomes a special problem the solutions of which largely determine

the form of environmental science and technology policy, not least in defining what policy initiatives are possible and which are not.

Similarly, environmental initiatives can be used to increase market shares in case where consumers are willing to pay more or prefer otherwise products which they perceive as "environmentally friendly" or in order to create a green image for the company in question, and thereby avoid embarrassing confrontations with environmental groups with consequent negative impact on sales. In the former case the effort is directed at consumers individually and the message is brought out through advertising, which may or may not enhance relations with environmental groups. In the latter case, the effort is targeted at environmental groups and the tool is public relations management rather than direct advertising, including ensuring favourable reporting in the media.

This may seem a somewhat thin distinction at first glance, but what it implies is a distinction between salesmanship and politics. Actions by environmental groups are usually aimed at companies and company activities which have a documented adverse effect on the environment, spread toxic waste, bury such waste on the company grounds or try to sneak them into public landfills, spill it into the ocean, and so on. Linking a particular effect to a company in other words requires a certain degree of visibility.

Installing environmental management systems and other certification procedures does in this context imply that first, the company takes it upon itself to investigate all complaints from the public regarding potential hazards and answer questions about them. Defusing potential protest movements by removing a problem such as bad smell, or at least promising to do so at the first opportunity, is arguably a more effective strategy than denying everything and having the local women gathering at the factory gates as a result, as happened to one of the companies we visited several years ago. Secondly, monitoring the process from an environmental perspective makes it possible to identify potential hazards which can also, at a later point in time, can become potential embarrassments. Environmental management systems do, in other words, make it possible to manage the process better economically and technically, but also open possibilities for managing relations with environmental groups more effectively, with the aid of specialist consultants who help companies avoid embarrassing incidents, but also advise them about how to keep a low profile and avoid attracting the attention of activists.

We saw above how such pressures are transmitted through supplier networks and local corporate networks, but the credibility issue is mainly settled in a different arena, however. The issue here is whether the company, if the question is posed at all, can be constructed by activists and media as hazardous to the environment (or its local environment) and if such a construction is possible, how the aspects of company activities on which it is based can be removed or at least removed from sight. One way to solve this problem is to develop a definition of environmental issues, according to which the company performs satisfactorily. In other words, rather than changing a particular process physically, arguments can be developed that the current form of the process is actually preferable to the (selected) alternatives and data collected to support that contention.

Life cycle analysis, EMAS and other methodologies can be put to this use, and there are indeed consultants who readily take on such work if it is called for, for example in order to secure continuation of operating licenses. At a more general level, there are scientists who maintain that nuclear power is environmentally friendly, and those who disagree. There are scientists who maintain that recycling consumes more non-renewable resources than landfills or burning and with the current status of recycling technologies, they certainly have a point. In this way, every particular measure can be portrayed in this or that way, depending on what kind of calculations is applied. The pragmatism of the ecological vision of a sustainable society does, in other words, open all conceivable steps to this goal to criticism from those who stand to lose from it.

From the viewpoint of public participation this means that whereas earlier, at least some clear-cut and visible (or emblematic) issues could be identified around which environmental campaigns could be organised, this is less the case now. More important however is the development of capabilities within corporations to identify potential political dangers and avoid serving environmental organisations with such issues, and when that is not enough, produce counterarguments and protestations of good faith which ostensibly accept the general sustainability story-line, but present a different version of it. The pragmatism of environmentalism has, if nothing else, accelerated this process.

VII. Brokers as entrepreneurs

Above, we have concentrated on brokers who, in consequence of their research interests or administrative positions in the academic or bureaucratic worlds have reached out to each other, within or across policy cultures and towards companies in order to put together environmental management or sustainable technology development projects. This type of brokers tends to be well established within one policy culture or another and build their brokerage efforts on that position. However, a different kind of brokers can also be observed which rather capitalises on their ability to bring together people from different cultures without being tied to any one of them.

If we see environmental discourses, with Hajer, as fragmented, and this apparently chaotic fragmentation as being structured in specific ways more or less according to a revised policy cultures model (including significant contradictions and conflict lines within the policy cultures about the interpretation of their specific traditions and the practical consequences etc.), this leaves us with sets of actors with specific interests, problem-solving approaches, access to other actors, which have to be negotiated, which leads us to another category of actors which is the exact opposite and which we want to highlight in this section: Not pursuing a particular practical imperative and often without strong roots in any specific culture, tradition or interest they can take on themselves to purvey any of the many possible interpretations and lines of actions which at the moment seems most advantageous, not to say lucrative, so long as it can be framed within the ecological modernisation paradigm.

This category is mostly identified as consultants, and many call themselves just that, but it would be fallacious to put all environmental consultants under this heading.

Rather we are focusing here on untied go-betweens, which cannot be construed as the ambassadors of one policy culture operating within another, nor as the generals of one culture assembling their forces for the defence of the realm, but more as messengers which, however, in the ways they relay their message and through selecting particular people to relay it to, amplify the dominant trends in their own particular way. Obviously, earlier engagement in environmental movements or academic research with environmental relevance is a major if not altogether necessary asset for all kinds of brokers but in this case it is essential because the social capital utilised and turned into concrete networking projects can only be acquired through such commitments, and the credibility/legitimacy of this type of broker also depends on sustained commitment. Therefore, these brokers tend (as do the others) to have a history of green activism of some sort - however, only in this kind of practice does it constitute its specific basis.

We will first discuss an example from Sweden, which is selected because the relative openness of the opportunity structure and the resulting bricolage which is so characteristic of environmental brokerage is particularly evident in this case. Here is how he describes the background to his work:

The organisations which represented environmental work in Sweden, they had spent the eighties pretty much on the barricades and since they drank hormoslyr on the telly and suchlike it has been very agitational and it has also whipped up moods which were not so fruitful, very conflict-laden. Here in this area we felt several different wishes about steps we wanted to take, ... in order to explicate for the public what this is all about, what kind of life we are living and how we with our lives influenced the nature around us and that this effect becomes total if you count in everything everyone does and nobody is without blame and therefore we have a common responsibility and the trend we could see was not positive when it comes to our air and our water and our use of resources in the energy field and the use of other resources.

The strong echo of ecological modernisation rhetoric is transparent in this quote. Seeing environmental issues as something everybody can work on together is after all a part and parcel of the process which has brought environmental issues to the centre of policy-making. No less interesting is that this is combined with a practical orientation which is primarily local in scope, but not limited to particular administrative divisions. The local forces were mobilised through an ideal association (a kind of NGO):

... we thought, we really needed to create a common forum both for [these] questions so we would be more effective, learn to know each other and get rid of some of this which is not so creative. ... a table to gather around for authorities, companies, organisations, schools, not private persons. ... The purpose was to increase our knowledge and strengthen the environmental work going on, create bridges between the different actors to see if we could together strengthen the competitive position of the region and make it better environmentally ... and we started a lot of things which

probably were perceived as fun, a little different, we work across the borders and we could do something different.

The character of this association is very much what we have posited above as a typical way of handling environmental issues, i.e. a consensus oriented network with participation from people representing or typical of different policy cultures. Among the events arranged by this organisation was a tour of the region by the standing committee on culture of the Swedish parliament, accompanied by local "creative company people." This tour featured among others a visit to a remote area with consumption of local food, a musical performance by the local bishop, and an internationally acclaimed writer lecturing the honourables on their responsibilities.

The resulting media coverage was a major step in establishing the particular construction of environmental issues presented by this network in the minds of the public, but also in establishing this organisation as a serious actor. Since then it has been involved in numerous educational activities "all of which involved increasing the level of knowledge." Among other things discussed were environmental strategies, environmental policy development in companies, different environmental management systems, use of ethanol, transport issues, logistics, housing, particularly wood construction, medical reusables, highland grazing, life cycle analysis of the family, etc.

Simultaneously, media coverage increased steadily, and documentation and educational materials were produced. Eventually a micro enterprise network was established to promote ecologically sound methods in small companies, and develop systems for monitoring both the internal working environment (a long standing and highly fundable concern in Sweden) as well as external environmental effects at the same time, which eventually developed into a consulting project which also included ecological/environmental management education for technical consultants. When EMAS and ISO 14000 were established as European and international standards respectively,

they became the interesting thing but we found that the small companies were lagging behind. All the time we have worked to get the processes going but our aim has not been to manage anything. But then this really took off with small and medium sized enterprises, ALMI and I don't know what, we tried to get our hand under all the dust and feel, what will happen next then? And then we realised that it is a completely different group of companies which needs help now and those are the micro-companies. ... Nobody really cared, they do not know much and they are very vulnerable.

In this way, environmental policies are, as it were, incorporated into regional policies and employment creation policy. More generally, we can observe how the rhetorical goal "sustainability" is incorporated into existing and dominating policy paradigms. The differences in these from one country to another reasonably also form the practice of sustainability.

The organisational structure of the initiatives described above and how they are funded brings out two important aspects of the Swedish case and perhaps of the current state of ecological modernisation. The first is the prevalence of the project form. The other is the prevalence at the local level of what has been called bricolage, that is the practice of engaging in a variety of activities for the purpose of self employment (and eventually profit and glory), a mode of operation which has spread in the academic world, is common in outlying regions of Europe, but is by no means limited to these instances. Ecological modernisation presents many opportunities for redefining task definitions and actual practices of consultants, engineers, and natural scientists, and these opportunities are taken up eagerly by bricoleurs who do not hold established bureaucratic positions but can and will co-operate with administrative authorities and corporate actors, and indeed can see it as a main task to build bridges between them, by advising on how companies can fulfil regulations and adjust to prevailing policy concerns, rhetorically or in practice.

An important aspect of this process is its dependence on public funding, at least in Sweden. This method of using public funds to subsidise or finance services to companies in order to "increase competitiveness" in the form of specific well defined projects, has not been invented for the purpose of ecological modernisation and the pursuit of sustainability. Rather, what has happened is that these goals have been redefined in order to fit with funding paradigms, and in this process the definition of a sustainable process and an environmentally acceptable image (or ecological credibility) and turning it into a "project" has been central. Not only does that make it possible to insert ecological modernisation in the management paradigms which prevail in the Swedish corporate culture, but also, and importantly, into the paradigms which regulate bureaucratic interventions in economic life, and thereby, endow them with the legitimacy bestowed by routine and tradition. This is fairly obvious where employment creation is concerned, not quite so obvious but discernible in the case of regional subsidies, particularly as perceived by local actors, but much less transparent in the case of science and technology policy.

In the cases where this redefinition of sustainability has been successful it has led to a privatisation of responsibility for implementation, subsidised by public funds. The money flow generated from public authorities to the corporate sector is however largely clad in the form of funding specific projects and it is there that opportunities are generated for "free lance" actors or bricoleurs intervene, academics as well as others, and design projects which attract the interests of corporate actors and are, simultaneously, fundable by government. Conversely, the ability of actors in different cultures, and the ability of actors within particular policy fields such as regional, employment, social, cultural, education, etc. largely determines the extent to which global aims such as sustainability are translated into practices relevant for that culture and that policy field. However, this is difficult to do from an ordinary position within the traditional university, at least in larger universities as described by one person working on those issues in such a university:

More and more I have become convinced that in the case of doing projects, that is projects designed and carried out for companies or branch organisations, I think it can be difficult to do that within the framework of the [university] system, it is

difficult to find the carrots, find the motivation, and besides it is difficult for the teachers to focus everything, they are to teach, they are to do research, and then also work with the outside, with the companies. If there is a small organisation on the side, which however is connected somehow ... they can focus on what they should do, namely transfer of knowledge within a certain sector, and that is their only focus, training.

The paradigm for doing this is the consultant company formed and staffed by academics to give their extracurricular activities an appropriate legal form.

The issue arises therefore in the case of environmental science and technology policy, if the low profile of sustainable technology and clean production can be explained at least partly by the relative inability of the relevant actors to generate projects in the traditional mode of organising policy-related interventions, i.e. by funding initiatives which both generate opportunities, show future opportunities, facilitates subsidisation by government and implementation by private firms and organisations - a problem which MISTRA in Sweden (the Foundation for Strategic Environmental Research) has in its own way attempted to solve.

An English programme, known as the Link programme, has similar aims in terms of promoting the dissemination of science-based technologies and bringing about the wherewithals to solve known environmental or other problems. However, its framing is very different: here it is a case of a government initiative to foster the commercialisation of public sector research in biotechnology. It is the principal UK government mechanism for supporting collaborative research between industry and the science base. The various LINK programmes are co-ordinated by the Department of Trade and Industry which provides matched funding (with industry) for technological projects that involve collaboration between academic institutions, SME's and large companies under various thematic priorities. The intention is to support on-going successful relationships between firms and academics and/or successful product/process innovations.

The main LINK programme involved in bioremediation technologies is known as the Biological Treatment of Soil and Water Programme (BTSW). This has funded about 15 projects, each of which has on average 4 or 5 participants. In total 12 or so universities and 25 firms are involved. The large companies tend to provide the cash and the SMEs and universities the expertise.

The BTSW programme was set up/brokered by an industrial scientist who earlier worked for a large oil company. He was seconded to the Department of Trade and Industry for 18 months where he set up the BTSW programme and then set himself up as a consultant for the Department of Trade and Industry running the programme. Several other LINK programmes in the wider biotechnology field are also run by consultants working on behalf of the Department of Trade and Industry. The BTSW broker was also asked by UK government to be the UK representative to the OECD on bioremediation. There he is also involved in writing books for the OECD on the contribution biotechnology can make to sustainable development which is aimed at non-scientists (for example managers) and provides information on the sort of

opportunities in this field. He was also involved in setting up and running international workshops on bioremediation for the OECD with industrial and academic participants. The BTSW broker is also the Environmental Biotechnology co-ordinator for the BBSRC (biological sciences research council) Chemicals and Pharmaceuticals Directorate.

If this example is typical, and we believe on the basis of interviews and other material gathered within the project that it is, a similar pattern emerges as was earlier described in the case of Sweden. If anything, the importance of business opportunities in brokerage are more accentuated in the English case due to the longer period in which support to private business initiatives has been high on the policy agenda in England. There, the vast majority of networks (between universities and industry) arise only as a consequence of government sponsorship according to this particular broker, something which, if true, differs from Sweden where existing networks may adapt themselves to the demands of applying for government money but where there usually, according to our information, is a history of informal networking or at least collaboration under other auspices, prior to cooperation in government-sponsored environmental projects.

However, the difference between the evidence from this particular case and others we have studied can also be interpreted as a result of the character of the innovations concerned. It appears that innovation networks in biotechnology do not have to face similar problems in terms of vested interests as do networks oriented towards for instance innovation in chemistry or combustion techniques, to name a few examples. In spite of its long history in food processing and brewing and a number of current experiments, biotechnology has not as yet become the foundation of a major industry on a par with, say, automobiles, electronics or telecommunications. In this relatively virgin field, there are fewer preexisting networks, fewer established jurisdictions, fewer legitimate expert groups and fewer scientific and technological conventions or established truths. On the other side of the coin, there is less to build on which is why innovation networks in this area tend to be built from scratch more frequently.

Our evidence on this is scanty, however, as biotechnology was not among the focus areas of the project from the start, but its importance grew on us as we went along, not least because of the ambivalent attitude of environmentalists towards this emergent source of solutions - or should it be constructed as one more threat against the biosphere, more serious than anything industrial society has brought forth so far? Although the scientific evidence is uniformly positive it is inconclusive. Further, one of the lasting heritages of environmentalism is that the public has learned that science can be put to many uses. Paradoxically, in view of the dependence of environmentalism on scientific arguments, it has contributed powerfully to the delegitimation of expert authority. This applies particularly to expertise commissioned by corporate, bureaucratic and political actors as part of public campaigns and decision making processes. Further, public fears as well as philosophically or religiously based opposition to the consequences of industrializing life itself are obviously cause for concerns in any democratic society. These in turn can lead to legislative action against particular biotechnical innovations or efforts to allay the fears of the citizenry and "sell" biotechnology to the consumers as sustainable.

We saw in the English case that brokers can and often do straddle the borders between different policy domains, and one more example of this will be provided, from the Netherlands. This broker started his career in 1958 in a large chemical corporation, in the division of fibres. Later, he worked within this company on long term economic planning. From 1972 to 1981, he was a member of the Parliament as a representative of a small, left-wing, progressive party. After that period, he became vice-chairman of a government-sponsored Societal Discussion on Energy Policy organised in response to the political turmoil over nuclear energy, in order to solicit views and opinions from the public. The results did not influence policy in the end, but the process is often seen as initiating a more cooperative attitude on the part of the environmental movement towards the established political system.

After this the broker managed a recycling project, was Environmental Inspector of a province and then ended up in the environment ministry where, because of disagreements with the minister, he found himself available. On the request of the director general of environmental affairs he then developed an idea for a sustainable technology programme, simultaneously with taking up a position as professor, but retaining his position in the ministry on a part time basis.

The broker joined with another person in the ministry who had an advanced degree in molecular spectroscopy, and who had later worked with trade unions in facilitating lay access to science and technology. After a spell as an associate professor in Chemistry and Society, he moved to the Ministry of Housing, Spatial Planning and Environment (VROM) where he took over temporarily the leadership of an environmental technology group, where he, in addition to overseeing various programmes, directed his attention to long term innovation trajectories, an interest he shared with the broker, and which brought them together. After being appointed part-time professor, and losing his temporary leadership position in the ministry, he asked to be detached for three days a week to the broker's programme which was granted, and from the start, he provided inputs to the programme in the form of technology assessment experiences and ideas from science and technology studies.

Meanwhile, the broker had formed his initial ideas about the sustainable technology programme. He suggested that it should be co-funded by several ministries, but carried out by an independent organisation and with active involvement of the private sector. After securing agreement to these conditions he started to develop his ideas in informal communication and negotiations with interested people in government, politics and industry. After funding had been secured and a number of large companies involved, the project was formally started. In securing the support of various actors, the network contacts of the broker and his main associate were crucial. Between the two of them, they covered all policy domains.

During the project, the pragmatic perspectives gained precedence. In spite of substantial university involvement and attempts to involve varied other interest, the dynamism implied by close connections to and willingness to adapt to industry gained the upper hand. However, it is particularly interesting to look at what happened after the end of the project (which lasted five years). A follow-up was organised at various levels and within different constellations. Projects will be transferred to national technology (innovation) programmes already existing and/or to research institutes and

private enterprises. In this process, our broker is central and utilises connections established earlier and during the programme.

One of these are with members of a government working group on knowledge infrastructure, which, as the programme drew to an end, developed proposals for further work along the same lines as proposed in the programme, that is networked development of sustainable technologies with substantial private sector involvement. These proposals have been initiated by the broker who has created a strong platform through his participation in this working group.

The broker has also been member of the advisory board of a technology stimulation programme "Economy, Ecology and Technology," a collaboration between the Ministry of Economic Affairs and the Ministry of Science, Culture and Education. In this programme attention is directed to prevention and process-integrated technology. The programme aims at cooperation between research institutes and companies in order to create technological breakthroughs in 5 to 20 years.

Finally, a number of research projects initiated by the programme have resulted in applications to research councils for continued funding of the effort, and in this, academic connections are important. Whether this can be seen as industry setting agendas for research, or as research breaking free from initial industry-defined bounds, remains to be seen, and perhaps both paths can be expected to occur.

VIII. Preliminary conclusions

These case histories raise important issues about the form that ecological modernisation actually takes in practice and the role of science and technology policy, particularly in creating an enabling environment for cleaner production/consumption initiatives.

In many cases, initiative comes from outside the policy realm. Various entrepreneurial actors, in the civic, academic and economic domains, are taking advantage of the opportunities, but on the policy level and in the bureaucratic domain, perhaps because of its limited potential for framing social conflicts, environmentalism and ecological modernisation is a consensus construction the implementation of which can safely be left to the experts. And these experts, with the important exception of the Netherlands and Denmark, tend to be found everywhere except in the realm of science and technology policy which remains closely related to dominant and traditional industrial interests, and hence, disconnected from the areas where most radical innovations occur.

Therefore, the effects that environmentalism does have on technological change (and they are many and varied) are generally the result of the refraction or translation of the discourse of ecological modernisation and its practical implementation by other means, and through other policies: higher education policy, regional policy, economic policy, and, often in actual practice, are the result of nature preservation concerns rather than any sustained or coherent cleaner production efforts.

One reason that this may have become so prevalent can be formulated as follows, on the basis of our research: Those people who are likely to become brokers/translators of the ecological modernisation paradigm, and bring the matter from "the barricades" into the practices of everyday life, connecting it with other (fundable or sponsorable) concerns, tend to come from outside the science and technology policy establishment. In many cases they lack any specific technological competence which confounds the translation problems, as those entrusted with practising ecological modernisation in various companies are often chemists or engineers. Hence, as political rhetoric becomes practice, the technological issues which in a way should be central tend to be approached indirectly, often in a very roundabout way, except where there are obvious savings or profit opportunities.

Chapter Four

On Transnational Linkages

In workpackage three, our research has focused on particular types, or cases, of internationalization in relation to public engagement and science and technology policy options. On the one hand, we have examined particular attempts to create networks across national boundaries, and have carried out a case study of the Greening of Industry network, as well as of the "transfer" of ecological modernization to Lithuania and other regions of eastern Europe. On the other hand, we have explored some of the potentially new "virtual" transnational linkages that are emerging, via the internet.

Since this has been the final work package in our project, the results are preliminary. We have therefore chosen to present the material in the form of three working papers: one on the Greening network, one on the transfer process to eastern Europe, and one on public participation and the internet. Additional working papers are sent along with this report.

Working Paper I

Environmentalism in an Entrepreneurial Age: The Greening of Industry Network¹⁴

1. Introduction

¹⁴ This paper has been written by Andrew Jamison. It is based on a number of discussions with Johan Schot and Kurt Fischer, as well as "participant observation" at Greening of Industry network conferences, in Santa Barbara, USA in November 1997 and in Rome, in November 1998. I have also drawn on a study of the network, written by Jose Andringa, as well as the network's own "self-evaluation" published in 1998.

In 1989, a young Dutch historian traveled around the United States in search of kindred souls. Not yet 30, Johan Schot had already set out on an unusual personal trajectory, combining an academic interest in the history and social study of technology with professional consulting in environmental management. After a first degree in history from the Erasmus University in Rotterdam, Schot had obtained a job at the TNO Center for Technology and Policy, a private research institute, as a consultant in the area of environmental technology.

In the US, he gave a talk at an academic conference in California, organized by the Society for the History of Technology, on constructive technology assessment, in which he applied some of the new conceptual tools of evolutionary economics and innovation theory to technology developments in the environmental field. By reflecting on technological development in a more proactive way, Schot argued in his paper, technology assessment could be integrated into the construction, or design, process, thus making many production processes more appropriate, and also more responsive to societal needs.

In the paper, he characterized three elements of constructive technology assessment, which he has continued to develop in the years since (Schot 1998). On the one hand, Schot contended, there was the element of expectation or anticipation; CTA sought to identify and articulate the ideas, visions, and goals of particular projects as an explicit part of the technological development process. Secondly, there was the element of reflexivity, of building processes of dialogue and interactive communication into the designing and constructing of technology. Thirdly, there was the element of contextual or social innovation: technology development, or construction, was not merely a matter of ideas or communication, it was also a matter of connecting people, of establishing what Schot called a "technological nexus" for bringing different "actors" or participants together in the co-construction process. To a large extent, the Greening of Industry network is an example writ large of what Johan Schot was talking about in that 1989 conference paper (Schot 1992).

After the conference, Schot went off touring the US, and eventually met up with Kurt Fischer at Tufts, who had worked in a number of different companies, and was now back in the academic world, trying to get his fellow academics interested in the environmental changes which were going on in the world of business. He was one of the few Americans, whom Schot met on his tour, who seemed to be on the same wavelength. Like Schot, Fischer was also working in the not-yet existing intellectual terrain of environmental management/ sociology, and, also like Schot, he was interested in creating new channels of communication and interaction, both within the academic world, but also across different worlds - of business and academe, of government and "non-government". By the end of his visit to the US, the young Dutchman and the middle-aged American had come up with an idea for a transatlantic meeting, bringing together a coterie of Americans and Europeans from different social domains and areas of concern to develop a new environmental management agenda. And so was born the Greening of Industry network.

The first conference in the Netherlands in 1991 was kept small by design, but the second, held two years later in Boston, attracted 166 people, with Dutch and

Americans making up well over half of the participants on both occasions. After that the network has grown rapidly, and a pattern was set which has continued throughout the 1990s, of having a conference one year in North America and the following year in Europe. And by having conferences in new places all the time, the network has enrolled substantial numbers of participants from Denmark (where the 1994 conference was held: in Copenhagen), Canada (where the 1995 conference was held: in Toronto), Germany (Heidelberg, 1996), California (Santa Barbara, 1997), and Italy (Rome, 1998). In 1998, a new node was established in Asia, with a network office in Bangkok inaugurated at an ambitious launch meeting in July. The network plans to hold its conference in 2000 in Bangkok.

The Greening of Industry network is neither a non-governmental organization nor a business firm. And neither is it an academic society or an intergovernmental body. While attracting participants from all four types of "policy domains" - business, government, academia and civil society - it is itself something different, and autonomous. As such, it is in principle not reducible to any one set of values, institutional ethos or organizational pattern. In a sense, the Greening of Industry network (GIN) draws on resources, ideas and interests from all four domains, but it makes them into something new. Its leaders continually mix up the various sources of influence and inspiration into new packages, which is both the charm, but also perhaps the eventual dilemma of the network.

In the pages that follow, we consider the Greening of Industry network as a kind of social movement of the 1990s. In an age when activism has become professionalized and marginalized at one and the same time, environmentalism has taken on new forms of operation and expression (cf. Lash et al 1996). No longer is the environmental message primarily propounded by activists in social movement organizations. Rather, there are a number of new hybrid organizational forms, that are behaving much like social movements did in earlier periods, in terms of getting out the message; but these organizations are often much more business-minded and professional than social movements tend to be.

In the pages that follow, we first briefly present the framework of analysis, which is based on a cognitive approach to social movements. Then we attempt to identify briefly the "opportunity structures" that confront environmentalists in the 1990s, as activism has given way to more established forms of political and subpolitical behavior and new kinds of actors have tended to colonize the life-worlds and public spaces that were previously occupied by activists. We then explore the cognitive praxis of the Greening of Industry network as a case, perhaps one of the most intriguing cases, of the contemporary face of environmental politics.

2. Social Movements as Cognitive Praxis

In previous work, we have explored the activities that take place in social movements - and, in particular, in environmental movements - in cognitive terms (Jamison et al 1990; Eyerman and Jamison 1991). While most students of social movements have approached their subject in more explicitly political or instrumental terms, we have focused on social movements, such as the new environmental movements, primarily as

producers of knowledge. Obviously, the explicit political activity is important to understand, but the ways in which social movements contribute to the development of human knowledge - what we might call their enlightenment function - is also important, and, in most accounts, overlooked.

We have argued that social movements, throughout the modern era, have carved out temporary public spaces for the articulation of ideas and historical "projects" that later tend to become institutionalized in academic disciplines, professional roles and identities, as well as in broader societal discourses. Social movements, we suggest, are forms of *cognitive praxis*, which combine new world-view assumptions, new criteria for scientific and technological development, with new forms for organizing and disseminating knowledge.

In the carving out of these new public spaces, social movements periodically serve as seedbeds for the reconstitution of social and intellectual life. But the "role" that social movements play in the development of knowledge is something that is largely neglected, both in the philosophy and sociology of science as well as in the literature on social movements,. We refer to three dimensions, or components, of cognitive praxis, a cosmological, a technological and an organizational, and suggest that what gives a social movement a central part of its core identity is the active and creative combination of these dimensions. The creation, or articulation, of an integrative cognitive praxis is, for us, one of the defining elements of a social movement.

In the 19th century, the labor movement, for example, played a crucial role in the development of both the historical and social sciences. In the early part of the century, out of the response to the first waves of mechanization, new ideas about society, economy, and politics were formulated that had a major influence on the later development of political economy, sociology and, of course, socialist theory. In the second half of the century, the organized labor movement provided the space for the development of both marxism, anarchism, and social democracy, which have been central building blocks or core elements in a range of academic and political discourses, from political and social theory to economic history to the theory and philosophy of science.

In the early 20th century, the social movements of the right and the left, both communism and fascism, but also the social movements of national liberation in India and China, similarly provided temporary spaces for innovative forms of cognitive praxis. The questioning of the values of Western civilization, which was an important source of inspiration for a range of cultural sciences and cultural theories, is probably the most obvious contribution of the movements of the interwar years to the development of knowledge. But there was also a strong impact on popular culture through what we have recently termed the "mobilization of tradition" in the social movements of the 1920s and 1930s (Eyerman and Jamison 1998). New forms of cultural expression - mural art, folk music, modern dance - and new forms for producing culture - particularly the mass meetings of the Nazis and the communists, but also the moral witnessing and exemplary action of Gandhi's liberation movement in India - were innovated in the space of social movements.

In our times, the new social movements of environmentalism and feminism and anti-imperialism have also contributed to new fields of knowledge, professional identities and new societal discourses (Jamison 1994). There is now, in the academic world, a plurality of sciences and, more generally, a plurality of approaches to understanding reality that are inconceivable without the innovative cognitive interventions of the new social movements. Similarly, the widespread exploration of traditional knowledges and of ethnic and cultural identities is, in large part, a result of the articulating cognitive praxis of the civil rights movement of the 1950s and 1960s and the neo-nationalist movements of the 1970s and 1980s.

Our cognitive approach to social movements has been inspired by the writings of Alain Touraine and Alberto Melucci, who have sought to distinguish the "new" social movements of the late 20th century from the older, or more classical, social movements of the 19th and early 20th centuries, especially the labor movement and the fascist movements of the interwar years. Touraine has emphasized the redefinitions of reality, the struggle, as he has put it, to define "historicity" as being central to the solidarity movement in Poland, the anti-nuclear movement in France, and the student movement throughout the industrial world (Touraine 1983). What made these movements new was not merely that they were fighting a different enemy, but that they were also challenging, in many respects, the achievements and the political positions of the older movements. Most central for new social movement theory was the recognition that aside from the actual political struggles, there was also a struggle for "identity" taking place in the new movements, and perhaps especially in the movements for women's liberation, or feminist movements.

These insights have been further developed by Alberto Melucci, especially in his books *Nomads of the Present* (Melucci 1989) and *Challenging Codes* (Melucci 1996). On the one hand, Melucci has distinguished between latent and active periods of movement activity, and he has pointed to the fact that movements change their character and their level of visibility over time. In the 1990s, social movements are perhaps best seen not as organizations but as networks, which are not as firmly or coherently coordinated as social movement organizations tend to be. What is important, for Melucci, is the symbolic action that takes place in these networks, the new codes or concepts that are articulated, as well as the bonds of solidarity or community that are established and reproduced. Melucci calls this code challenging for symbolic action, emphasizing, as we do, that there is much more than instrumental behavior going on in social movements and, indeed, in social life more generally. Our concept of cognitive praxis, and our newer notion of exemplary action, can be thought of as particular categories of symbolic action.

3. The Contemporary Face of Environmental Politics

To a large extent, Melucci's ideas about latent networks resemble Ulrich Beck's notion of "subpolitics" (Beck 1992). In his account, it is not social movements that are seen to be the carriers of an alternative political activity, or identity, in what Beck terms the risk society; it is rather a much looser, much less organized sphere of social life or interaction that is important to identify and support. The term subpolitics implies that

what is most characteristic of the environmental politics of our time is the significance of what is carried out below the surface of formal politics and policy making. Subpolitics is political in a less visible or explicit way than social movement activities tend to be. But it is the form of politics that seems to emerge in a nonpolitical, or commercial age.

For while social movements have tended to fade from the scene as political actors, a new range of organizations have entered the world of environmental politics. On the one hand, there are the transnational actors, both corporate, intergovernmental (World Bank, UNEP, EU), as well as non-governmental (Greenpeace, WWF) that have been central formulators of the global environmental agenda, and central participants in the quest for sustainable development.

On the other hand, there are a number of new established actors, in government, business and academic life, often moving between or among these domains in hybrid forms. The 1990s have witnessed the emergence of a new discourse of environmental politics in the guise of ecological modernization, and a new cluster of discourse coalitions, or institutionalized forms of societal practice, that have tended to fill, or replace the public space that was once occupied by environmental movements and movement organizations.

In an attempt to develop further the ideas of subpolitics and symbolic action, Bron Szerszynski has differentiated four forms of what he terms ecological piety, corresponding to different kinds of organizational forms and structuring principles (Szerszynski 1997).

Szerszynski distinguishes between purposive and principled action, the one aiming to change political decisions or achieve direct political results, the other oriented more to changing values or behavior. He further distinguishes between counter-cultural and mainstream forms of practice.

There is thus, on the one hand, a “sectarian” piety, which is purposive and counter cultural, characteristic of the direct action groups such as those currently opposing motorway construction and animal experimentation. Secondly, there is a “churchly” piety, which is purposive and mainstream, characteristic of groups such as Greenpeace or the Worldwide Fund for Nature. Here, one participates in environmental politics by paying one’s dues to a professional organization: a green church. Thirdly, there is what Szerszynski calls a “monastic” piety, which is principled and countercultural, characteristic of closely linked groups that develop common “lifestyles” and attempt to practice an ecological way of life. And finally there is a “folk” piety, which is principled and mainstream and characteristic of larger consumer or conservation societies, as well as other mainstream organizations. Here membership, or activism, is much more “part time” than in a social movement, but it is also flexible in its criteria for involvement and participation. It can be suggested that the Greening of Industry network is most appropriately seen as an example of this fourth type of ecological piety.

4. The Cognitive Praxis of the Greening of Industry Network

Let us then examine a bit more closely the cognitive praxis of the Greening of Industry network. On a cosmological level, the network seems to be part of what has been called the discourse of ecological modernization. This cluster of ideas and concepts has been discussed from a number of different perspectives, and a number of core beliefs have come to be identified (see Rinkevicius 1998).

Most fundamentally, ecological modernization, like the Greening of Industry network, strives for an integration of environmental concern with economics. Hajer refers to a rationalization of ecology, by which a certain kind of functional narrowing of the discourse takes place. The earlier emancipatory, or visionary, cosmology that characterized the environmental discourse in the 1970s has been replaced by a more instrumental rationality that evaluates measures and activity in commercial terms. Related to this is what Hajer terms an economization of ecology, literally a translation of the language of ecology into economic and management terms (Hajer 1996).

The overall discursive dynamic is from a view of environmental problems as the inevitable side-effects of industrial development, as they were often portrayed in the 1960s and 1970s, to a more constructive, or integrative, view of the environmental problematic. According to ecological modernists, if environmental problems are to be solved or dealt with more effectively, they need to be incorporated into industrial development in a more fundamental sense. Industry, in short, has to be "greened" through various preventive measures and approaches. But the environmental discourse also has to be reformulated in the language of business and economics.

The notion of greening of industry is, of course, a multifaceted term and can be thought of as a specification, or application, of the concept of sustainable development to the economic or corporate sphere. In the report from the first Greening of Industry network conference, it is put this way, "Companies must attune their managerial attitudes and practices to the goal of sustainable development." (Cramer et al 1991, 1). The goal of the network's first conference was "to improve our understanding of how companies act on environmental issues and under which conditions companies are becoming 'green'".

Greening of industry, like ecological modernization, is a processual term; it focuses on the dynamic elements of change, rather than on what might be termed the substantial elements, and it was thus no easy matter to carve out the particular discursive space in which the network could operate. From the outset, it was clear that the network was not trying to develop a new academic discipline; rather, greening was to be seen in interdisciplinary terms and the subject matter was primarily to be company behavior and procedures, both in theory and practice.

In keeping with the belief system of ecological modernization, the cosmology of the network also includes a strong emphasis on dialogue, cooperation, communication and networking. As a social process, greening is seen to necessitate new forms of institutional and organizational "learning", and from the very first conference, a good deal of the network's attention has been devoted to learning theories, particularly in management science, and to theories of innovation. Greening was defined as a process of changing behavior, among business managers, but also among engineers, consumers, and public officials.

The technological dimension has been, in many respects, underdeveloped in the Greening of Industry network, both in terms of developing new criteria for technological development, as well as in generating new kinds of green innovation practices. But this was never the intention of the network's founders. Johan Schot's vision of "constructive technology assessment" has been more actively pursued, or implemented, in other fora or contexts than in the Greening of Industry network (Schot 1998). In a sense, the GIN has not been an appropriate forum for technology development, perhaps because it is a bit too big and all encompassing - too inclusive - but also because there seems to have developed, in the course of the 1990s, separate institutionalizations of green management and green engineering. Running in parallel, the two legs of ecological modernization have been difficult to combine in particular projects and activities. The specializing "logic" of institutional development has led to sub-discourses of environmental management, on the one hand, and cleaner technology or pollution prevention, on the other.

In this regard, there can be seen a development over the past ten years in the Greening of Industry network, a gradual shift of focus from the hardware side to the software, or organizational side of company behavior. In the early conferences, there were a number of papers on technological innovation, and representation from those academics who work in the field of science and technology studies. By the Rome conference in 1998, the technological emphasis had largely faded from the program; there was a plenary session on "Can technology save the earth?", but there were few other sessions on science and technology related topics.

At the same time, participation from academics in the field of science and technology studies had become smaller as a proportion of the whole. At the first conference, roughly half of the academics could be characterized as science and technology oriented, and half could be characterized as management oriented. At the Rome conference in 1998, there were only a handful of science and technology studies academics among the several hundred participants, which were primarily academics from management departments and business schools.

In this respect, the shift in focus can be viewed as a process of specialization. While other networks and organizations have developed in the areas of cleaner technology and energy efficient technology, the Greening of Industry network has become somewhat more oriented to the world and study of business management. The result is both a narrowing of the technological dimension of the network's cognitive praxis, but also a sharpening of the contours of the network's identity.

The substance of the organizational dimension has also changed, or, perhaps more accurately, expanded in a number of ways since the network was first established. The original idea to have conferences has led to a range of other activities, including projects, publications and workshops. The network's founders have devoted significant attention to reflecting on the network's organizational form, both in terms of formulating strategy documents, but also in terms of interacting with the network's members, particularly those in the corporate sphere, or business world. Both Kurt Fischer and Johan Schot, and more recently Theo de Bruin have visited a number of companies involved in the network, and they have also helped develop specific

activities that companies have taken part in and supported, such as the survey of members that was proposed and conducted by General Motors in 1998 and reported at the Rome conference.

As befits a social movement in an entrepreneurial age, a good deal of energy in the network goes to fund-raising, public relations and marketing. As the conferences have become bigger (from 68 participants in 1991 to over 400 in 1998), the organizational challenge has grown. The general principle, however, is that the conferences should pay for themselves, through rather high registration fees, although there is a good deal of sponsorship of particular parts of the program by local firms.

What is characteristic of the network conferences on the organizational level is the continual commitment to innovation and interaction. Plenary debates are sometimes carried out in a kind of mass meeting format, with a moderator (such as the long term member Eric-Jan Tuininga) circulating in the audience with a microphone and quizzing the panelists and the audience much like a television talk show host (which he has been).

What makes GIN conferences interesting is that they are explicitly meant to be innovative meetings, reducible to neither trade fairs, academic conferences, organizational meetings or policy deliberations. What GIN tries to produce are events that are both memorable in their own right, but also part of a process of network building. The conferences are supposed to be noteworthy and informative, but also catalytic, providing opportunities for people to meet across the normal societal domains and to catalyze initiatives across the different areas of society, and the world.

The catalytic nature of the network is not just confined to the conferences. Several attempts have been made to formulate research agendas and to use conferences and workshops for projects and publications. The network has established relations with both a journal, *Business Strategy and the Environment*, which publishes contributions to the conferences both in theme issues and separately; and with a publisher, Island Press, where several volumes have been produced.

One of the special features of the network is its transnational quality. While the Greening of Industry network is a central "discourse coalition" in regard to ecological modernization, what gives GIN a good part of its special identity is the confrontation, or dialogue, that has been established between North American and European variants of eco-modernism. Comparing the two conferences in Santa Barbara in 1997 and Rome in 1998 thus provides a way to explore the differences between these variants and reflect on what the differences depend on. For while both the Santa Barbara and Rome conferences were organized around similar topics and themes - pollution prevention, environmental management, sustainable transport, etc - the ways they were talked about differed in intriguing ways.

To begin with, the emblems were different: the Santa Barbara conference was entitled "Developing Sustainability: New Dialogue, New Approaches" and there was an emphasis on terminology, on ideas, on values - on what might be termed the ethics of greening. The American presence was, of course, quite strong, and the plenary sessions sometimes had the tone of a camp meeting, with different preachers, ministers,

"believers" promulgating their new idea, their new twist on the eco-modernist discourse. Particularly strong there was the emblem of "responsibility", and like a new denomination, the coalition for environmental responsibility and sustainability (CERES) had its day, with plenaries and parallel "break-out" sessions, one of which I happened to chair.

The religious tone was hard to miss, especially since CERES' new executive director is an ordained minister and in his talk, he spoke of the values and the ethics of the sustainability transition and the greening process. CERES has a list of principles that companies are encouraged to sign, a kind of ten commandments of greening, and the emphasis is on using the principles as a way to alter the values of the firm.

The emblems in Rome were quite different; here the business of greening was in the hands of a new important national actor, the co-host, Legambiente, an NGO-cum-think tank-cum-consulting firm, which has all but replaced the public authorities in Italy, and which is extremely secular, rational and pragmatic in its presentation of the green message. Entitled "Partnership and Leadership. Building Alliances for a Sustainable Future," the conference in Rome emphasized the business of greening, the process of operating: in short, green entrepreneurship. There were sessions on financing and marketing, on substance chain management, on life cycle analysis. The ambience was on the mechanics of greening, themes that were perhaps less relevant in the American context.

At both meetings, it was clear that the network was something different than a social movement. Whatever else it does, a movement provides a sense of collective identity, of taking part in a common enterprise, a (counter)cultural manifestation or a broader historical "project" (cf. Eyerman and Jamison 1998). And it can be argued that that identity has to be lived, or performed, as well as discussed and articulated. Even though the conferences did include a pleasant dinner and dance, the festivities were not integrated into the meetings nor, for that matter, into the lives of the participants. In this regard, it was clear, at least to this participant, that it is perhaps more accurate to think of GIN as something else than a social movement, perhaps an emerging "tribe" in the making, or, to return to the terminology of Beck, Melucci and Szerszynski, a new kind of subpolitical network.

5. Conclusions

The Greening of Industry network provides a window into the changing world of ecological modernization. Emerging in the late 1980s as part of the quest for sustainable development, ecological modernization has developed into one of the ruling doctrines of environmental policy in the late 1990s. But it has, at least for this observer, also lost something of its original ambitions, and its confidence, along the way.

On the one hand, ecological modernization has tended to split apart or fragment into a number of different subareas or special interests. Most noticeably, the proponents of environmental management have developed a discourse or subdiscourse of their own

which has separated out from a technical, or engineering discourse of cleaner production or technology. In relation to the Greening of Industry network, the management "wing" of eco-modernism has tended to take over, and the engineering, or science and technology "wing" has moved on to other fora and organizational locations.

This has meant an increasing specialization, as well as a focusing of the original ambitions. Over time, the focus has become more explicitly oriented to the business world, and, even more narrowly, into the world of business education. It is indicative of this development that the 1999 conference is to be held at a business school, for the first time, at the University of North Carolina, and that the meeting has been framed in a much more explicit business language than previous conferences have been.

Even more significant perhaps is what might be called the closing of the autonomous space that the network has represented throughout the 1990s. GIN has been an open and open-ended network, which has meant that anyone who wanted to could present a paper, but also anyone who wanted to could be involved in its operations. As Kurt Fischer puts it, "you're a member if you do some work". This quality is perhaps what most resembles that of a social movement, and it is something that seems, at least to me, to be challenged by the new kinds of activities that the network is taking on, in terms of expanding to Asia, but also in terms of interacting more directly with business firms.

There has always been a tension in the network between those who were most interested in greening - primarily environmentalists and former environmentalists - and those who were most interested in industry - primarily business people and management scientists. For most of the 1990s, it has been a fruitful and creative tension, and the success of the network, in holding memorable conferences and in producing interesting literature has been, in large measure, a result of the mixing or recombining of perspectives.

With a sharper emphasis on doing business and influencing the world of business, and a growing agenda that will require increasing efforts in fund-raising and acquiring corporate assistance and support, it is an open question how long the network can remain open and movement-like. It will be interesting to see how GIN moves into the next millennium.

Working Paper II

On the Transfer of Cleaner Production to Eastern Europe¹⁵

Cleaner production in Lithuania is largely promoted by the Norwegian Society of Chartered Engineers and carried out through the Institute of Environmental Engineering based at Kaunas University of Technology. Both parties are actively involved in the international Cleaner Production Roundtable.

The so-called CP schools based on short-term courses and intermediate “homework” at companies is the main approach followed in Lithuania by the Norwegian and local counterparts. Conceptually it is aimed at the local capacity building. In practice, however, a tendency is propagating cleaner production as a *must*, in developing a sense of inevitability about cleaner production. Local companies are encouraged or advocated to get involved in the training programs in cleaner production and properly do their “homework” if they want to be respected by the international business community, foreign investors and potential partner-industrial companies along the product value chain. Particular regulatory acts are initiated by the CP promoters to make attendance of the CP schools obligatory for the companies if they are seeking soft loans from the international credit funds (e.g. the Scandinavian-based fund NEFCO) or even seeking to obtain an annual pollution discharge permit from the public environmental authorities.

Opposition to, or skepticism about, such CP-promoting initiatives results in confrontation rather than synergy among actors who are active in the network entitled the Cleaner Production Roundtable. For instance, considerable confrontation among the CP promoters is visible in Poland where those who started the first initiatives and projects in the early 1990s later undertook steps to “monopolize” the realm of cleaner production and the greening of industry more generally. Similar tendencies are visible in other countries as well.

The orientation towards the centralized “national” cleaner production centers does not remain, however, an issue within the boundaries of particular countries. Such an approach, in the name of cleaner production, is advocated by particular national governments as well as by OECD and UNEP. There are formal and informal commitments by the governmental agencies of the Netherlands, Austria, Denmark, Norway and other countries to support NCPCs (national cleaner production centers) in particular transitional and developing countries, e.g. the Czech and the Slovak Republic, Zimbabwe and Thailand, India and Mexico. The international environmental S&T networks such as the Cleaner Production Roundtable become then a forum whereby the need for such new establishments is promulgated, defended and translated into particular policy initiatives which are later endorsed and further disseminated by the transnational organizations such as OECD and UNEP, but also the EU.

This creates a fertile ground for consulting jobs supported by governmental agencies of Western countries or international organizations such as OECD. There is very little

¹⁵ This paper has been written by Leonardas Rinkevicius

evidence, however, that such efforts lead to broad publicly visible experiments that would point to new directions in environmental S&T policy or successful dissemination of CP. On the contrary, certain already existing ways for dissemination of cleaner technologies, established through certain targeted actions of *inter alia* the European Commission, remain underutilized.

To mention just one example, a wide-ranging data-base has been established at the Danish Technological Institute covering most recent achievements in cleaner technology, for example, in the branches of tannery and textiles. However, our case studies in Lithuania show that, for example, the representatives of the Norwegian Society of Chartered Engineers involved in promoting cleaner production in South-East Asia and Central and Eastern Europe, have difficulties knowing that next door in Denmark there are knowledgeable people and relevant data bases in particular fields of technology. The Norwegians learn about the Danes not through direct contacts, and not through the CPR or UNEP, but through the occasional contacts with local associates in Lithuania; similarly, the Dutch learn about the Swedes through the Ukraine, and so on.

Such examples indicate that after 8 years since the establishment of the new networks, their contribution in creating new knowledge (relevant for technological innovation or policy-making) or linking potential transmitters and receivers of such knowledge has been quite limited. However, this also points to the conclusion that new international networks such as CPR are quite necessary, and there are particular unexplored areas where such networks could add to what formal structures, like various units within the EC, are doing.

An important question arises concerning the constraints which are making networks like CPR and GIN limited in their impact. Let us examine some cases of the diffusion of environmental technologies and environmental management concepts as well as policy innovations in Eastern Europe.

Most of such innovations, originating in the Western countries, are injected in CEE countries through various types of bilateral and multilateral assistance projects and programs. The overall framework is set by the periodically-held conferences of the environment ministers from EU member-states, other Western countries as well as their counterparts from CEE countries. Starting with Lucerne in 1993 (which has produced the Environmental Action Programme for Central and Eastern Europe), such high-ranking conferences have been later held in Sophia in 1995, and Aarhus in 1998.

The overall institutional framework and the guidelines for environmental S&T policy development which through such conferences is recommended by the EU and other Western donor countries to CEE are very much in the spirit of ecological modernization - preaching the significance of low-cost “win-win” improvements in industry, reducing pollution while increasing production efficiency, intensifying application of economic policy instruments, and in different other ways “ecologizing economy” and “economizing ecology”.

The public participation as one dimension of this overall ideology is based on models, experiences and “recipes” which have been already tested in EU countries and are then

“exported” to CEE. Environmental impact assessment exercises, eco-labeling, stakeholder involvement in corporate environmental management systems are some of the institutional approaches to public participation in environmental S&T policy most frequently promulgated by Western parties and advised for adoption in CEE.

Such policy guidelines are set through the regular meetings of ministers of Western donor countries. However, both the EU countries and CEE countries are represented in those conferences not only by the governmental officials, but also by representatives of the business community and NGOs. For example, besides the Minister of Environment of Lithuania this country was represented in the Sophia conference by the President of the Ecological Engineering Association (which is closely affiliated with the Lithuanian Confederation of Industries), Rimantas Budrys, and the Chairman of Lithuanian Green Movement, Linas Vainius. Delegations of other CEE countries have similar composition which indicates the presence in the dialogue and networking of actors rooted not only in the bureaucratic, but also in the economic, civic, and sometimes the academic domains.

Although their recommendations are not legally binding, these ministerial meetings have very strong influence on the direction and instruments which CEE countries are deploying in their environmental S&T policy. Moreover, based on decisions and recommendations of those regular conferences other influential organizations as well as less formal networks are set in charge of propagating certain novelties in Central and Eastern Europe.

For example, a special task force unit for CEE has been established in OECD in Paris. Endorsed by the Ministers’ conferences it has been delegated to promote cleaner production in CEE and former Soviet republics. Similar responsibilities have been assigned to the Regional Environmental Center (REC) located in Budapest (Szentendre) which is a combination of an NGO and professional consulting organization. Those are the two organizations which have taken the lead in coordinating the research and practical activities in the field of the greening of industry and environmental S&T policy in CEE and CIS. Therefore, major policy initiatives, coordinating and exchange of relevant knowledge and information are primarily organized under active involvement and close supervision by OECD and REC.

It is interesting to note that many of the key officers involved in those organizations are people who have obtained their master’s degree in Western countries (e.g. Sweden, UK, the Netherlands) primarily in the field of environmental management. There is a close interaction of the university departments and particular academics involved in training environmental management specialists in Amsterdam, Lund, Oxford and other places. In this way, the learning about each other and first networking interactions among teachers but also MSc students who later take important positions in transnational networking nodes have their starting point (roots) in the academic institutions.

For example, some people working at the Regional Environmental Center in Budapest have been educated at MilieuKunde in Amsterdam and the Center for Environmental Change Studies in Oxford, and their counterparts, working at the Task Force in Paris have been educated in Lund. Those people know each other, however, long before

they take job appointments. Moreover, those new institutional arrangements like REC or the unit at OECD are funded by Western donor countries, and the selection of officers is thus very much influenced by informal networks between university organizations and particular individuals and the people in environmental ministries, or agencies, providing the funding for those new institutional set-ups.

For example, the Danish environmental authorities are funding the position at the task force in OECD in Paris for promotion of cleaner production in Eastern Europe. To fill this position, they recruited a Lithuanian engineer who has been trained in the master's program in Lund and was strongly recommended to Danish EPA and OECD by the Swedish experts on cleaner production who have carried out several projects in Eastern Europe beforehand.

This kind of informal networking has several implications for environmental S&T policy in Eastern Europe. The Western-educated officers at REC, OECD and other organizations, who form certain new network nodes, become the propagators in CEE of those approaches to the greening of industry and environmental S&T policy in which they have been educated in Lund or Amsterdam. Since their funding comes from Denmark, the Netherlands or Austria, the kinds of paradigms or "belief systems" which they are preaching or promulgating depend very much on the ideas shared by the funding agencies (bureaucratic domain) which in turn are significantly influenced by particular "gurus" in CP or environmental management rooted in, or affiliated with the academic domain.

It is not a secret that academics who have a "strong finger" in placing their former graduate students into important positions have very strong influence on the kinds of projects which those new networks are launching in CEE. They also quite often get from their former students the consulting assignments in those new projects to promote CP or other novelties in Eastern Europe. Another dimension of such networking is the ways in which such programs are scrutinized and publicly assessed. For example, OECD and the Danish EPA have hired the people from Lund University to assess particular programs and projects on dissemination of CP or cleaner technology in Eastern Europe.

Paradoxically, those who are supposed to carry out this assessment are the same people who were in charge of carrying out the CP projects in Eastern Europe in the first place. Thus the whole system of disseminating cleaner production and environmental management systems in Eastern Europe becomes a closed system where informal transnational networks, or linkages, between academic institutions, governmental agencies and new formal networking nodes like REC and OECD are very important, perhaps decisive. In such a way, other possible forms or approaches to environmental S&T policy, new kinds of programs and projects are potentially excluded. At the same time new kinds of dissemination of specific approaches to the greening of industry and environmental S&T policy are promoted.

Such tendencies are visible not only in the realm of cleaner production. For example, the so-called National Environmental Strategies, or Action Plans (NEAPs) were developed in a parallel development in most of the CEE countries in the period, 1994-96. Pollution prevention, cleaner technology, precautionary principle in environmental

S&T policy, principles of shared responsibility and subsidiarity, implementation of economic incentives and other policy novelties are frequently mentioned in those policy documents. Those concepts and approaches were diffused in CEE through numerous EU-funded projects which were carried out by consulting firms based in EU member-states. All this simultaneous drafting of national policy documents and the fact that their development was funded by EU (Phare programme) was very much based on the guidelines of the Environment Ministers' Conference in Lucerne in 1993. The astonishing similarity of those new policy documents enacted in CEE countries with strong support by Western advisors indicates that there exists a similarity to the case of CP informal network of actors through which particular approaches to environmental S&T policy were translated into NEAPs.

Similar tendencies can be observed in the simultaneous establishment of rotating Environmental Investment Funds (EIF) in several CEE countries. Most such funds were established with seed funding from EU and by active coordinating efforts by the Task Force placed in OECD. The institutionalization of such funds is very much influenced by the ideology of ecological modernization and particular environmental S&T policy advice given through the Environment Ministers' conferences. Actors rooted in the governmental institutions, academia, industry but also some NGOs were involved in the establishment of EIFs in various CEE countries. An exchange of information, knowledge and experience regarding the institutional model of such funds was actively mediated by the "policy entrepreneurs" via OECD-based Task Force as a formal coordinating and networking unit.

There are examples when EU functionaries in Brussels who, instead of recommendation, give more or less direct orders concerning the institutional shape for the new environmental S&T policy if the funding is to be provided from EU sources. For example, in parallel with the Environmental Investment Funds there are so-called Energy Efficiency Funds established in CEE countries following the same general ecomodernist ideology transmitted by EU. Energy conservation through various technological improvements is the main objective for establishment of such new institutions. EU has specific ideas on what should be the "role" of the national bank, the ministry of economy, ministry of energy, etc. with regard to the institutional set-up of those new funds. If such funds work in Slovenia, the same model is prescribed to Lithuania, even though its National Bank has quite different legal status than in the Slovenian case and the legal framework for establishing different public funds has entirely different legal basis.

Besides formal organizations and less formal networks functioning as an umbrella across all of the Central and Eastern Europe there are also transnational networks established on a regional level. The Baltic Environmental Forum is an example of such regional brokerage between actors rooted in various domains in the three Baltic countries - Lithuania, Latvia and Estonia. This network is funded by the EU (DGXI) and periodically organizes activities in the fields prioritized by the policy documents produced under the auspices of the aforementioned Environment Ministers' conferences. Transnational conferences and other activities have been organized by this Forum regarding the public participation in environmental impact assessment, hazardous waste management, industrial environmental management, EU approximation strategies for the Baltic states, sustainability indicators, etc.

Other EU-endorsed networks are set up and developed within the boundaries of particular CEE countries while following similar organizational models across CEE, and diffusing transnationally technical, organizational and policy innovations. For example, the so-called ECATs (Environmental Centers for Administration and Technology) have been established in the Baltic States, St. Petersburg and Kaliningrad (Russia), and other places in Central and Eastern Europe in order to generate and disseminate novel approaches to environmental S&T policy on the municipal level.

In Lithuania, the ECAT is funded by EU, particular governmental agencies and ministries of Finland, Sweden, Bavaria (FRG). ECAT in Lithuania works closely with the Association of Municipalities and its environmental committee. ECAT's activities are very much triggered by, and associated with, the development of various initiatives in various countries within the framework of Agenda 21. It organizes projects and mediates educational and information exchange between Lithuanian municipalities with active contributions of experts from EU related to environmental management, public participation, etc.

Particular models of dialogue among various actors from different sectors of community - business entrepreneurs, municipal authorities, academic organizations, NGOs and common citizens - are introduced to Lithuanian municipalities through ECAT's training courses, joint workshops, and other forms of activity. For instance, through the twinning project the municipality of Kaunas in Lithuania is learning from the experience of the city of Tampere in Finland in building Agenda 21 and promoting community involvement. The model of the so-called public Forum which is developed in Tampere is presented to the environmental authorities of Kaunas and other cities demonstrating the ways in which particular "policy entrepreneurs" employed by municipal authorities can become important brokers building a certain arena on the municipal level for dialogue between the actors rooted in different societal domains.

Lithuania's ECAT thereby acts as a kind of transnational broker transferring positive experiences in environmental S&T policy making from Finland to Lithuania. The mutual learning from similar projects initiated by ECATs in other CEE countries is very important in order to successfully adopt environmental S&T policy innovations originating in the EU and being diffused in CEE countries.

All the above-mentioned examples of transnational brokerage in the field of environmental S&T policy indicate the existence of a variety of networks which share two important characteristics, albeit having different organizational structures and different degree of formality in the association of its members. One is the ideological and financial support provided by the OECD, European Union (DGXI, Phare programme) and its particular member states. Therefore, those networks are developed not in the empty public space, but rather in the institutional environment in which certain tendencies ("belief systems") in environmental S&T policy are endorsed and disseminated on the EU level, and certain resources are provided.

Second, most activities initiated by those transnational networks to disseminate environmental S&T policy novelties in CEE countries are in line with the guidelines and directives set by the periodically organized Environment Minister's conferences.

Those conferences set the agenda which is an outcome of an active dialogue among, and intensive lobbying of, various parties involved which are rooted not only in the bureaucratic, but also economic, academic and civic domains. The way of policy-making is based on directives generated on the level of the conference of the ministers of EU and CEE countries. However, there are bottom-up initiatives, ideas and particular “operationalized” policy options suggested by other actors from business community, academia and NGOs.

Those bottom-up messages are then translated into advice given by the EU and its ministers to CEE countries which are further translated into particular programs and projects carried out through EC directorates, OECD, REC - on the scale of entire CEE, smaller networks like the Baltic Forum - on the regional level, and the networks like ECAT - on the level of regions and municipalities within particular CEE countries. In such a way, most of CEE countries have prepared National Environmental Action Programs which became core documents for environmental S&T policy; similarly ecomodernist institutional arrangements (like Environmental Investment Funds and the Energy Efficiency Funds) have been introduced which are bridging the bureaucratic domain (national governments, ministries and EU structures) with the economic actors (mainly industrial enterprises which are interested to borrow money for cleaner technologies) and academic institutions providing information and knowledge on those technologies.

Lessons from the success and failure stories of operationalizing ecomodernist ideology and disseminating it in various forms of environmental S&T policy innovations later make the basis on which the new recommendations, guidelines and directives for future policy undertakings are grounded. Coupled with other “newly-fashioned” directives of EU (like IPPC directive) they make the platform on which the agenda of the Environment Minister’s conferences is based and which are later articulated in the written pieces of advice by the West for environmental S&T policy change in CEE countries.

The main implication of all those policies and actions is that the pool of intellectual and financial resources is directed into those areas. Those from CEE who are interested in environmental investment funds are joining the trans-national network specializing in this area, those interested in National Environmental Action Plans and sustainability indicators have their own networking framework and interfaces for exchanging relevant information. The same could be said about those dealing with cleaner production, environmental management systems, even with those interested in the issues of Agenda 21 and public participation.

Moreover, there are indications that the political culture in Central and Eastern Europe is still based on the dominant role of the bureaucratic domain, and the main tendency in joining the trans-national networks is the pursuit to adopt the new “fashionable” Western concepts and approaches to environmental S&T policy. In such a way the CEE countries are often wasting some positive legacy and already existing institutional arrangements which, at least in part, could be sustained and further developed by integrating them with those strongly promulgated through various authoritative Western institutions like EU and OECD. Some models for networking and dialogue

among actors rooted in different policy domains which have been introduced in the former Soviet bloc are discontinued and forgotten (see Rinkevicius 1998).

Instead, the pieces of advice given by EU and other donors regarding the need, for instance, to establish particular institutions (e.g. investment funds), to draw certain policy documents (e.g. National Environmental Action Plans), or enact certain laws and regulations (e.g. on pollution charges) appeal to Eastern European policy-makers much more strongly as compared to earlier public policy experiments. As a result those new institutional set-ups which are promoting CP, NEAPs or EIFs make the core for newly emerging networks to which CEE actors are attracted.

By contrast, such networks as GIN have much more open-ended, laboratory-like approach to environmental S&T policy. Therefore they are less attractive to many Eastern Europeans who due to their political culture are more willing to learn about, and adopt, Western-made clear-cut approaches, policy instruments, institutional arrangements, technological options rather than attending the conferences like those of GIN which often seem to those people too diversified and not providing direct and simple “recipes” on how to pursue sustainable technological development.

This does not mean, however, that there is no room left for the networks like GIN to foster environmental S&T policy innovation and diffusion from industrialized to transitional countries.

With respect to the effective enforcement of particular EU regulations and directives such as the IPPC (Integrated Pollution Prevention and Control) Directive, the development and accessibility of the specialized data bases on cleaner/ best-available technologies (not exceeding excessive costs) is of crucial importance. In this regard, such networks as the GIN and CPR can achieve a lot by mediating and providing access to such data bases or other sources of relevant knowledge through their informal horizontal linkages as opposed to certain top-down approach which would be the case if the European Commission (or its’ particular Directorates) would do it as a formal bureaucratic institution.

The National Pollution Prevention Roundtable in the US has started creating such a data base on preventative technics back in 1995. This is an interesting combination of a formal organization funded by the EPA, but also having a less formal networking linkages to, and a brokerage role among, different public and private organizations and actors, linking different sources of information in different branches of environmental S&T.

In a similar way, GIN and CPR could help disseminating technological novelties, generated by various actors and organizations funded *inter alia* through DGXII, among actors who are usually associated more with DGXI, and in opposite, environmental policy innovations induced by actors supported by DGXI could be “digested” through less formal networks such as GIN and CPR where they could be translated into particular corporate R&D strategies, models for broader public engagement, or even changes in “national innovation systems”.

In this respect, the seeking for competitive advantage prevailing in most industrial entities makes GIN or CPR conferences a good fore for public relations rather than a channel to really share best achievements with others who might wish to pursue a similar path.

On the other hand, besides particular projects funded by the EC to compile data bases on cleaner technologies in different branches of industry, there are numerous other efforts to create brokerage organizational forms for disseminating cleaner technologies and best practices. One example could be the working groups on particular industrial branches established under the auspices of the Paris-based UNEP IE/PAC. Periodical publications by such working groups cover broad range of technological and organizational innovations and are disseminated in certain circles. The broader public access, however, is still lacking as is lacking the synergy of other similar international networks or formal national and EU structures dealing with environmental S&T policy. Performing such “function” could also become a new kind of activity for the Greening of Industry Network or the Cleaner Production Roundtable.

Quite on the contrary, examples are abundant that engineers active in the Cleaner Production Roundtable are increasingly shifting not towards particular branches of cleaner technology, but rather becoming (or aiming to) the “gurus” in the new-fashioned field of EMS - environmental management systems. Yet, at the same time as “selling” environmental management and cleaner production they exhibit a very limited knowledge in particular fields of technology and engineering. Rhetorically it is proclaimed that the key is to know the “methodology” of cleaner production, whereas finding relevant experts in particular fields of technology is only a secondary issue. In practice, however, the lack of both the knowledge in cleaner technology but also in management makes it hard for the promulgators of CP to compete with traditional leading consulting firms in specific branches of engineering and management.

Working Paper III

Public Participation, Electronic Democracy, and the Environment¹⁶

In this working paper we will first give a brief overview of the promise and practice of information and communications technology (ICT) in respect of public participation and democracy, and explore some ways in which it has been applied to environmental and other related issue domains. We then go on to outline an on-going, CSEC-based experiment with a number of government agencies which is using ICT to consult the public on landscape character and change.

In the twentieth century the introduction of new media has usually been associated with strong claims about their democratic potential. Allen and Miller (1998) outline how this was the case successively for radio, broadcast TV, cable TV, teletext and

¹⁶ This paper has been written by Sue Holden and Bronislaw Szerszynski, Center for the Study of Environmental Change, Lancaster University

CD-ROM, but suggest that the technological optimism that accompanies the Internet exceeds that of any of its predecessors. The democratic promise of the Internet can be seen as originating from certain characteristics that distinguish it from previous media. In particular, some of these make it possible for users to participate actively in the Internet in addition to consuming its services. These include:

- ◆ *Low cost of entry:* to publish information on the web one needs a computer, some software and a phone line. The financial costs are therefore very low compared to other media.
- ◆ *Access:* publishing on the web is not controlled by gatekeepers; no licence or permission is required, nor is access prevented by the actions of existing players in the marketplace, as is the case for other media.
- ◆ *Skills:* in a literate society, the skills required are considered to be widely held or within reach of a large proportion of the population.

Other features of the medium make it well-suited to notions of enhancing democracy and the development of 'electronic democracy':

- ◆ *Unmediated:* the Internet allows individuals to communicate without the moderation or interference of an editor or talk show host.
- ◆ *Information dissemination:* the Internet provides a simple way of making large amounts of information widely available.
- ◆ *Abolishing geography:* the technology allows people who are geographically distant to communicate with ease.
- ◆ *Speed:* communication can happen at a much faster rate.
- ◆ *Multiple modes of communication:* the Internet can support one-one, one-many, many-one and group interactions.

Steve Clift, founder of Minnesota E-Democracy, sees the Internet as a 'mass micro media'¹⁷. Whereas in the past business and government have held the 'pens' which with the mass media is controlled, he believes that the Internet has the potential to 'get the pens to the people'¹⁸. In particular he emphasises the Internet's role in promoting interaction between citizens, and defines 'electronic democracy' as follows:

'It is about making the online communication tools for many-to-many civic discussions, organising and public involvement available. It is based on the belief that open communication and participation is the foundation of democracy.....It is where citizens see themselves as active producers of ideas and opinions, not just consumers of information.'¹⁹

¹⁷ <http://www.abc.net.au/ola/citizen/eps/ep12/text12.htm>

¹⁸ <http://www.e-democracy/do/library/pen.html>

¹⁹ <http://www.e-democracy/do/library/pen.html>

Others such as Steve Miller include the role of the state in their understanding of electronic democracy:

‘...democracy is enhanced when people are informed about issues, where there is a high level of public debate, when residents organise in support of their positions, and when citizens evaluate public officials and then hold them accountable for the effects of their decisions....Access to information will make people better informed, and two-way communication will facilitate broader participation in policy discussions and decision-making.’²⁰

Finally, the Internet holds the potential for making direct democracy possible, whereby members of the public can not only receive information and join debates, but also vote on specific issues in electronic referenda.

There are however a number of issues which raise notes of caution in respect of electronic democracy:

- ◆ *Access*: if people do not get access to the new technologies (which are being developed ‘from above’ by multinationals) then we may have an ‘information aristocracy’ instead of a ‘digital democracy’. Existing power structures will be reinforced and will manifest in ‘information haves and have-nots’ (Carter 1997).
- ◆ *Vested interests*: to date, most democratic institutions have used the Internet for their own interest in conveying information, while avoiding the risk of greater public scrutiny or the kind of debate that could undermine their influence.²¹
- ◆ *‘MacDemocracy’*: interaction may become denigrated and packaged as vertical, predefined and controlled (Bryan 1998). ICL for example are developing a system called CAFÉ which would give citizens an electronic interface with the government but which would not include discussion or any mechanism for tapping their opinions (Allen and Miller 1998).
- ◆ *Public fatigue*: excess information and demands on public participation in polls and referenda may lower participation.
- ◆ *Too many voices*: everyone may get to have their say, but with increasing participation it becomes harder to be heard. It may be true that everyone gets to speak for themselves, but they may be speaking *to* themselves.

Our brief survey of democratic spaces and deliberative forums on the Internet reveals a range of approaches and levels of success. Here we look at a number of cases according to the type of citizen activity they make possible, and the relationship that they might put citizens in with public bodies such as local authorities.

1 - PROVISION OF INFORMATION BY LOCAL AUTHORITIES

As Tsagarousianou (1998: 57, n.1) notes, the main democratic use of ICT in has been in the provision of information. Some authorities are making information about their

²⁰ <http://www.cpsr.org/cpsr.html>

²¹ <http://www.e-democracy.org/do/article.html>

services available to the public through computer terminals in public places. For example, *Nottinghamshire County Council* has 'County Contact Kiosks' located in its libraries as well as in some shopping centres²², and *Cumbria County Council* has 'Genesis Terminals' in 20 sites across the county, mainly in libraries. In a recent survey (DETR 1998) 74 local authorities in the UK said that they use an 'interactive web site' as a means of public participation. In the main, however, it seems that 'interactive' denotes features such as touch sensitive screens, search functions and providing the e-mail addresses of officials, rather than an opportunity for users to participate in deliberative for a with each other.

2 - PUBLIC CONSULTATION BY AUTHORITY

In some instances local authorities have used the Internet to consult with constituents. One example is the *London Borough of Brent*, which has made its annual paper-based council tax consultation available on the web for the past 2 years. While the web method used the same questions and format as the leaflets, Internet users could check how many people had responded from different streets and look at other peoples' (anonymous) responses. However, the very short questionnaire had no open questions, so the opportunity to read other's opinions was limited to seeing if they had ticked A B or C. The use of the web was low, with only 33 people responding via the Internet - this is not surprising, however, as the leaflets were delivered to every household and would probably have been filled in preference to responding on the web. (The total response for 100,000 leaflets was only 4.5%).

A more sophisticated use of electronic consultation is that carried out through the 'debate engines' devised at the *newMetropolis* science museum in Amsterdam. Consultations have been carried out on a number of themes from the age at which women should have their first child, to green wildlife corridors, some in collaboration with the Netherlands Ministry of Information. These have not been internet based, but instead have been made available on terminals within the newMetropolis building.

3 - PUBLIC-AND-AUTHORITY DISCUSSION FORUMS

We found three kinds of discussion forum between the public and local authority, depending on who initiates and participates. The first kind is where a public body initiates a forum as a listening exercise. For example, *Minnesota Senate* has Town Meeting Internet Forums where people can join in with any of meetings on a set topic, or opt to talk in an open meeting called 'what's on your mind'.²³ Each virtual meeting space opens with a statement from the administration and some starter questions, and the ensuing discussions between citizens are strung so that particular arguments can be followed. However, there is no participation from senate officials; for them the point of the forums is 'to send our constituents the strong message that we want to hear their opinions'.

²² <http://www.nottscc.gov.uk/council/contacts/kiosks/index.htm>

²³ <http://www.senate.leg.state.mn.us/caucus/dem/demforums.htm>

A second category is where the state initiates a forum with its officials participating. In the UK, **the London Borough of Brent** claims to have been the first authority to do this. The forums were set up for them by UK Citizens Online Democracy and were on 3 specific topics – Local Agenda 21, recycling and Wembley – and one general open space²⁴. However, the response to them appeared very low, with the four sites between them showing fewer than 10 comments, including messages posted by council staff. More recently Brent has launched a discussion area called ‘brain’ from its own website²⁵ which currently offers 3 topics – trading standards, neighbourhood watch and lottery applications. Again, participation appears to be limited – the lottery discussion group, for example, shows a total of 18 postings in 4 months, with 8 of those being notices from the council official concerned. No posting had generated more than 2 responses.

A third kind is where a community group initiates a forum and invites officials to participate. An example of this is the Community Forum space set up by **Northfield Community Online** (NCO).²⁶ Each forum is a time-limited event which is run simultaneously by other local media, such as newspapers, local radio and through face to face meetings. Community members can participate in the Internet discussion either through the web café, or through a special e-mail list. NCO had run 11 such community forums in the past 2 years on a range of topics from general discussions such as ‘building cohesive family’ and ‘growing a healthy economy in a liveable community’ to more policy orientated topics such as the city’s transportation plan, city parks and trails, the city council election and a community resource centre referendum. Each forum begins with an introduction from the moderator and initial discussion between the invited panel members. After a day or two members of the public can join in, with panel members and the moderator staying in the discussion. The discussion is not strung, but participants are encouraged to use a posting reference to link the discussion points.

Finally, also belonging in this category although less deliberative and more plebiscitary in character is the Greek-based **Network Pericles**,²⁷ where the National Technical University of Athens has worked with a number of European municipalities to develop electronic local democracies (Tsagarousianou 1998). Through public terminals, citizens of these municipalities are able to vote in referenda; propose issues on which to have referenda; and amend or annul earlier decisions.

4 - NATIONAL-LEVEL DEBATE

The Internet is also being tentatively used for national-level discussion between citizens with the input of politicians. **UK Citizens Online Democracy** is the first such service in this country, but is difficult to evaluate as it doesn’t appear to be being maintained now. On launch it offered a ‘Have Your Say’ site (with endorsement by Tony Blair) which is no longer operating. Its discussion forums were on a number of topics including freedom of information and the transport white paper. The format split the

²⁴ <http://www.democracy.org.uk/brent/>

²⁵ <http://www2.brent.gov.uk>

²⁶ http://www/nco.northfield.mn.us/html/community_forums.html

²⁷ <http://147.102.16.10/pericles/Info.htm>

politicians and the public. On the one side a politician from each party was asked to contribute a statement with reference to a small number of questions; the politicians were then expected to respond to each other's points, but this did not seem to have happened. On the other side, members of the public could join in a strung discussion, but the archives of these suggested that they were dominated by fairly small numbers of participants. Another effort of this kind was the *Canberra Commons*²⁸ experiment, which is now off line.

5 - CITIZEN-TO-CITIZEN COMMUNITY FORUMS

These community forums aim to get community members discussing issues and generating public opinion, without necessarily involving local authorities in the structure of the debates.

Minnesota E-Democracy is perhaps one of the best known electronic democracy sites and home to MN-POLITICS²⁹. This is an e-mail discussion forum which has been running since 1994. It acts as a 'public commons', with around 400 direct participants who include 'ordinary' citizens and people in public office. On-going discussions can be somewhat abstract, but some participants use MN-POLITICS to announce things, the media sometimes pick up on the issues discussed, and on occasions small groups of participants have got together to take action on a specific issue.

The *St Paul Issues Forum* is an offshoot of Minnesota E-Democracy which serves the St Paul area of Minnesota³⁰. As with other community forums, it is managed by a volunteer. It has only recently been set up, but since the beginning of the year it shows 12 main discussion titles and a total of 71 postings. The discussions within each title are not strung, and can wander off the point – for example, the topic on pedestrian friendly neighbourhoods got sidetracked into a discussion of the logic of road numbering in Minnesota before someone brought it back on topic.

Digital City Amsterdam was one of the first virtual cities³¹, being founded in 1994, around a city metaphor of themed squares, houses and flats. Access is both through the internet and through public terminals. Now boasting about 50,000 'residents', the Digital City also hosts on-line debates, including one about the City itself.

6 - NATIONAL/STATE ELECTION SITES

One of the most obviously democratic uses for the Internet is to use it in the run up to elections. *Minnesota E-Democracy* claims to have made the first use of the web in this way when, in 1994, it put most of the candidates for the US Senate online, and held the first online debate among candidates at that level. Repeating this in 1996 and 1998, it claims to be seen as a trusted neutral host for such events.

²⁸ <http://canberracommons.netinfo.net>

²⁹ <http://www.e-democracy.org/mn-politics/explain.html>

³⁰ <http://tcfreenet.org>

³¹ <http://www.dds.nl/dds/>

Similar sites have been used in other places, but it is not easy to evaluate them as, following elections, most connections on their pages seem to be stagnant. These include *Nova Scotia Democracy Forum*³² and a site for the Australian 1998 federal election³³. Another site, *Europe 99*³⁴ for the European Union elections promises moderated discussions in its 'community rooms' (including one on 'environmental, consumer and health policy') but these are not yet operating.

Another kind of event-specific democratic space is the *SenateVote* page.³⁵ This focused on the topic of President Clinton's impeachment trial, but went one step further than simply providing a space for people to post their views. Instead, it aimed to link members of the public with their senators. People posted comments on their senator's page, which were then printed and given to the respective senator throughout the trial. This initiative aimed to deal with the problem that e-mail is, apparently, the least effective way to have an impact on a member of congress.

7 - TOPIC DISCUSSION GROUPS

Most people use the Internet in relation to their own interests, and so services have been set-up which centre on discussion on a certain topic or area of interest. There are many e-mail discussion groups of this kind with no web presence. The following all have websites.

The Democr@cy Forum aims to provide a space for discussion, debate, proposals and announcements concerning IT and democracy, with automated translations into a number of European languages.³⁶ It was relaunched in July 1998, but a visit to the site suggests it is not attracting many participants, with many postings authored by one of the organisers.

Shifting Ground is a functionally similar, open-access discussion and resource space for academics and activists interested in social and cultural movements.³⁷ It contains a threaded discussion area, and bibliographic, resource and notices areas, to all of which material can be directly posted.

active-sydney is a site for environmental and social activists in Sydney, which uses open-source software to allow groups to post up information about themselves and about forthcoming events.³⁸ While it does not offer any discussion forum on its web site, there is an e-mail group to join in discussions, and the option of periodically receiving automatic notification of new postings and events. The organisers actively encourage the cloning of the site for other cities and regions of Australia, and it is expected that every major Australian city will have their own version by the end of 1999.

³² <http://ccen.uccb.ns.ca/edemoc/frame2.html>

³³ <http://election98.net>

³⁴ http://www.europe99.com/content_community.html

³⁵ <http://www.senatevote.com>

³⁶ <http://www.gotzspace.dk/democracy>

³⁷ <http://www.lancs.ac.uk/users/csec/shiftingground>

³⁸ <http://www.active.org.au>

The *Millennium Energy Debate* aims to involve, inform and educate the public on the issue of global environmental change. It will hold a Key Debate in 2000 through a series of 12 debates building up to Global Internet Poll.³⁹ However, as yet there is no online debating in evidence.

The *Prince of Wales* has an online forum at his website.⁴⁰ The forum topic will change from time to time, but his first topic is that of genetically modified food. The site has a short piece by the Prince outlining his views, and then invites the comments of visitors via an e-mail form. Nine pages of other people's contributions can be viewed, each time beginning with those in agreement with the Prince before including those arguments against. It seems that these contributions must be selected and edited by a moderator, and the page acts more as a visitors' book as the arguments are not strung or structured in any way.

The *Guardian* newspaper's talk space is similar to that of the Prince of Wales, with many pages of unstrung postings from the public on a number of current topics, such as GMOs.⁴¹

Reflections

Our review of the use of the Internet in promoting participation and democracy leads us to some observations.

DIMENSIONS OF PARTICIPATION

As in all initiatives concerned with 'participation', the Internet-based efforts we have outlined cover a range of modes and intensity of participation. The two key axes which seem most significant to us are:

Controlled – Open	To what extent are participants' contributions edited? How does the page structure control how they participate?
Posting – Deliberating	To what extent are participants encouraged to deliberate, with the possibility of learning new ideas or changing their minds? How much can participants interact? Do people visit once or come back?

Clearly these two axes are also interrelated. From a liberal perspective, one might expect the 'open' and 'deliberative' combination to be the most preferable. However,

³⁹ <http://www.millennium-debate.org>

⁴⁰ <http://www.princeofwales.gov.uk/forum>

⁴¹ <http://www.newsunlimited.co.uk/BBS/Newstalk/0,2154,2836|Thread|a|1,00.html>

it possible that this is hard to achieve, as in a totally open forum, opportunities for deliberation may be lost in the noise of unstructured talk. The outputs of such forums may also be rather user-unfriendly, as there is no end point, nor mechanism for generalising the consensus of opinion. NCO's Community Forums were one of the most promising sites in terms of deliberation, yet they have a degree of moderation, rules and inclusion of invited participants that do not sit with the idea of being totally open. Notably, however, NCO is a community organisation, so the control that is imposed could be seen as originating from within, rather than from on-high as might be the case in a government-initiated and moderated forum.

IMPACT

It is perhaps not surprising, but worth noting, that we found little evidence of the efficacy or otherwise of these Internet initiatives. A handful of sites showed the crude indicator of 'no of hits to this site', and in the case of forum discussions we were sometimes able to see how many people had taken part. In the case of closed sites (eg the sites for elections which have passed), however, Brent's budget consultation was the only one to provide a report. The Minnesota Senate site thanks everyone for taking part in its first Town Meeting Internet Forums, and includes 2 enthusiastic quotes from participants. However, it gives no information on how many people took part, the themes they discussed nor – crucially for a project set up as a listening exercise - who in the Senate read them and with what impact.

CONTENT

Our sample of Internet sites leads to the following observations regarding the content of the web pages:

- ◆ Most focus on tangible issues (budgets, neighbourhood watch, election candidates) rather than abstract concepts.
- ◆ 'The environment' appeared in several guises, both as local issues such as city parks (NCO) and recycling (Brent), and within wider discussions on, for example, transport policy (NCO, newMetropolis) and GMOs (Prince of Wales, Guardian).
- ◆ Consultations are seen to concern more specific issues and policies that fit with referenda and polling.
- ◆ All rely on text as the stimulus; while the pages may be enlivened or decorated by images and logos, the interaction is highly dependent on text, to the exclusion of sound or pictures.

PROBLEMS

The two most evident problems, aside from that of giving feedback and measuring impact, were that of attracting enough users to make debate forums work, and of keeping pages up to date. The *UK Citizens Online Democracy*, for instance, appeared to have had a relatively small group of people taking part in its discussions, and has pages which have not been updated for more than 2 years with no explanation as to the current status of the project.

IMPLICATIONS

Our analysis throws up a number of ideas that we aim to explore in an experiment in public consultation with local partners. These include:

- ◆ Can the Internet be used to explore thoughtfully concepts and ideas, rather than tangible issues and yes/no decisions?
- ◆ Can such explorations be beneficial to participants, as well as providing data to the initiating agency?
- ◆ Could the Internet's capacity to use images and sounds be better exploited in web-based initiatives to promote participation?
- ◆ Could a degree of control in the format of a step-by-step consultative process be used to encourage thoughtful and reflexive participation? And could the resulting data be more usable and useful than that which comes from the extremes of a questionnaire or totally open talk forums?
- ◆ Can structured Internet consultation provide a progression to two-way communication for local authorities from their existing use of the Internet mainly for one-way information provision?

Chapter Five

Conclusions and Reflections⁴²

I. Some Policy Implications

1) One policy-related conclusion that can be drawn from our research is that *there is a gap between rhetoric and reality in the quest for a more sustainable socio-economic development.*

While many governments and politicians have come to acknowledge the need to take more regard to environmental concerns, the actual practice of science and technology policy-making - from formulation to implementation to evaluation - continues to compartmentalize those concerns into separate sectors and specializations. The precepts of deregulation and privatization that were put firmly on the policy agenda in the 1980s serve as constraints to a broader integration of environmental protection with other socio-economic policy objectives.

At the doctrinal level, there remains an overriding emphasis on furthering economic growth and international competitiveness. The formulation of policies and the making of policy priorities continues to be dominated by the monetary rationality and acquisitive logic of the ever present Market. What this means is that the dominant

⁴² This chapter has been written by Andrew Jamison

doctrinal tendency in science and technology policy has been to translate the quest for sustainable development into a business language, via the concepts of environmental management, cleaner production and, more generically, ecological modernization.

In terms of policy implementation, there is throughout Europe a fundamental focus on economic efficiency, by which the role of the public policy authorities is largely reduced to cost-accounting and rationalization. The trend to shift responsibility to the private sector has been of crucial significance in the implementation of actual programs, and, in the quest for sustainable development, this has meant a number of new managerial and administrative procedures that attempt to relegate environmental concern to normal business activity, in order to make "pollution prevention pay."

When it comes to considering the results or consequences of public policies, there is an underlying instrumental bias, by which meaning is transformed into measurement, and the effects of policy measures are interpreted almost exclusively in economic, or commercial terms, i.e., in relation to the proverbial bottom line.

Perhaps most crucially, over the whole range of policy making, there remains in place a fundamental belief in scientific-technological progress and on finding "technical fixes". Thus, even though the so-called policy discourse has changed to a certain extent, in that the rhetoric has tended to get greener, the way in which public policy making is actually carried out has not been affected very much by the quest for sustainable development.

2) A second conclusion that can be drawn from our research is that *the attempts to involve the public in science and technology policy making have had little direct impact on policy decisions or business behavior*. The calls for increased "stakeholder" involvement have become recurrent themes in science and technology policy and management, and, in recent years, there have been explicit references to a more active public engagement, or participation, in many other areas of public policy, as well.

Many policy makers, and even business officials, have talked of the desirability of greater public involvement, and, particularly in the media, there has been widespread discussion of the need for greater access to, and accountability of, decision-makers in regard to their constituencies. In the meantime, however, there have been noticeable shifts in science and technology policy toward decentralization and privatization (and, of course, to a greater dependence on decisions taken at the European, primarily EU, policy level). The result up to now seems to be more a diffusion and fragmentation of influence, however, rather than an improvement in direct public involvement in decision-making. The relatively few exceptions, such as the Infrastructure laboratory in the Netherlands, point to the importance of channeling public engagement into constructive activity, but also to the structural barriers that constrain such efforts.

In relation to the Agenda 21, adopted at the Rio "Earth Summit" in 1992, a certain reallocation of public funds has taken place throughout Europe, particularly to activities at the local level and within non-governmental organizations, in order to encourage a more sustainable socio-economic development. But in all too many cases, the new resources have been given to programs that have little to do with the

environment, and which relate to sustainable development in name only: for example, normal infrastructural and construction projects.

In other cases, projects have served to keep people employed for temporary periods, and have had difficulty establishing themselves as permanent programs. It has also been observed that while certain pilot projects are indeed based on ideas about sustainable development, the dominant economic and sectorial policies (in, e.g. transportation, energy, agriculture) continue to foster less sustainable paths to development. In most of the municipalities that we have investigated, Agenda 21 programs remain marginal to the dominant developmental trajectories and policies.

More generally, we have seen that the experiments in participatory approaches to science and technology are extremely limited. In our research, it was only in the Netherlands and Denmark that participatory experiments have come to form a significant part of the science and technology policy activity, but even in those "front-running" countries, the experiments are highly circumscribed and have little effective relation to the actual sites of technological development and decision-making. It is characteristic that the experiments are located outside of the authority of the economic ministries, and are generally funded through authorizations that are separate from economic policy decisions.

3) A third conclusion, derived from our studies of network building, is that it is, to a significant extent, *cultural, or contextual, factors which condition the effectiveness of new programs in science and technology.*

Three factors seem to be particularly important in this respect. First is the degree of institutional flexibility that characterizes the "mode" of science and technology, or research and development in a particular nation, region, or locality. A crucial condition for effective network building is the organizational capacity for social, or institutional innovations in science, technology, and work organization.

Those networks that we have investigated that seem to have had the most success are those that have been able to create new forms of research and development, often combining resources from different organizations, business, university and non-governmental. Particularly significant is the ability to link private and public initiatives, but also to draw on a broader public engagement, from small industry, voluntary organizations and concerned citizens. The synergistic effects of linking particular programs to regional policy goals are quite important; here again, compartmentalization or sectorization of "green" activities is a constraint, rather than a supportive factor.

A second feature of successful networking and/or brokerage is the relative openness of the political and policy structures, and the degree of substantive political interest and engagement in particular policy initiatives. The support "from above" in the form of political signals and interest is often crucial in the actual development of a network. At the same time, the willingness of political leaders and public officials to take risks, and open new channels of communication and interaction, i.e., to serve as "policy entrepreneurs", is often of crucial importance.

Finally, and perhaps most significantly, the viability of new networks of innovators depends fundamentally on the amount of resistance that is mobilized, that is, the degree and strength of opposition to new initiatives from established interests, most especially from representatives of traditional academic disciplines, business firms and sectorial authorities. In our research, we have discovered that many of the more successful networks are located in new, and often explicitly non-traditional, universities that pride themselves on their entrepreneurial capacities; in the older universities, as well as in many of the more established industrial branches, it has often proved more difficult to institute new routines and "paradigms".

In relation to transnational linkages, it can also be observed that a commercial and entrepreneurial ethos has come to the fore in many different contexts. For example, the Greening of Industry network has become ever more oriented, in the course of the 1990s, to management discourses and practices. As we have seen, among other places, in the experiences of transferring cleaner production to eastern Europe, engineering interests have tended to link up in other ways, often in contexts that are more directly commercial, niche-seeking and export-oriented.

A business of "greening" has emerged during the 1990s that can be expected to become a more visible and increasingly important part of the international political economy in the years ahead. But from our research, the question can be raised if it will be able to make meaningful inroads into the dominant socio-economic strategies and trajectories, or become an intriguing, but limited, sideline and/or a "moral" or public relations excuse for continuing unsustainable practices.

II. Concluding Reflections⁴³

In more general terms, it can be concluded that two distinct strategies seem to be crystallizing in relation to sustainable development, with characteristic patterns of public engagement, technical experimentation, and network building (see figure).

The Dialectics of Sustainable Technology	
"Democratic"	"Authoritarian"
locally-based	transnational
not-for-profit invention	marketable innovation

⁴³ This is a revised version of a talk given at a Conference on Technology Assessment at the Danish Engineering Association, Copenhagen, October 30, 1998, and at the Conference on Cultural Politics of Sustainable Technology: European Experiences at the newMetropolis, Amsterdam, December 3, 1998

collective ethos	entrepreneurial ethos
small-scale, artisanal	systemic, science-based
appropriate to context	externally produced
social learning "from below"	hierarchical management "from above"
horizontal network links	vertical integration
local empowerment	corporate expansion

On the one hand, in many of the various projects of so-called ecological modernization, participation is primarily conceived in a top-down way, with the public given the role of the environmentally-conscious consumer or offered opportunities for ecological employment. On the other hand, and opposed to this, are the bottom-up approaches emanating from locally-based initiatives, where forms of participation remain open-ended and highly diverse. The pursuit of environmental sustainability provides a catalyst in many of these cases for experimentation with new forms of sociality and association.

In the 1960s, as part of his two volume work on *The Myth of the Machine*, the American writer Lewis Mumford made a distinction between two fundamental types, or modes, of technological development, which he called "authoritarian" and "democratic", and which resemble, in many ways, the two strategies that have emerged in the quest for sustainable development. Despite their being somewhat provocative, Mumford's terms can be a useful way to characterize what might be termed the emerging dialectics of sustainable technics. The different approaches that we have identified and explored in the project can be grouped into two ideal typical categories, with different types of motivations, different types of network links, and different types of rationality that guide the scientific-technical practices that are being conducted.

For Mumford, the authoritarian form had been the most prevalent type of technology development throughout human history - centralized, hierarchically organized, linked to the powerful, and governed by the logic of large systems and the needs of those in power for control and domination. In his book, Mumford used the term *megamachine* to characterize this authoritarian technics - by which he meant that even more than the technology itself, there was a deep-seated belief in order, control, and domination that shaped authoritarian technics. There was a mechanical logic, or belief system, that lay behind and shaped the mechanical reality; and Mumford traced the emergence of this megamachine, this mechanical belief system, back to the city states of Egypt and Mesopotamia and the empires of pre-Columbian America.

Democratic technics was something quite different; it was dispersed and decentralized, developing throughout human history in response to local needs and resources and desires, based in handicraft operations and small scale organizational forms. It was a technology that grew from below, in a kind of unconscious opposition to the megamachine, and its logics were many and pluralistic. Its products were also highly diverse and contextually specific, related to the needs of particular living organisms and not artificially imagined machines.

Mumford's argument was that the two types of technics had coexisted throughout history, and that they each had their advantages and disadvantages, but he felt that by the 1960s, the megamachine had become far too dominant. With the powerful "military-industrial complex" and the other large corporations dominating technological development, the opportunities for democratic technics were seriously threatened. And like many other writers and critics of the time, Lewis Mumford called for a reaffirmation, or reinvention, of democratic alternatives to the megamachine.

This idea of a democratic technics - which Mumford and other cultural critics, like Herbert Marcuse, Rachel Carson, Paolo Friere, Ivan Illich, Paul Goodman, and many others articulated in the 1960s - was one of the sources of inspiration for a wide range of activities that came to take place in the 1970s, within the environmental and other social movements that developed at the time (cf Harper et al 1975). There was most prominently the experimentation with renewable energy technologies, but there was also an emergent interest in ecological agriculture and ecological design and construction. And there was a general interest in rethinking technical development assistance in more democratic terms. The economist E.F. Schumacher, who had worked in India for many years, developed, in his book, *Small is Beautiful* (1972), the concept of appropriate, or intermediate, technology, which he proposed as an alternative to the modern and often highly inappropriate technologies that were exported and transferred to developing countries.

Obviously there was a great deal of silliness and just plain bad engineering in the alternative technology movement of the 1970s. Not everyone could be an engineer and certainly not every social need could be satisfied with small scale alternatives. And yet it is hard not to miss that movement today when we think about the problems that confront humanity, particularly in terms of the interaction between human and non-human reality and the widely felt need to fashion more sustainable technologies as part of a more sustainable socio-economic development.

In many ways, the alternative technology movement of the 1970s - like so many social movements before and since - was a victim of its own success. Many innovations - in renewable energy, environmental technology, organic agriculture, and ecological design - that were made in movement workshops and production collectives, in alternative "grass roots" organizations, showed themselves to be profitable. And the temptation became too strong for the entrepreneurial types in the movement to commercialize their work, to set up companies, to go into business.

Others set out on a long march through the institutions, seeking ways to translate their ideas about democratic technological development into the more instrumental, or authoritarian, language of policy making and management. In Denmark and the

Netherlands, the term that was used most often was technology assessment. The way to change technology development into more socially desirable directions, many seemed to feel, was to examine the consequences in advance. If you could predict what the negative effects would be of a new product or process, then you could perhaps make it less harmful, both to the environment and to the eventual users.

Still others were won over by the charms and attractions of the new technologies that were coming out of the laboratories of the big corporations - the personal computers and the fascinating new ways to manipulate genetic material. Many were the former critics who became enamored with the new "high" technologies, arguing that they did not carry with them the same negative values and negative implications that nuclear technology and chemical technologies had. And so gradually, the alternative, or democratic, technology movement faded away, and a new "entrepreneurialism" emerged to take its place.

To return to Mumford's language, there came in the 1980s a new period of dominance for the megamachine, for authoritarian technics, and as a result, the balance was once again lost, and the entrepreneurial ethos, or spirit, spread to other societal domains. But, with the call for a more sustainable development that began to be heard in the late 1980s, there are signs of new types of democratic technics emerging here and there. They are fragile to be sure, and it is not at all the same kind of movement that it was in the 1970s. Rather, as we have come to understand them in our project, the experiments in democratic technics that are taking place across Europe are quite limited and do not make up a coherent, or integrated movement, as the experiments in the 1970s seemed to many of us - both then and now in retrospect.

The contemporary experiments are much more fragmented, and many of them appear, on closer examination, to be more rhetorical than real. That is, they are more talk about what could be done - or should be done - than practices that are actually taking place on a wide scale. Many of them go under the name of technology assessment, but often with a new prefix attached: constructive technology assessment or interactive technology assessment or participatory technology assessment.

Particularly in the Netherlands, but also in Denmark, a number of policy makers and academic students of technology and society have carried out projects that have tried to involve various public groups in technological development. There is the sustainable technology program in the Netherlands, and the Infralab that has involved those who are affected by infrastructural projects in scenario workshops and various planning activities. There are lay panels that have been established to formulate their ideas about technological development projects, through the auspices of Offices for Technology Assessment, and there are the consensus conferences that have begun to spread as an export product from Denmark to other countries. In recent months, both Korea and Australia have held their first consensus conferences.

What all of these activities have in common is a democratic ambition and certainly they are valuable additions to technology policy; but do they really represent a democratic technological development? I think not. So far anyway, there is still an enormous distance between the technology assessment activity and the dominant, authoritarian centers of technological research, development and innovation. The technology

assessment activities have become institutionalized and, to a certain extent, professionalized, but they have not yet entered into the real world of technological decision-making.

A very different kind of democratic experimentation has been taking place around Europe in the name of local Agenda 21. In many places, particularly when local environmental activists have been able to exercise some kind of control over the process, a number of things have started to happen that, at least to me, look more like a movement of democratic technology development.

New kinds of links, or horizontal networks, are being established, through local Agenda 21, between people from different places - small businesses, environmental groups, local government, schools. It points to the fact that a movement for democratic technology development is not just about concrete technological development projects; even more so it is about organization and finding new forms of working and interacting. Local Agenda 21 is one of the more visible sites of democratic experimentation. The danger is that it's done too much for show: because it is supposed to be done - what we have called participation by mandate. Unlike the 1970s, there are not enough alternative public spaces to house and cultivate the seeds of experimentation that are being sewn in the name of local Agenda 21.

A central factor is the decline, or rather the changing role, of the environmental movement, and other public interest, organizations. As with so many academics, who were part of the movements in the 1970s and then became professional experts, often in the name of technology assessment, the organizations have also changed, without too many new ones to take their place. Many environmental organizations have come to play a consulting role, and act to a large extent as business firms, in relation to Agenda 21, but also in relation to such things as environmental consumption. Other former environmental activists have become promoters of renewable energy, cleaner technology or ecological food, which is certainly a positive development, but is not necessarily a part of democratic technology development.

A final personal conclusion, then, is that there are many activities that are taking place across Europe that can be interpreted as seeds of a more democratic technology development. But they are rather weak and uncoordinated in relation to the dominant forces of "authoritarian" technics. What PESTO has indicated is that there is a good deal that we, as academic students of technology and society, can do, both to analyze the conditions and criteria for a more democratic technological development, but also to shape new kinds of linkages between experts and lay people.

What was so central to the movements of the 1970s, I believe, was the fact that many academics stepped out of the universities and worked with labor groups and environmental groups and other kinds of activist organizations. Of course, it was a different social and political climate then, but it still should be possible to do more than is being done today. I think that we, who are at the universities, should think seriously about the roles that we play in relation to authoritarian technics, on the one hand, and democratic technics on the other. The fragile experiments in democratic technology development need some help if they are to survive and continue to grow. And, as we

discuss science and technology policy options, we need to bring about a better balance between the democratic and authoritarian modes of technological development.

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Appendix: The PESTO research process

1. The PESTO network

The research project, Public Engagement and Science and Technology Policy Options (PESTO) was initiated in June 1996, and was completed in January 1999. The project was organized as a partnership among the following institutions and individuals:

- Research Policy Institute, University of Lund, Sweden (Andrew Jamison, Arni Sverrisson, Magnus Ring, Kees Dekker and Per Lindqvist);
- Bocconi University, Milan, Italy (Mario Diani, Marco Giuliani, Mauro Tebaldi);
- Kaunas University of Technology, Lithuania (Leonardas Rinkevicius);
- Twente University, the Netherlands (Johan Schot, Jose Andringa, Robbin te Velde, Richard Rogers);
- Center for Technology and Society, NTNU, Trondheim, Norway (Per Østby, Stig Kvaal, Lise Kvande, Pål Næsje, Signy Overbye, Ingvild Vaggen Malvik);
- Center for the Study of Environmental Change, Lancaster University, UK (Brian Wynne, Patrick van Zwanenberg, Robin Grove-White, Bronoslaw Szerszynski, Sue Holden).

In December 1996, the coordinator, Andrew Jamison, was appointed professor in Technology and Society at Aalborg University in Denmark, which meant that the coordination was conducted primarily from Aalborg, and that Aalborg University became a de facto participating institution.

The project was organized in three work packages, and used primarily qualitative methods. In all, over 200 interviews were conducted, some 75 of which have been recorded and transcribed, particularly in relation to work package two, Networks and Brokers.

Project meetings were held in Trondheim (November 1996), Aalborg (May 1997), and Nervi, Italy (January 1998), at which time the workplan was discussed and the preliminary results were presented. There were also a number of visits made to the participating institutions by the coordinating team (Andrew Jamison and Arni Sverrisson, now at Stockholm University). In the course of the project, the various partners also visited each other on a regular basis for research and educational purposes.

A series of outreach meetings, where results from the project were discussed with relevant user groups, were held in Lund (January 1997), Vilnius (May 1998), Trondheim (June 1998), Kaunas (September 1998), Stockholm (October 1998), and Lancaster (January 1999). A separately funded conference was organized by the

coordinator, together with the Dutch partner, and held in Amsterdam in December 1998 at the NewMetropolis Science and Technology Center.

2. Conference Participation, Dissemination of Results

The participants presented results from the project on the following occasions:

1. The EASST/4S joint conference in Bielefeld, Germany, October 1996 (Jamison and Wynne)
2. A conference on Science and the Environment, Trondheim, November 1996 (Jamison and Wynne)
3. A conference on Sociological Theory and the Environment, Utrecht, March 1997 (Rinkevicius)
4. A conference on Risk and Society, Oxford, July 1997 (Jamison, Wynne, Grove-White, and Szerszynski)
5. A conference on Science for Sustainable Development, Roskilde, Denmark, September 1997 (Jamison and Wynne)
6. A lecture series on Science Meets the Public, Amsterdam, October 1997 (Jamison and Wynne)
7. The conference of the Greening of Industry network, Santa Barbara, USA, November 1997 (Jamison and Rinkevicius)
8. A conference on Planning for Ecological Transformation, Aalborg, March 1998 (Wynne)
9. The International Conference on Science and Society: Technological Turn, Tokyo, March 1998 (Rinkevicius).
10. A conference on Cultural Politics of Technology, Trondheim, June 1998 (Jamison and Schot)
11. The World Congress of Sociology, Montreal, July 1998 (Rinkevicius).
12. A workshop on Human and Social Ecology, Pori, Finland, August 1998 (Jamison)
13. A conference on Participatory Technology Assessment, Copenhagen, September 1998 (Jamison)
14. Two sessions, at which the project results were presented, were organized at the Conference of the European Association for the Study of Science and Technology (EASST) in Lisbon, September 1998 (Jamison, Rinkevicius, Sverrisson and Østby)
15. A UK-Nordic seminar on Public Understanding of Science, Helsinki, October 1998 (Jamison)
16. The conference of the Greening of Industry network Rome, November 1998 (Schot and Jamison)

Material from the project has also been presented in a variety of courses at the participating institutions, at both the undergraduate, master's and postgraduate levels. All of the partners have also given lectures reporting on PESTO at several other universities in Europe.

As has been reported earlier, Professor Jamison has also continued with several of the project research themes in his current position in Denmark, as coordinator of a research program on Ecological transformation as part of the Danish center on environmental social science, and as a member of the Danish committee on technology foresight under the Technology Council.

3. Publications, reports

Two books have been published in the course of the project, which are sent along with this report:

1. Andrew Jamison and Per Østby, eds, *Public Participation and Sustainable Development. Comparing European Experiences. PESTO Papers 1*. Aalborg University Press, 1997
2. Andrew Jamison, ed, *Technology Policy Meets the Public. Pesto Papers 2*. Aalborg University Press, 1998

The following working papers are included as chapter four of this report:

1. Andrew Jamison, Environmentalism in an Entrepreneurial Age: Reflections on the Greening of Industry Network
2. Leonardas Rinkevicius, On the Transfer of Cleaner Production to Eastern Europe
3. Sue Holden and Bron Szerszynski, Public Participation, Electronic Democracy and the Environment

In addition, the following publications and other reports have been produced. Those marked with an asterisk are sent along with this report:

1. Jose Andringa, The influence on Local Agenda 21 on local policy and the quality of environmental decision-making: the pioneer city of The Hague, in: F. Coenen, et al, eds, *Participation and the Quality of Environmental Decision-making*. Kluwer, 1998
2. Jose Andringa, The Dutch Sustainable Technology Development Program
- *3. Mario Diani, Studying science and technology networks: Methodological reflections
- *4. Mario Diani and Arni Sverrisson, The Greening of Industry Network: Transnational Linkages and Environmental Science and Technology Policy Options
5. Robin Grove-White and Mark Toogood, Greenpeace Beyond the Millennium, an interview
6. Andrew Jamison, How Can We Educate Green Engineers? Reflections on Technology, Society and Ecological Modernization, inaugural lecture as professor in Aalborg, February 1997

7. Andrew Jamison and Erik Baark, National Shades of Green: Comparing Ecological Modernization in Sweden and Denmark, to be published in *Environmental Values*, 1999, 2

8. PÅL NAESJE, ENVIRONMENTAL MANAGEMENT SYSTEMS IN NORWAY

*9. Leonardas Rinkevicius, *Ecological Modernization and its Perspectives in Lithuania: Attitudes, Expectations, Actions*. Doctoral thesis (English version). - Kaunas University of Technology.

10. Leonardas Rinkevicius, Ecological Modernization and Public Participation in the 'Double-Risk' Societies. A Case of Lithuania, to be published in Spaargaren G., Mol A.P.J. and Buttel F. (eds) *Environment, Sociology and Global Modernity*. Sage

11. Leonardas Rinkevicius, Transformations of the Civic Environmental Activism and its Implications for the Environmental S&T Policy in Lithuania" to be published in *Environmental Politics*

*12. Richard Rogers and Noortje Marres, Landscaping Climate Change: Mapping Science & Technology Debates on the World Wide Web

13. Johan Schot, Can Technology Save the Earth? Promises and prophecies in the technological future, a multi-media lecture presented at the conference of the Greening of Industry Network, Rome, November 1998 Video plus text are available on request

*14. Arni Sverrisson, Networks, Brokers and Entrepreneurs in Ecological Modernisation (report on workpackage two, integrating 2, 8 and 17)

*15. Mauro Tebaldi, Proceses of technological innovation, railway transport policy networks and brokerage roles. An overview of the Italian case

*16. Mauro Tebaldi, Environmental policies and brokerage roles in Italy. The plastic recycling industry

17. Patrick van Zwanenberg, Networks and Brokerage in the Development of Bioremediation Technologies

18. Per Østby, Industrial Ecology as a Strategy of Ecological Modernization