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# Radical Reformism: Towards *Critical Ecological Modernization*

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## ABSTRACT

According to a specialized research area within environmental sociology – ecological modernization theory – the shift towards seeking to protect the environment constitutes a broadly emergent sociological phenomenon: the radicalization of modernity. The understanding of the fundamentals of such phenomenon is, therefore, crucial for both the practice and theorization of *organization and environment*. This is the main reason why this paper seeks to incorporate ideas from the disciplines of both environmental sociology and organization theory. By delving into the main sources of dynamism that ‘produced’ modernity the paper argues that a sustainable organizational practice depends on the incorporation of a special type of radicalism into ecological modernization. The paper anchors its main arguments in research conducted in the European automobile industry – a socio-technical context undergoing ecological modernization. The main conclusions of the paper relate to the nature of the reforms required for organizational practices to facilitate sustainable industrial development. Copyright © 2005 John Wiley & Sons, Ltd and ERP Environment.

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## Introduction

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IS ECOLOGICAL MODERNIZATION ‘MERCANTILISM WITH A GREEN TWIST’? HAS IT LED TO A NEW form of ‘state-managerialism’? Does ecological modernization produce a break with previous discourses on technology and nature, or is it precisely the extension of the established technology-led social project? Or should the ‘ecological question’ be understood as the successor of the ‘social question’, and ecological modernization as the new manifestation of progressive politics in the era of the ‘risk society’? (Hajer, 1996, p. 250).

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Given that 'modernity is itself deeply and intrinsically sociological' (Giddens 1990, p. 43), the understanding of the *greening* of organizations requires a good degree of 'sociological sensitivity'. It is for this reason that we attempt in this article to bridge theory and research in the field of *organization and environment*<sup>1</sup> with developments in environmental sociology. Because the design of environmental policies and the resulting process of internalization of environmental costs by organizations have been characterized as a phenomenon of *ecological modernization* (Young, 2000; Mol and Sonnenfeld, 2000; Spaargaren and Mol, 1992; Simonis, 1989; Jänicke, 1985), in this paper we provide a basic contextualization of the major environmental strategies and practices developed by modern organizations. We believe this contextualization can help organization theorists to establish a link between the organizational and sociological levels of analysis in regard to environmental issues. On the other hand, by delving into the fundamentals of ecological modernization we intend to offer important insights to environmental sociologists for the refinement of their theory.

Having emerged in the 1980s as a social theory with a strongly normative character, ecological modernization has gradually become the dominant approach in today's environmental policy, practice and theorization (Orsato, 2001a). The underlying assumption of ecological modernization is that human ingenuity will be able to harmonize economic advancement with environmental improvement (Jänicke, 1985; Jänicke and Weidner, 1997). There is an undeniably optimistic 'faith' in the possibility of moving towards hyper-industrialized societies by incorporating the natural environment into the redesign of modern institutions. Besides the assumption that there is no trade-off between environmental protection and economic costs (also known as 'win-win' or 'double dividends' scenarios), the incremental and accommodative character of the theory has resulted in the dominance of ecological modernization in government policies and management practices. For instance, ecological modernization framed the *White Paper of the European Commission on Economic Growth, Competitiveness and Employment* (Andersen and Massa, 2000). This, on its turn, influenced the development of the industrial and environmental policy of Western European countries (Binder *et al.*, 2001), and the emergence of a strong social consensus around ecological modernization policies in countries such as Denmark, Sweden and Germany (Lundqvist, 2000). At the level of industry, ecological modernization has become the leading perspective of 'double dividends' or 'win-win' solutions in the chemical (Mol, 1995) and automotive (Orsato, 2001b, 2004; Orsato *et al.*, 2002) industries.

Historically, neo-Marxist, counter-productivity and de-modernization theories, and theories of post-industrial society, have been the main intellectual forces arraigned against ecological modernization (Badham, 1984; Spaargaren, 1997; Mol, 1995). The shared belief of these theories is that ecological restoration and protection can only be achieved through *radical* changes in systems of production and consumption. However, radicalism has gradually been overshadowed not only by academic debates but also by eco-activism organizations such as Greenpeace and WWF (World Wildlife Fund). By the mid-1990s, conciliatory approaches were dominating the scene.

Interestingly, the only theory that managed to gather some momentum in limiting the pervasiveness of ecological modernization did so not by questioning the nature of policies based on ecological modernization but through the idea of control. *Risk society theory* has a more 'pessimistic' view of the phenomena underway in highly industrialized societies. From this perspective, the contribution of modern

<sup>1</sup>The Academy of Management interest group uses the concept of *organizations and the natural environment* (ONE) to refer to this area of research. In order to avoid equating this group of (mainly North American) researchers with the broad field of studies about environmental issues in organizations, this study adopts the concept of *organization and environment*.

science and technology to bring about an ecological switchover, as proposed by ecological modernists, is very questionable (Beck, 1992a). Instead of a change to more benign ecological practices, risk society theory sees such societies as generating increasingly levels of irreversible environmental risks; hence the 'risk society' theory.

Although sympathizers of the theories of ecological modernization and risk society were polarized for a while, by mid-1995 some academics were suggesting the complementary character of the theories. Cohen (1997), for instance, suggested that the disposition of nations to using scientific rationality defines the pathway towards ecological modernization or risk society. In this paper we extend Cohen's view to an enquiry into the nature of *reflexivity* – the central characteristic of modern rationality. In doing so, we question whether ecological modernization represents a new phase of progressive politics or is instead a conformist, conservative movement. The reason for such effort is simple: if ecological modernization is indeed so pervasive in guiding policy-making and environmental management in firms, there is a clear need to create awareness about the limitations of the theory. In order to ground our arguments, we briefly review Orsato's (2001a) study of the automobile industry – an industry in which ecological modernization is underway. The case has been instrumental in helping uncover some subtleties of ecological modernization.

Practically, the capacity of *radical* theories to contribute to the eco-ordering of societies seems to have had little impact on environmental policy and management (Newton, 2002), but if radicalism seems an improbable basis for public policy – because it demands too great a change in total systems – the *incremental* nature of ecological modernization seem to be overly simplistic and confident in the efficacy of its science, techniques and tools.

Hence, a fundamental question for research and management practice presents itself: despite reservations, are *radical* changes imperative for the ecological sustainability of modern industrial societies or, although it seems to promise more than it can deliver, is *incrementalism* enough to lead them towards sustainable patterns of production and consumption? We are not so ambitious as to seek to provide a final answer for such a question. Nonetheless, by revisiting the roots and the main weaknesses of ecological modernization we intend to indicate the direction in which solutions may be found.

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## The Emergence of *Organization and Environment*

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During the 1990s, some organizational theorists started to direct more attention towards ecological issues (Kivisaari and Lovio, 1996). The number of publications, compared with traditional areas of science, remained marginal but the natural environment gradually gained ground in the study of organizations. The early studies in *organization and environment* were characterized by an appeal to ethical principles by which organizations *should* guide their ecological actions. Possibly, this was a reaction to the anthropocentrism that has historically dominated organization theory and theorists. Approaches such as deep ecology, spiritual ecology, social ecology and eco-feminism inspired the theoretical foundations of some pioneer *organization and environment* works. These areas of study considered bio-species egalitarianism a pre-requisite for economic advancement in harmony with nature, encompassing what Egri and Pinfield (1996) called the 'radical environmentalism paradigm'. The lack of empirical evidence about ecologically sustainable organizational practices possibly explains why organizational scholars have often used ethical and moral philosophies, such as bio-species egalitarianism, to prescribe appropriate organizational behaviour towards the natural environment. Until the 1990s, empirical examples of pro-active environmental practices in firms were extremely scarce (Orsato, 2001b). As a result, theo-

retical and prescriptive approaches became common in the emerging field of *organization and environment* (Lovio *et al.*, 1997).<sup>2</sup>

Less radical approaches stress the necessity of working *with* the rules that currently guide managerial action by incrementally incorporating bio-centric values into these rules, which, over time, would result in better environmental practices in organizations. These intermediate approaches compose the 'reformist environmental paradigm', and have been adopted by emerging disciplines dealing with environmental issues in organizations. The very basic idea of reformism is that organizations – and more specifically business enterprises – are both the responsible agents for the promotion of environmental reform and sufficiently powerful to be able to do so (Hart, 1997; Hawken *et al.*, 1999).

The majority of the literature on corporate environmental management assumes reformism as the guiding principle for organizational change. *Incrementalism* is the basic principle of the standards of environmental management systems such as the ISO 14000 series (International Organisation for Standardisation) and the European EMAS (Eco-Management and Audit Scheme). These programs assume that through incremental improvements organizations will achieve organizational eco-efficiency and, eventually, ecological sustainability. It is precisely this prerogative of incrementalism that radical environmentalists attack. Colby (1990) stresses that the anthropocentric bias of reform environmentalism produces only minor adjustments to economic and technological systems rather than (the necessary) transformational changes in human society.

Both radical and reformist studies could be criticized on the grounds of their prescriptive nature. Ethics and moralities compose prescriptions for radical ecologists, while rational rules for eco-efficiency in corporations constitute the recipe of managerial-oriented reformist texts. While most of us – academics or otherwise – are able to recognize that ecological sustainability requires organizations to incorporate ecological principles into managerial rationality, it seems that too many answers have been given before enough questions have been asked. There is still a notable lack of understanding about how modern industries and societies can work towards ecological sustainability. If a bio-centric world is to be achieved, radical environmentalists have yet to develop a theory to satisfy this transition. Conversely, studies that can indicate whether incremental innovations are conducive to industrial sustainable development have not yet been developed.

The expertise that organizational theory has accumulated can certainly be used to address these issues. Indeed, the decade 1994–2004 has been marked by an impressive growth in environment-related studies<sup>3</sup> (see Sharma and Starik, 2004). However, comprehensive knowledge about systems of production and consumption and alternative models with which to reorganize them requires expertise from several disciplines, such as engineering, economics and sociology. Hence, this paper fuses developments from environmental sociology with organization studies. Fundamentally, the emergence of pro-active environmental management practices is not an isolated phenomenon but one that has emerged in conjunction with other socio-cultural developments, which need to be considered in the evolution of corporate environmental strategies. Following the footsteps of the classic work of Weber (1968) in trying to explain formal technical rationality as a particular sociological phenomenon in which modern organizations are embedded, the remaining sections of this article will try to 'locate' pro-active environmental practices in a broader phenomenon: ecological modernization.

<sup>2</sup> Early efforts to introduce the natural environment into organization studies were made through special editions of academic journals: *Journal of Organisational Change Management* (Number 7, Issue 4, 1994), *Academy of Management Review* (Number 20, Issue 4, 1995) and the *Scandinavian Journal of Management* (Number 12, Issue 3, 1996). The majority of the papers in these journals prescribed paradigmatic changes towards ecologically centred organizational behaviour.

<sup>3</sup> For instance, in the year 2000 the *Academy of Management Journal* (Number 43, Issue 4) presented a special issue on organizations and the natural environment.

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## The Ecological Modernization Theory

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The idea of ecological modernization originated in Western Europe in the 1980s. Ecological modernization theory assumes the current destruction of natural ecosystems is a result of design faults capable of reform by a further extension of that reflexive knowledge that characterizes modern thinking.<sup>4</sup> Many authors contributed to the development of the theory during the last two decades of the 20th century,<sup>5</sup> but its foundations were established in Germany through the work of Joseph Huber. The personal experience of Huber as an active environmentalist strongly influenced his conviction that the pathway towards *hyper-modernity* and industrialization is not only inevitable but *should* also be considered as a desirable strategy to overcome the current environmental crisis (Mol, 1995). The historical role of social movements, economic agents and technology as promoters of change towards more ecologically sound societies is central in Huber's proposal of ecological modernization. In his understanding, the importance of social movements as collective actors promoting social changes has declined substantially in the last decades of the 20th century. Economic actors – especially business organizations – have become central for the promotion of environmental reforms. Limited economic feasibility and poor political support, among other factors, have significantly reduced the scope of *de-industrialization* initiatives in restraining ecological deterioration (Mol and Sonnenfeld, 2000; Mol, 1995). Leading environmental groups have also shifted their strategies from ideological radicalism focusing on confrontation to more solutions-oriented courses of action (Hajer, 1996). A clear example of this shift is provided by the most widely well known environmental organization in the world, *Greenpeace*. After many years of radical activism in the 1990s *Greenpeace* moved from a strategy of pure confrontation to one of cooperation with business.

Over the last quarter of the 20th century, *Greenpeace* has been a central agency promoting public awareness and changes in organizational practice. Realignment of its course of action has the potential to influence changes in the circuits of political ecology (see Orsato and Clegg, 1999) involving other activist environmental organizations. The acceptance of incremental strategies for the incorporation of ecological principles into commercial activities – rather than their negation – by organizations such as *Greenpeace* endorses the role of industrialism as the motor for environmental restructuring. While environmental activism continues to be part of the mission of non-governmental organizations (NGOs), direct negotiation and collaboration have increasingly become ideologically acceptable and empirically practiced forms of organization. The emergence of the new ideology guiding the political strategy of non-governmental environmental organizations was central to Huber's understanding of ecological modernization. He saw it as a phenomenon driven by a new ideological positioning in times of *reflexive modernity* (see Beck, 1997) rather than a political program based purely on hypothetical assumptions.

By the late 1990s the theory was well developed (for a full review see Mol and Sonnenfeld, 2000). At the core of the contemporary approach is the view that societies are capable of dealing with environmental crises if their states demonstrate political will and leadership. It draws on experiences in some Western European countries to demonstrate that modern policy institutions can incorporate environmental interests into their daily routines. Elsewhere, economic and political interests singularly dominate the state and thus development trajectories, and environmental deterioration continues, challenging the premises of ecological modernization. Clearly, the theory relies on an implicit theory of the state,

<sup>4</sup> For an early overview of the ecological modernization theory, see Mol and Spaargaren, 1993; Mol, 1995; Spaargaren, 1997; Spaargaren and Mol, 1992, and Chapter 6 of Orsato, 2001a. A broader and more recent debate on EM can be found in Mol and Sonnenfeld (2000) and Young (2000).

<sup>5</sup> Martin Jänike, Volken von Prittwitz, Udo Simonis and Klaus Zimmermann (Germany), Geert Spaargaren, Maarten Hajer and Arthur Mol (The Netherlands) and Albert Weale (Great Britain).

one that in Miliband's (1969) terms is instrumental. There is no functional necessity why modern states should support ecologically harmful practice; indeed, it may even be functional for them not to do so – in this way they force the migration of national champions from more wasteful ecological practices to more sophisticated use of resources. Thus, adjusting the national policy environment can produce compliance with emerging best practice that should give national firms an advantage in global markets that are becoming increasingly sophisticated.

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### Another Technocentric, Neo-Liberal, Conformist Ideology?

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The wide acceptance of ecological modernization within academic, political and managerial circles also made it the target of a wide array of criticisms. Primarily, the broad spectrum of the theory allows space for its interpretation as another *neo-liberal ideology* applied to the environmental front. Industrialism rather than capitalism *per se* is identified as the main dimension to address in the process of ecological restructuring to achieve more sustainable systems of production and consumption. There are critics who find this objectionable; the capitalistic corpus has to be thrown out with the footprint of non-ecologically sound practices, they say. Realistically, the ecological modernizers seem to be on far sounder footings: if the future of the planet depends on some overthrow of globally dominant and dynamic systems of production and consumption then we may as well give up trying to achieve change; the stakes have been set too high. Hence, it is not surprising that in ecological modernization perspectives *win-win* situations or the discourse of *double dividends* gain ground; there is no direct threat to institutions that support political systems based on capitalist transactions. In this view, environmentalism is not a risk for capitalism. Not surprisingly, this assumption is in diametrical opposition with perspectives that consider capitalism the major cause of the current environmental crisis.

The proposition of ecological modernization theory as a viable solution to ecological crisis remains problematic for those who see the expansionist character of capitalism as the main cause of environmental degradation. Hajer (1996, p. 255) points out that 'eco-software will not save the planet if capitalist expansion remains the name of the game'. Although we do not intend to defend ecological modernization theory from such criticisms – which are more ideological than useful, the distinction between industrialism and capitalism can be used to question the assumption that environmental degradation is an immanent feature of capitalism. Rather than assuming the expansionist character of capitalist societies as the main cause of environmental degradation, ecological modernists locate the problem in the paradigm guiding the design of systems of production and consumption, independently of the political systems in which they are established. Nonetheless, this argument is still controversial and further analysis of the interdependencies between capitalism and industrialism is required; especially if ecological modernization is to become a normative theory, it will be crucial to use its analysis of interdependencies to elaborate schemes that can attack the sources of environmental degradation generated in industrial capitalist society rather than merely defer and aspire to some utopian non-capitalist system.

In fact, ecological modernization emerged to countervail neo-Marxist, counter productivity and demodernization theories, and, to a lesser extent, theories of post-industrial society. Since the early 1980s, these theories have been the main intellectual forces arraigned against ecological modernization. They offered alternative explanations and solutions for environment-induced social change. Since comprehensive analyses of the main presuppositions of these theories and their explanatory power as alternative social theories has been developed elsewhere (see, for instance, Badham, 1984; Spaargaren, 1997; Mol, 1995), the critique presented here is based on a different assessment. By enquiring into the nature of *reflexivity*, here we concentrate on whether ecological modernization theory represents a conformist, conservative movement or a new phase of progressive politics.

In the opinion of Mol (1995, p. 394), ‘the theory of ecological modernization seems to diverge somewhat from the notion of reflexivity (. . .) the theory seems to ignore the institutionalization of doubt, the disenchantment of science and the endangering characteristics of modern science and technology’. The strong reliance on rationality guiding the ever-increasing role of science and technology might persuade one to conclude that ecological modernization theory is just another *conformist* strategy. The basic idea of the Enlightenment, that there is a steering role for a guiding science, might not seem sufficiently challenged. By proposing that environmental restoration be implemented by governments and corporations, ecological modernists implicitly seem to assume the possibility of controlling the environment in the same fashion as the positivist tradition, using this control to produce normative measures. Yet, the reflexive nature of the appropriation of knowledge in modern times implies that more information does not necessarily bring greater control over social systems. On the contrary, it can have a destabilizing effect. The nature of the environmental debate is thus an expression of this dynamic character of modernity. Seen as ‘cultural politics’ (Hajer, 1996), ecological modernization implies that political discourses are hidden in the constructs that define what the environmental problem is. Moreover, limitations in the potential control of social systems can also be observed in unintended consequences of regulatory measures. In sum, the degree to which the generic notions of environmental restoration are based on positivistic assumptions might undermine the potential of ecological modernization theory to be recognized as a social theory with strong foundations.

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### The Case of the Automobile Industry: Incrementalism × Radicalism

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The grounding of ecological modernization theory in the phenomenon of the ‘emancipation of ecology’ in specific sociological spheres of hyper-modern societies represents the ‘parasitic relation’ with the object to be interpreted that is referred to by Jay (1996). In other words, if theory is expected to have some usefulness, it must be grounded in observable phenomena. One such study of an observable phenomenon was the empirical study developed by Orsato (2001a) in the European automotive industry. It illustrates the advances and limitations of a process of ecological modernization based solely on incrementalism. By briefly examining the environment-related improvements in car design and manufacturing, we identify some key point where radicalism might be necessary.

#### Eco-Modernization in Car Manufacturing

Generically, the vast majority of automakers have adopted a pro-active attitude towards the reduction of the environmental impact of their production processes. During the 1990s, the industry responded to increasingly strict governmental regulation by adopting cleaner manufacturing technologies and investing in environment-related research. Virtually every major high-volume car manufacturer worked towards increased levels of environmental performance and there are no doubts that improvements have been made (Nieuwenhuis and Wells, 2003). Such strategies and practices are aligned with one of the characteristics of eco-modernization, notably that ‘the design and evaluation of performance of production (and consumption) are increasingly based on ecological criteria, besides economic criteria’ (Mol, 1995, p. 58). From the perspective adopted in this article, such a scenario requires one to ask ‘Why is this happening?’ and ‘What explains the incorporation of ecological principles in the management of automobile factories?’.

Straightforwardly: it makes business sense. In the context of automobile assembly, organizational survival demands constant efforts to reduce the costs of industrial processes. The rationalization of systems of production became an imperative for car manufacturers not because competitive advantage was

expected to emerge out of such practices. They did so simply to *remain* competitive. Fundamentally, the pressure to cut costs in every possible manner has driven auto assemblers to work towards the minimization of waste and optimization of resources. In this respect, platform consolidation and modular assembly (for details, see Orsato, 2001a; Nieuwenhuis and Wells, 1997), related to several other initiatives, have been adopted by automakers as attempts to increase overall resource productivity in automobile manufacturing and to increase the chances of reaching greater economies of scale. In this case, a potential reduction of the environmental impact of car manufacturing can be seen as a consequence of strategies that aimed at increasing the overall productivity of the firm. Besides, even if such practices have further potential to generate cost savings in manufacturing, further (economic and environmental) gains are expected to be more difficult to achieve.

The economic principles guiding business action, among other factors, also justified automakers in developing strategies based on beyond-compliance practices in auto-assembling, more widely known as *lean production* (Womack *et al.*, 1990). Although the relationship between the adoption of lean production and the environmental performance of industrial processes still requires research, one can anticipate that such an approach will facilitate the process of improving the eco-efficiency of automobile factories. By the same rationale, by adopting standardized environmental management systems (EMSs), such as ISO 14001, some of the business codes of environmental practices adopted by automakers might have been pursued irrespectively of their commitment towards environmentalism. While ethical commitments might explain why some car manufacturers voluntarily adopt these principles, such as *Ford* and *Toyota*, it is possible that the search for a competitive edge also influences such actions.

Finally, the optimization of systems of production in car manufacturing is still attached to a paradigm of car design that is mostly adapted for assembling internal combustion engines into all-steel car bodies (Nieuwenhuis and Wells, 1997). This technological paradigm orientating car design and manufacture substantially limits the alternatives available to automakers. It requires high investments in manufacturing, and consequent high *break-even points*, with volumes of production for individual car models situated at around 200 000 units per year. In other words, the concept inherited from the past and reproduced in the present practice of car design imposes a specific set of technologies that have to be adopted in production, significantly influencing the environmental performance of cars during their use phase.

### Vehicle Environmental Performance

Regarding air emissions, the average environmental performance of cars has significantly improved in the last quarter of the 20th century. At the turn of the millennium, the internal combustion engines powering (new) cars that enter Western European roads emit around 95% less pollutants into the air than their counterparts did in 1975 – hence, a *factor 20* improvement (Graedel and Allenby, 1998). From a perspective privileging *incrementalism*, these figures suggest that automobile manufacturers have indeed pursued ecological modernization of the existing vehicles: the environmental performance of internal combustion engines (ICEs) has been greatly enhanced in the past decades. A clear-cut explanation for such achievements can be located in the imposition of emission standards upon car manufacturers.

Improvements in automobile air emissions in the last decades, however, have not alleviated the pressure faced by car assemblers. Regulatory measures have continuously intensified in Europe and other industrialized countries, such as Japan and some states of the United States of America (USA). Satisfying standards on air emissions has required the industry to invest increasing amounts of money in increasingly expensive research and development programs. Basically, the easy technological fixes in

controlling auto emissions have already been achieved, and even though further improvements are still possible they are both expensive and limited by the technology embedded in ICEs.

In light of ever-tightening regulations on automobile emissions, one could ask why (more radical) alternatives for the internal combustion engine, such as battery electric vehicles – which have long been available to auto industrialists – have not yet succeeded in the marketplace. Fundamentally, the high energy content of hydrocarbon-based fuels gives a competitive edge to ICEs when compared with their electric counterparts. Such an explanation is fundamental in demystifying some assumptions about the efficiency of conventional automobiles. Modern cars present surprisingly low levels of energy efficiency and ‘ecological maturity’. For instance, 95% of the power generated in an ICE is lost before it reaches the wheels (Graedel and Allenby, 1998). A radical reconfiguration in design could result in saving up to 80% of the amount of fuel consumed by an average car (Hawken *et al.*, 1999). Hence, modern cars are embarrassingly inefficient in terms of energy utilization. However, for the consumer who is not aware of or interested in issues of energy efficiency and environmental performance, ICE-powered cars still provide better *motoring* performance than electric vehicles (EVs). The result has been a persistent failure of markets for such alternatives.<sup>6</sup>

Could this situation change? In addition to these apparent technological imperatives, are there other factors that inhibit automakers in the mass commercialization of EVs, which remain the best available technology in terms of air emissions? If car manufacturers were unwilling or unable to supply EVs, why then have new entrants into the auto industry not fulfilled such a market niche? The analysis of Orsato (2001a) of EV cases shows that while traditional carmakers have been unwilling to adopt a new concept of the car body, converting (heavy) all-steel cars into EVs, new entrants face significant technological, economic and political limitations in developing, manufacturing and commercializing their vehicles. For the new entrants, the overall conditions within the automobile field require resources that are not so easy to acquire or maintain.

Some industry experts (Maruo, 1998, for instance) believe that developments in hybrid powertrains will make the pure battery obsolete. Essentially technical arguments justify this understanding: by generating the electricity on board, hybrid vehicles solve the problem of low battery storage capacity and the consequent limited range of ‘pure’ EVs. Hence, an essentially technical perspective may explain why the development of hybrid powertrains assembled in all-steel car bodies has been prioritized by automakers. From the perspective of *political ecology* explored by Orsato and Clegg (1999), however, the development of such technology can be seen as an attempt by car assemblers to innovate without having to move away from their core competencies. As long as the sunken investments in systems of production based in petroleum engines and all-steel car bodies can be secured, auto manufacturers can also maintain their centrality.

In sum, improvements in engine technology in the last quarter of the 20th century made possible *factor 20* reductions in air emissions of motorcars (i.e. 95% lower). Even though this achievement was mainly provoked by imposed regulations, the automobile as a whole could be seen as being in a process of ecological modernization. However, if one assumes that radical innovations in product design, manufacturing and material specifications can result in further *factor 20* improvements in the overall energy and environmental efficiency of automobiles, a more accurate impression of ecological modernization in the industry would require a move away from the ICE car. Viewed from this angle, the auto industry is still in its infancy. The *incremental* improvements seem to represent the ‘last gasp’ of an outdated technological option, rather than a characteristic of ecological modernism in the industry. Some radicalism seems necessary.

<sup>6</sup> For a detailed explanation for the (relative) market failure of electric vehicles, see Chapter 10 of Orsato (2001a).

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## Towards a More Critical Ecological Modernization

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The study of eco-modernization in the socio-technical context of the automobile industry addressed in the previous section was the source of contributions that can enhance the theory. Throughout the development of the study it was possible to incorporate additional insights on the main research problem area, as well as those that could enhance the ecological modernization theory. These insights are presented next.

### Refining Reflexivity: Fallibility as the Guiding Principle

Proponents of ecological modernization argue that rather than dismantling the foundations of industrial societies, the only viable alternative to solve the ecological crises – the continuous burdening of the sustenance base of the planet – is to fully explore the potential of wealth creation. This would be done through the use of one central source of dynamism of modernity: the *reflexivity* of knowledge appropriation. The use of rational capabilities should allow us to install a process of continuous reevaluation and redesign of modern institutions. Over time, systems production and consumption would be redefined according to ecological requirements, besides economic and technical ones. The intensification of reflexive thinking would, ultimately, allow modern societies to redefine the rules governing the economy, as well as its social extensions.

Such a view is quite appealing. Maintaining modern institutions is an alluring argument for those who benefit from the current state of affairs in highly industrialized societies. It is for this reason that critics of ecological modernization theory see it as another neo-liberal ideology in *green* camouflage. Fundamentally, the notion of win–win scenarios does not challenge capitalism and its associated dysfunctions, such as the tendencies towards monopolistic organization, social inequality and the appropriation and exploitation of nature. Moreover, the theory of ecological modernization apparently ignores the institutionalization of doubt, the disenchantment of science and the endangering characteristics of modern science and technology (Beck, 1997; Mol, 1995).

While the academic and popular debate about the meaning of ecological sustainability or sustainable development proceeds, a more pragmatic set of issues related to the limited character or reflexivity needs to be addressed by ecological modernists. Some vital questions need to be addressed. How can the reflective awareness of the possibilities of ecological modernization be increased? How can the theory and practice of ecological modernization become sufficiently open in order to examine the fundamental principles guiding its own definition of problems and programmatic strategies? It seems that the answer is located in the incorporation of another concept into the reflexive nature of knowledge appropriation, as well as the development of science and technology. *Fallibility* is the only certainty we have about human action. For this reason, it need to be linked with the notion of reflexivity when considered as both a source of reflection about human knowledge and a principle used for the definition of eco-modernizing strategies and actions. If it is at all possible to do so, ecological modernization theory must incorporate the concept of fallibility to provide a countervailing view of the role of modern science and technology: in this way ‘risk society’ theory was born.

### Complementing Ecological Modernization with the Risk Society Theory

The acceptance of *fallibility* as an immanent characteristic of human action is critical for the reflexive appropriation of knowledge, which is expected to lead societies to ecological modernization. In the opinion of George Soros (1998) – a very successful stock market broker, only when we start accepting

our tendency to *fail* in interpreting reality will it be possible to reform the institutions governing economic and social action. In this process, open consultation and debate are pre-requisites for more stable and egalitarian economic systems and societies. Interestingly, the notion of fallibility is also central for risk society theory. According to the leading proponent of the theory, Ulrich Beck (1992a, 1992b), societies in times of high or reflexive modernity are seen as organized around the negative process of distributing ecological risks; hence they are *risk societies*. The secularization and high degree of industrialization achieved by some countries transforms (traditional) insecurity about natural forces into fear of environmental catastrophes generated by human science and technology. In this perspective, the escalation of unintended consequences generated by expert systems is inescapably attached to hyper-modernity. The accident in the Ukrainian nuclear power plant of Chernobyl is the example used by Beck to explain why high consequence risks in industrial societies cause a permanent sense of insecurity in lay citizens.

The risk society theory takes a sceptical view of the contribution of modern science and technology to bringing about the ecological switchover proposed by ecological modernists. Nonetheless, some eco-modernists have suggested that rather than being conflicting theories risk society and ecological modernization have the potential to complement each other. Mol (1995, p. 395) sees an opportunity for some kind of 'specialization' of the theories, in which risk society theory would be used for the analysis of high consequence and low probability ecological risks, whereas ecological modernization would direct attention to 'normal' environmental problems such as water pollution, waste management and soil acidification.

Ulrich Beck seems to substantiate this view. By proposing a new model of politics for times of *radicalized* modernity, Beck (1997) goes beyond the identification of immanent problems of industrialism and recognizes the need for theoretical frameworks that can also be normatively used for environmental protection and restoration. Cohen (1997) did just that – designed a framework for the approximation of risk society and ecological modernization theories – leading the way towards a more critical environment-related theory. In this article we simply go one (small) step further by further questioning the reflexive evaluation of science and technology guiding industrialism. In our understanding *fallibility* should be a leading principle in reflexive modernity. This principle, however, needs to be complemented with another concept that also is based on an apparent dichotomy.

### The Need of 'Radical Reformism' in Ecological Modernization

Are *radical* changes imperative for the ecological sustainability of modern industrial societies or is *incrementalism* enough to lead them towards sustainable patterns of production and consumption? According to the conclusion of this study, the answer is both: incrementalism and radicalism, which directs us to the concept of *radical reformism*. Although this notion may seem a paradox – since one term contradicts the other – the concept of *radical reformism* may become vital for the development of ecological modernization theory. Similar to the notion of *utopian realism*, which characterizes both the visionary and the pragmatic aspect of ecological modernization, radical reformism requires the qualification of the terms. Thus, in the context proposed here, the radical aspect relates to technological innovation while the incremental refers to institutional reformation.

However, before we present our view of radical reformism, it is opportune to emphasize that the term 'radical' here differs fundamentally from the meaning attributed by radical or deep ecologists, neo-Marxists and counter-productivity and de-modernization approaches, addressed earlier in the paper (see also Mol and Sonnenfeld, 2000). The use of the term here does not go as far as demanding a revision of (ethnocentric) values guiding human action or the radical restructuring of modern societies. All we propose is a qualification of the term 'radical', so a clear meaning is attached to it. In our

understanding only by doing this does the term become 'workable' in the sense required by the normative aspect of ecological modernization.

The limitations of environment-related solutions that favour the current paradigm of production in car manufacturing have been presented earlier in this article. Incremental improvements in internal combustion engines (ICEs) have resulted in significant environmental gains but also limit the possibilities of alternative powertrain technologies to succeed. The high energy content of hydrocarbon fuels used in ICE-powered cars allows automakers to maintain steel – a heavy metal that significantly reduces both the energy and environmental efficiency of cars – as the main material used in car bodies. This example exposes the limits of *incrementalism* in ecological modernization. Put simply, technological incrementalism avoids questioning the principles embedded in specific technological applications and, by extension, does not question the fundamentals of science guiding industrialism. Hence, if ecological modernization is expected to facilitate sustainable industrial development, *radical technological innovations* may be necessary in several instances.

Radicalism in technology may need the incremental transformation of the institutions of modern societies. The radical view envisions essential dramatic changes to both the products and the industry, which are to be accommodated within a more ecologically sustainable framework. On the other hand, radical technological innovations will certainly displace those associated with outdated technologies. For instance, the substitution of carbon fiber for steel in car bodies may become economically feasible in the coming years – since, technically, the substitution is already possible, but what would happen to those who lose their jobs in the steel industry as a result of such changes? Who would pay for the decommissioning of steel furnaces, among a series of other economic activities associated with this industrial sector?

This hypothetical example suggests radical technological innovations require the development of macro-strategies for the *management of transition* between modern to ecologically modern societies. Because such reforms engender ample democratic negotiation among social actors, they are inescapably reformist in their character. In other words, ecological modernization demands *incremental institutional reform*. Therefore, radical technological innovations and incremental institutional reform, together, constitute the concept of *radical reformism*, which may have important implications for both the development of ecological modernization theory and its normative application.

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## Final Considerations

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This article has explored how the broad concept of 'the *greening* of organizations' constitutes an extension of the same historical continuum that 'produced' modernity and, consequently, cannot be dissociated from it. Within the domain of industrialism, pro-active environmental management practices in organizations are part of the phenomenon characterizing the 'emancipation' of ecology from the economic and technological spheres. Pro-active environmental practices in organizations constitute part of a broader phenomenon under which some sectors or industrial societies have been immersed in the last quarter of the 20th century: the move towards a *high* or *radicalized* modernity (Beck, 1997; Giddens, 1990). Although such perspective provided by environmental sociologists at first sight might be seen as alien to organization theorists and managers dealing with environmental issues in organizations, it is in fact crucial for advancing the theorization and practice of 'sustainability management'.

In this perspective, the increasing adoption of ecologically efficient practices by firms can be interpreted as a phenomenon that results from the extension of reflexive thinking to business–environment relationships. The process of emancipating the ecology from the economic and technological spheres is a result, rather than a cause, of the reflexive appropriation of knowledge in the front of corporate envi-

ronmental management. In this respect, pro-active environmental management can be seen as a response to stakeholders' future expectations of performance. Ecological modernization is the social theory that was developed around this sociological phenomenon.

The theory of ecological modernization has two main distinctive uses. In its analytic–descriptive character, it is a social theory that aims to interpret the historical process of emancipation of ecology. *Modernization*, in this situation, relates to the dominant characteristic of western industrialized societies. *Ecological* expands this recognition to the phenomenon of upgrading industrialism through the reformation of institutional clusters that have been increasingly based on ecological principles. The normative character of the theory is expressed in the proposal of strategies be adopted by organizations and governments in order to harness the causes of the current ecological crisis. The 'historicity' of the theory emerges when the radicalization of industrialization processes is proposed as the next desirable stage of development of modern societies. In such a social design, where the institutional clusters of capitalism, nation-states and military power would not necessarily change their modern characteristics, the design of systems of production and consumption would increasingly be based on ecological principles.

The reflexive nature of ecological modernization is also questioned in the light of the risk society theory. The role of science and technology becomes problematic if ecological modernists are not able to recognize the limitations in controlling social systems and the unintended consequences associated with the implementation of normative strategies. The prescriptive use of ecological modernization theory suggests that the solution for current ecological crises and the eventual pathway towards sustainability may require not only the internalization of environmental costs by manufacturing organizations but also the all-encompassing reformation of systems of production and consumption. According to the arguments developed in this article, the success of such reform requires the incorporation of both more critical and more radical pre-conditions into the development of the theory.

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