

## From Resistance to Co-Management? Rethinking Scientization in the Contestation of the Technosciences

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### Abstract

Since the critique of science movements emerged in the 1970s, knowledge–power relationships in the technosciences have changed significantly. The mobilizations both of scientists to produce *science for the people* and of lay producers of knowledge and expertise have helped to remedy the perceived deficits of official science. STS research to date has abundantly and rather enthusiastically examined the forms and conditions of production of this critical, dissident, alternative knowledge, but few studies have looked at how scientific and political elites react to and engage with such knowledge–based mobilizations. Focusing on ways of governing techno–criticism, this article aims to contribute to filling this gap. It investigates the innovative capacity of social movements and public authorities as well as their capacity for renewal and ability to shift power relations in their favor, including in the inevitable crisis and scandal situations. Drawing on empirical evidence from a long–term sociohistorical study of the contestations over French nuclear complexes, I propose an analytical framework that distinguishes four historically situated modes of managing scientifically informed contestations of the technosciences. I conclude that scientized or expert activism can be most effective, including within top–down participatory settings, if it is accompanied by oppositional protest and even radical criticism.

### Keywords

techno–criticism; social movements; scientization; antinuclear protest; institutional responses; France

### Introduction

Many empirical studies have shed light on the historical and contemporary dynamics of contesting science and technology. Few have looked at how they connect with and are—at least partially—shaped by official expertise structures and institutional policies. How are “mobilized publics” (Hess 2015) valorized or conversely sidelined by technoscientific institutions? In what ways do they transform themselves when they enter into interaction with technoscientific elites or are included within expert circles?

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These questions are far from a new one given that the official valorization and institutional visibility of unofficial or dissident knowledge, in other words of “citizen science” ([Irwin 1995](#); [Strasser et al. 2018](#)), is a phenomenon dating back to the late 1970s. Important factors in the reinforcement of such an institutional recognition of critical or lay actors and their cognitive/knowledge capabilities were: (i) the contemporaneous rise of discourses around the risk and knowledge societies ([Pestre 2008](#)); (ii) the sudden development of an epistemic—or pragmatic at least—modernization movement that was gaining ground among political decision-makers and managers just as a number of crises and scandals were coming to light, and scientific uncertainties were becoming evident ([Moore et al. 2011](#)); and (iii) the gradual increase in the number of STS scholars calling for this knowledge to be recognized, and for greater public participation in the governance of the technosciences ([Wynne 1996](#); [Callon, Lascoumes & Barthe 2009](#); [Collins & Evans 2002](#)). These all paved the way for a cognitivist shift in the analysis of technoscientific disputes and controversies ([Eyerma & Jamison 1991](#)).

During the same period, public participation began to be adopted as an indispensable tool of good governance by a large number of institutions and regulatory bodies. These developments took place in parallel with the increasing recourse to science and technology within social movements, in particular green movements ([Yearley 1991](#); [Jamison 2006](#); [Ollitrault 2008](#)). This evolution—which resulted from a rising concern among activists or “critical” individuals and groups over the need to produce alternative knowledge and expertise in order to make their action more efficient and legitimate,—contributed to destabilizing official decision-making mechanisms in the short and medium term with regard to concrete issues. While numerous studies have already illustrated these dynamics ([Wynne 1996](#); [Brown 1992](#); [Epstein 1995](#)), there has been little research, despite the existence of pioneering theoretical and empirical reflection ([Hess 2015](#); [Kinchy 2012](#); [Welsh & Wynne 2013](#); [Wynne 2006](#)), conducted either on the trajectory followed by scientific or scientized forms of environmental activism (which do not necessarily challenge or reject a given innovation per se but rather the scientific hypotheses, evaluations, norms and tools through which it is controlled, regulated, and/or governed) or on the ways in which these forms of activism do or do not succeed in strengthening or legitimizing broader movements that are opposed to controversial or risky innovations.

In line with the so-called political ([Frickel & Moore 2015](#)) or critical ([Pestre 2008](#); [ibid. 2009](#)) schools of thought in STS as well as the “descendant” literature on participatory governance in the technoscientific domain ([Pellizzioni & Vannini 2013](#); [Wynne 2006](#); [Lezaun & Soneryd 2007](#)), this is the approach I would like to pursue here. I draw on empirical evidence from a long-term sociohistorical study conducted as part of my doctoral and postdoctoral research (2005–2012), which looked at the topic of French nuclear complexes and the contestations over them (from 1970s–2010s). More specifically, it examined the transformations in antinuclear protests through the decades and the different strategies adopted by nuclear promoters to control and police opposition to nuclear energy. The research was based on: systematic participatory observations conducted at NGO and activist meetings and at protest events during the whole research period; ethnographic observations carried out within two independent NGO laboratories; fifty-one interviews conducted with members of the antinuclear movement (over four decades) as well as with

experts, managers, trade unionists and public opinion specialists from the nuclear industry and agencies;<sup>1</sup> an in-depth study of archive documents from protest groups and official bodies; and a systematic review of press archives and activist magazines.

In this paper, I will focus on three areas in particular. I will look at (i) what alternative knowledge and expertise signify and how they contribute to social movements at different phases of their mobilization; (ii) how institutions (especially regulatory bodies) deal with scientific criticism and scientized protests; (iii) what all this tells us not only about the innovative capacity of social movements and of public authorities and decision-makers but also about their capacity for renewal and their ability to shift power relations in their favor, including in the inevitable crisis and scandal situations.

I have drawn on the artistic and social critique recuperation mechanisms described by Boltanski and Chiapello in *The New Spirit of Capitalism* (Boltanski & Chiapello 2007) for my analysis in this context.<sup>2</sup> Rather than *recuperation*, however, I will talk about the government of *techno-criticism*. The criticism I refer to in this paper includes—but is not limited to—different types of “scientific counter-publics” (Hess 2015). By “government,” I mean the set of strategies, discourses, and instruments designed to manage, control, police, supervise, co-opt, neutralize, and even eliminate public challenges to a technological innovation in order to ensure its social acceptance. Speaking in terms of “government” rather than using the notion of “governance”—which is politically loaded (Pestre 2014)—provides the opportunity to maintain an analytical distance vis-à-vis the actors analyzed.

The analytical angle I will adopt through focusing on the diverse ways of governing techno-criticism has already been applied in its various forms in some major empirical studies. Focusing on siting controversies over several techno-industrial projects (airports, dams, nuclear power plants) in Japan and in France, Aldrich (2008) showed how plans for siting these “public bads” were elaborated by taking into consideration not only technical factors but also social ones, namely local resistance and the strength/weakness of (local) civil society. Such a major concern pushed experts and policy-makers to innovate a set of strategies that allowed them to counter public opposition on time and finalize the siting processes successfully. The success of a giant dam project implanted in Laos and analyzed by Goldman (2001; *ibid.* 2006) also relied on such strategies aiming to neutralize public opposition to projects whose environmental risks and damages were publicized to a large extent. These strategies were elaborated and deployed in the late 1990s by the World Bank who, after difficulties and failures faced during the implementation of similar projects in India, fully *reformed* itself by adopting discourses and practices of eco-

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<sup>1</sup> The interviews were organized as follows: nineteen with members of antinuclear/ecological activist groups, eleven with “critical scientists” (some of whom openly adopted antinuclear positions at times), five with trade unionists, twelve with experts and managers from nuclear bodies, and four with public opinion specialists within the nuclear industry and agencies.

<sup>2</sup> Luc Boltanski and Eve Chiapello described the strategies used by capitalist institutions and circles to overcome the crisis arising from the wide-scale social and artistic critiques of May–June 1968. They argued that the changes and reforms that took place in the post-May ’68 period were inspired and even shaped by those critiques. Capitalism renewed and re-legitimized itself through social and moral arguments and through the actions elaborated and reclaimed by the protest movements while simultaneously contributing to weakening those movements.

governmentality designed by a wide range of experts and consultants. In a different perspective, in her study of the disputes over an oil refinery in Louisiana, Gwen Ottinger (2013) analyzed the ways the refinery's experts gradually managed to sideline and even subvert the local protest groups' grievances over the health impacts of the installation as well as their overall demands for environmental justice while at the same time meeting some of their other demands. Their subtle and systematic promotion of the moral authority of official science and expertise served as a self-government tool in relation to those protesters who, despite being proficient enough to continue to contest the official "truths" by producing critical or alternative knowledge, ultimately opted for other, less offensive action forms. Last but not least, the complex relationship between post-disaster techno-criticism and its governance was extensively analyzed by Kimura (2016) in her study of food controversies in post-Fukushima Japan. The author shed light on the authoritative, gendered and neoliberal strategies through which experts and decision-makers systematically sought to invalidate, dismiss, sanction or depoliticize "citizen science" initiatives and in particular mothers' mobilizations that aimed to improve the surveillance of radiation-contaminated food.

The present study aims to enrich the existing literature by departing from the specific case of French nuclear complexes and adopting a sociohistorical perspective that situates but does not circumscribe the different modes of governing techno-criticism within their historical contexts. I will mobilize an analytical framework that distinguishes four modes of managing scientifically informed contestations of the technosciences. While these modes are historically situated, they can all extend beyond their time because they have been brought to the fore in certain circumstances or periods and forced to retreat in others. Rather than assuming they are ever-evolving regimes that simply succeed one another, I will consider them in their plurality within the context of a cumulative learning process that the institutions and expert bodies engage in.

A subject that merits investigation in this respect is that of the *scientization of environmental protest*. I propose to observe its development through the decades from its inception. I will mobilize the notion of scientization in its broadest sense, that is to say as a series of processes of (re)organizing or (re)framing a protest, conflict, or action in scientific terms (Jasanoff 1996; Wynne 2006; McCormick 2006; Kinchy 2012). Scientization can take a number of different forms. It can be promoted or actively steered by technoscientific institutions within delimited spaces or platforms, such as top-down consultation exercises, it can intervene more gradually and under more implicit or invisible policing or through the influence of technoscientific institutions, or it can manifest as a form of self-empowerment or self-government. Within social movements, scientization can be initiated by scientists (who join or support the movement), activists, laypeople, or "hybrid groups" (Callon et al. 2009). Scientization does not automatically signify depoliticization. Depending on the context, it can serve as a strategy purely to (re)politicize a problem, or it can become a way of eliminating a political or indeed any other type of ontology that does not put the values of science at its center (Welsh & Wynne 2013; Kimura 2016). In sum, scientized criticism and disputes often differ from "indivisible" or "either-or" type conflicts (Hirschman 1995). They correspond rather to "divisible" or "more-or-less" type conflicts, which have been defined by Hirschman as intrinsically easier to settle. According to Hirschman, in the case of divisible conflicts, "even when the parties are initially far apart they can theoretically 'split the difference' or 'meet halfway' ('half a loaf is better than none') whereas these types of compromise solutions are often less available when the sections making up a society and

coming into conflict are divided by matters of religion, language, race, or gender” ([ibid.](#), 213–214); or we could add, by matters such as the (un)acceptability of nuclear energy in political, social, and ethical terms.

From an institutional point of view, questioning the utility or *raison d’être* of certain innovations in an indivisible way is an *undisciplined* form of challenging the technosciences, while scientized criticism can be considered to be *disciplined* given it has a scientific language that does not impose the promotion or rejection of a technological offer as a moral condition of the negotiation among the different parties. The institutional valorization of such a disciplined form of protest can also be considered an official strategy for denigrating the more radical, oppositional, denunciatory forms of protest. In other words, it can be seen as a way of defining the good vs. bad ways of criticizing techno-industrial innovations and the desirable vs. undesirable ways of being “critical citizens” in an era of “responsible growth,” where it is assumed that scientific progress cannot be stopped but that its externalities should just be better managed.

Within this framework, I will examine the various actions of protest groups, particularly in relation to the production of counter-expertise. The counter-expertise focused on here involves a specific form of scientized protest. It refers to forms of critical, alternative, and mostly local knowledge produced by actors situated outside the conventional or official circles of science and expertise, namely antinuclear activists, “concerned” scientists, and citizen or victim groups. With regard to the modes and places of production of counter-expertise, determining to what extent counter-expertise is (or may remain) an outsider activity may prove tricky given that the boundaries of counter-expertise (like those of expertise) are fluid and dynamic and that the identity discourses of the actors involved (the counter-experts) are diverse and/or have evolved gradually. Instead of attempting to redraw these boundaries, I will focus on how such innovative action forms subvert (or not) the nature of the challenges presented to the technoscientific bodies and how these modify (or not) the nature of protests in general. In this context, I do not start from a top-down or normative assumption that counter-expertise type actions or science-based protests would necessarily have a colonizing potential over other kinds of protest. Given that social or ecological movements are quite often heterogenous in terms of the types of actors mobilized, problems identified, and forms of intervention implemented ([Cefaï 2007](#)), science-based protests are just one among many action forms (site fights, media whistleblowing, boycotting, juridical action, etc.) used to improve efficacy, at least in the early phases of collective mobilizations. However, they can also gradually pave the way for an institutional or media benchmarking of “best” protest practices, which may cause divisions within a given social or ecological movement. Put differently, while pluralistic action forms may be complementary, they can also gradually enter in competition with one another depending on the external constraints that protesters are subject to in their efforts to make their actions legitimate or visible. Based on a comparative and systematic study of these multiple action forms that have constituted and shaped the French antinuclear movement over the decades, I have paid particular attention to such dynamics in relation to science-based or counter-expertise type actions. Distinguishing these from other action forms may, of course, seem to be a risky, and even biased, methodological choice on the face of it given that such action forms are rarely static or isolated and that the actors who mobilize them may also mobilize other forms in parallel. However, such a choice offers an important heuristic advantage in a case study like the one presented here, as will be detailed further below.

## The (Initial) Context

I begin with a review of some of the characteristics that marked the French nuclear program analyzed here. In 1974, the world's most ambitious nuclear program—known as the Messmer Plan—was announced in France in response to the oil crisis. The construction of 170 nuclear reactors was envisaged by the year 2000 to meet all of the country's electricity needs. The slogan used at the time was “Tout électrique, tout nucléaire” (100% electric, 100% nuclear). Having achieved military greatness over the previous two decades ([Hecht 1999](#)), France sought to use the atom to strive for industrial greatness. The Messmer Plan was to reveal the full extent of technocratic operations concerning French techno-industrial projects during this period. Given that the Plan was conceived and then implemented by a very small group of experts and bureaucrats without consulting the wider scientific community, antinuclear opponents denounced this specific form of nuclear technocracy, which they named “nucleocracy” ([Simonnot 1978](#)). The clash between the regulatory bodies and those that promoted and exploited nuclear energy was also criticized. For instance, the CEA (Commissariat à l’Energie Atomique [French Atomic Energy Commission]) was at the time both the architect of the plan and the safety and radioprotection watchdog for nuclear power stations in service or under construction. Moreover, there had been very few national studies conducted on the environmental and health impacts of the mass construction of these facilities. The problem of nuclear waste remained unresolved, and the calculations relating to the likelihood of incidents and their potential consequences were kept secret as indeed were the investment costs and national energy consumption forecasts for the coming years. Hence, from the late 1960s onward, nuclear energy critics mobilized against a highly opaque and powerful military-industrial technology. Despite the fact it has undergone significant changes and lost momentum over time, this mobilization turned out to be fairly sustainable. In response, the scientific and political elites began in the '70s to redouble their efforts to monitor and police the antinuclear protest movement through a series of what I have elsewhere examined as *criticism governing tools* ([Topçu 2013a](#)). One of these tools is the participatory tool, which became key to managing antinuclear movements and the public space from the '80s onward. In particular, the scientific dimension of the movement was valorized in this context with crucial consequences for the possibility of challenging nuclear energy, as will be developed further below.

## The Gradual Scientization of the French Antinuclear Protest

### The Rise of “Critical Scientists” in the 1970s

In the 1970s, civil nuclear energy, as it is known, occupied a very specific place in the widespread contestation of science and technology in most developed countries ([Flam 1994](#); [Nelkin & Pollak 1981](#); [Jasper 1990](#)). The French antinuclear movement, which had emerged around '69, took a major leap forward in response to the Messmer Plan, and by '76 it had become one of the largest antinuclear movements in Europe. It brought together a wide range of actors (residents, farmers, teachers, clergymen, prominent figures, scientists, trade unionists, political activists, anarchists, and so on), all with different reasons for becoming involved ([Touraine et al. 1983](#)). These included criticisms of science, technocracy, experts, capitalism, the consumer society, technological risks, state centralism, and authoritarianism. The collective actions also took on highly varied and innovative forms. For example, self-managed cooperatives (Groupements Fonciers Agricoles) were created to buy up the private land around planned power plants, and the first counter-expertise association in the field of civil nuclear energy, GSIEN (Groupement des Scientifiques pour

L'Information sur l'Énergie Nucléaire [Association of Scientists for Information on Nuclear Energy] was established. This association is of particular interest because it constitutes the first organized scientific and expert endorsement of the antinuclear movement. It was set up jointly in '75 by a group of scientists from prestigious research institutions (such as the Centre National de la Recherche Scientifique [National Center for Scientific Research], the Collège de France, and the Institut National des Sciences et Techniques Nucléaires [National Institute for Nuclear Science and Technology] and trade unionists from the CFDT Confédération Française Démocratique du Travail [French Democratic Confederation of Labour]). Both groups were inspired at the time by the Union of Concerned Scientists in the United States. They took particular issue with the scale of the project (100% electric, 100% nuclear) and aimed to inform people and alert them to the “propaganda” being disseminated by Électricité de France (EDF), a then entirely state-owned electricity utility company, which was in charge of implementing the Messmer Plan. Based on a systematic review of official reports and international studies, the GSIEN scientists and trade unionists produced alternative information on a variety of safety problems and potential pollution associated with the deployment of the Messmer Plan. For instance, in '76, they raised the alarm about the fact that a major accident at the fast-breeder reactor Superphénix could result in a million victims. A year later, they publicized the shortcomings of the emergency systems at the Fessenheim power plant. The GSIEN members thus served as counter-experts for the antinuclear movement. However, they refused to identify themselves as such in the '70s. They believed that positioning themselves as experts or counter-experts would depoliticize their action and the antinuclear protest more broadly. One of GSIEN's founders told me during our interview:

Expertise, at that time, was a tool used by those who had power, by the state, which tried to impose nuclear energy on the people. Our aim was to disrupt that power game. (One of GSIEN's founders, December 8, 2008, Orsay)

### **From “Critical Scientists” to “Lay Experts” in the 1980s and '90s**

With the shock of the Chernobyl accident in April 1986, especially in relation to its poor management by the French authorities who minimized both the risks and the need for public information at the time ([Liberatore 1999](#)), these early counter-expertise efforts in the '70s paved the way for new initiatives led by new actors — largely laypeople assisted by professional scientists. As a result, two major counter-expertise NGOs emerged to change the landscape of nuclear energy criticism in France in the decade following the Chernobyl accident, namely CRIIRAD (Commission de Recherche et d'Information Indépendantes sur la Radioactivité [Commission for Independent Research and Information about Radiation]) and ACRO (Association pour le Contrôle de la Radioactivité dans l'Ouest [Association for the Control of Radioactivity in the West of France]). These new mobilizations engaged with a clear identity discourse ([Hunt & Benford 1994](#)), that of the “independent expert” who was neither for nor against nuclear energy. The action forms they advocated also appeared to be much more technical and empirical than those championed by GSIEN. These included regular measurements and monitoring both of the environment and of local foodstuffs using Geiger counters as well as the creation of two nonprofit scientific laboratories to undertake these tasks. One of the activists stated:

I decided to act in order to protect my children and prove that the state experts were not only lying to us but were also incompetent. (One of CRIIRAD's founders, April 5, 2005, Valence)

The type of actors engaged in antinuclear protests thus underwent a major transformation during the late '80s. The balance of power shifted from “critical scientists” in the '70s to “lay experts” in the '90s. This evolution paradoxically corresponded to a greater scientization of antinuclear activism in France, with a shift from preliminary counter-information efforts to certified counter-expertise (Topçu 2013a). This concerned not only the lay mobilizations that had emerged in the immediate wake of the Chernobyl accident but also, over time, the largest environmental organizations, such as *Greenpeace France* (Ollitrault 2008). This dynamic converged to a large extent with the more general changes underway in the ecological movements of the same period (Yearley 1991; Jamison 2006)—an evolution that was already visible in the '70s, especially within feminist health groups (Murphy 2012).

The scientization of antinuclear criticism destabilized the business-as-usual world of the official experts by highlighting not only errors and limitations but also issues that were left unsaid or omitted intentionally. One ACRO member explained:

[Thanks to competencies we acquired, we were sometimes also able to reveal] downright dishonesty in their hypotheses and methods. (One of ACRO's founders, October 8, 2008, Caen)

Scientization legitimized the activists' actions in the eyes of the media and the public at a time when nuclear energy was already a *reality*, with nearly seventy percent of national electricity supplied by nuclear power stations. It was difficult for official bodies to publicly ignore these actions because rather than defending an “deological” position—which the antinuclear activists of the previous decade had been accused of—the activists focused their efforts and claims on concrete problems such as an “abnormal” radioactive release around the facility at The Hague. However, during this period, the scientization of criticism also meant that the activists had to ensure their words and actions largely conformed to the scientific or technical norms because they were obliged to speak the same language as the official experts, to calibrate their measuring instruments with those of the official bodies, and even to act as experts themselves. The activists thus became self-regulated through scientific norms and values. “We don't have a right to any error” [nous n'avons pas droit à l'erreur] was a slogan they often put forward during the interviews.

As a result, in the decade after the Chernobyl accident, the French nuclear debate was characterized by a range of mediatized reports, and sometimes scandals, about local pollution cases discovered in various locations, followed by a battle over radioactivity measurements between the nuclear agencies and the counter-experts. With the exception of the strong local opposition movements to the government's radioactive waste storage projects during the second half of the '80s, calls for a national nuclear phase-out and the elaboration of alternatives to nuclear energy began to dwindle and in fact almost stopped altogether. Chateauraynaud and Torny (1999) described this new situation in the first half of the '90s as a “configurational hollow” in terms of antinuclear protests.

### **The Return of French Antinuclear Protests at the End of the 1990s**

In the late 1990s, this configuration was to change once again. Three main factors played a role in this context. First, at international level, the rise of a global debate on climate change was followed by the rise of industrial strategies calling for a “nuclear renaissance,” that is to say new forms of expansionism that prioritized nuclear energy in the fight against global warming. In order to prevent such a greenwashing of nuclear energy, a number of antinuclear groups remobilized, and facilitated by the rise of the internet during



the same period, incorporated their action into international networks. Second, the nuclear phase-out announced in Germany in June '00 encouraged French activists to reassert their call for a phase-out in France. Third, the establishment of a “pluralist left” government in '97—involving Les Verts (Green Party)—and the decision to phase out the fast-breeder reactor Superphénix intervened as a source of further encouragement to act. Significantly, some of the activists from the antinuclear network Européens contre Superphénix [Europeans against Superphénix] went on to found RSN (Réseau Sortir du Nucléaire [French nuclear phase-out network]) two years later. RSN federated more than seven hundred NGOs and local groups and committees in the space of just a few years. Greenpeace France also restructured itself during the same period and made the antinuclear struggle a top priority again alongside climate change and GMOs.

RSN and Greenpeace France established scientific advisory boards and developed technical competencies to orient their actions and communication strategies throughout the 2000s. Like CRIIRAD and ACRO, and indeed sometimes in collaboration with them, they launched alerts and debates on issues of safety, pollution, and radioactive waste. For example, in 2000, Greenpeace released images of some of the almost thirty-thousand radioactive waste barrels that had been dumped in the Hurd Deep (a trough in the English Channel, close to Cap de la Hague) by the UK in the 1950s and '60s. Also, in 2005, RSN leaked a confidential official report to the media that acknowledged that the “evolutionary pressurized reactors,” the new generation reactors that France was planning to replace the existing ones with, would not be able to withstand a terrorist attack similar to that of 9/11. One of RSN activists explained to me:

Occasionally, confidential official reports that can prompt a media scandal leak to us. The issue is how to make good use of them, how to publicize them at the right time (November 12, 2006, Paris)

Last but not least, these antinuclear organizations elaborated various public education campaigns to counterbalance the official information and propaganda. Demands for a better (more transparent, less technocratic) management of the nuclear industry were thus combined with calls for a nuclear phaseout, although there was little agreement among either the antinuclear groups federated within RSN or any other groups on the proposed temporalities and modalities of a phaseout during this period.

### **The Institutional Management of Scientized Protest: Four Models**

In parallel with the developments outlined above, there was a significant change in perspective on the part of both the state and the nuclear agencies with each generation of scientific criticism in relation to the knowledge-based (counter-information, counter-expertise) forms of collective action. Viewed initially as an outright threat, this criticism from the scientific community, the labor unions, and subsequently the activist networks and the lay community came to be seen as a challenge that had to be integrated into the government of the nuclear sector, in particular during the second half of the 1990s, when the nuclear industry attempted to become more “participatory” and even “green” at both the national and international levels.

Regarding the French context specifically, the institutional management of scientized criticism can be analyzed in four distinct phases. In the '70s, there was a denigration and exclusion of such criticism by the governing bodies. In the '80s, there was partial recognition for the purposes of a modernized management (of public information in particular). In the '90s, there was greater recognition/inclusion with

the aim of rendering official expertise more legitimate and of restoring public trust. In the 2000s, there were attempts at routinized inclusion aimed at individual responsabilization (and deradicalization). Each of these phases can be considered representative of a specific mode—or model—of governing techno-criticism, which I call: (1) the deficit model; (2) the co-information model; (3) the co-expertise model; and (4) the co-management model. These models do not entirely replace one another from one period to the next. Rather, they can co-exist and indeed also in certain circumstances neutralize one another. For the French nuclear case analyzed here, each can be considered a dominant (but not unique) mode of governing dissent during a given historical period. The changes in such modes of governing techno-criticism, which are highlighted by the shifts from one model to the next (or one period to the next), echo more general changes related to the governing of contested or controversial technosciences at national and international levels. This study has drawn on those identified by: Michel Callon (1998) and Callon et al. (2009) based on a variety of case studies, including AIDS activism, opposition to nuclear waste management, and patient mobilizations for the treatment of myopathy; Alan Irwin (2006; 2014) in his analyzes of evolving forms of science governance; Pierre-Benoît Joly (2001) in his study of the management of GMO controversies in France. In the same way that the modes or models described in these studies often co-exist (at least when a series of techno-scientific or techno-medical sectors are considered together) instead of being singular regimes that definitively close one era and open the next, so the models I have distinguished for the specific case addressed in this article co-exist.

### **The Deficit Model: Denigrating Scientific Criticism (1970s)**

In this model, the governing bodies consider scientific criticism to be the most dangerous form of public dissent against the technosciences. Other forms of dissent are thought to be easier to stigmatize as irrational, ignorant, or “not-in-my-back-yard” (NIMBY) reactions. Continuous efforts are made by the promoters of the contested innovation(s) to draw a divide (Gieryn 1983) between the official experts and those who are not proficient enough or qualified to speak in the name of science. This form of managing techno-criticism characterizes the French nuclear experts’ and agencies’ evaluation of and political work in relation to the scientifically reinforced protests of the 1970s.

During the ’70s, the French nuclear organizations, notably CEA and EDF, acknowledged the fact that the protests, far from being marginal or isolated events or an irrational fear of the atom from a small number of individuals, had become a “social phenomenon” (Barthe 2006). The social sciences were heavily mobilized in this context. On the one hand, the nuclear energy promoters aimed to better understand the protesters (the “enemy,” whom they feared could “contaminate” public opinion with their ideology) by analyzing their arguments and identifying their typical profiles. On the other, they sought to systematically monitor public opinion through opinion polls, which became highly sophisticated and were extensively used during the ’70s.<sup>3</sup>

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<sup>3</sup> The number of national opinion polls sent out during the ’70s (almost 120) was three times higher than that distributed over the previous twenty-five year period.

In particular, the nuclear bodies saw the scientists' mobilization as a major threat to the government's energy plans during this period. It became difficult for nuclear energy promoters and regulators to pretend that opposition to nuclear energy was a primitive reaction from irrational, fearful, or ignorant individuals. They thus developed diverse discursive strategies to denigrate the scientists' argument by putting forward for instance the importance of the division of competencies within the scientific professions and among theoretical vs. applied scientists. They claimed that the "scientists who criticize the nuclear program do not know" or "are not experts on" the different technical aspects of a nuclear power plant.<sup>4</sup> Beyond their deficit of knowledge, their action was also judged to be "irrational," "anti-democratic" (because they represented a "minority").<sup>5</sup> Based on these arguments, the EDF and CEA experts mostly refused to participate in public debates with GSIEN members during this period in order that the "critical scientists" would not be recognized as legitimate stakeholders. In a sense, the scientists' refusal to be labeled as antinuclear movement experts undermined their cause because it helped EDF and the government bodies reinforce the divide between the official nuclear experts and the rest (non-experts).

There were a number of rapid developments in the institutional responses to the activists' demands in the '70s, including the organization of two local referendums in '75 and the establishment in '77 of a so-called pluralist information council that incorporated environmental activists. However, the activists' and especially the "critical scientists," their arguments and demands were better received after the change in government in '81.

#### **The Co-Information Model: Partial Recognition of the Virtues of Scientized Criticism (1980s)**

In sharp contrast to Model 1, scientized criticism is evaluated pragmatically in Model 2 (and even more so in Model 3 described below). Actors that elaborate a scientized criticism are no longer seen or presented as illegitimate or ideological individuals with whom the official experts and decision-makers do not need to debate or negotiate. Instead, they are progressively called upon as co-producers of information (Model 2) and even of expertise (Model 3), especially in contexts of high-level public mistrust and strong demands for more transparency. This does not mean that other ways of managing antinuclear criticism, such as surveillance, policing, and repression, disappear—they simply become less visible.

Model 2 became operational in France in the 1980s. This period is marked by several important events, including the Socialist Party's electoral victory in '81 and the Chernobyl nuclear accident five years later. It should be noted here that, soon after the electoral victory, François Mitterrand's Socialist Party largely reneged on its pre-electoral promises on nuclear energy (which included a moratorium on the Messmer Plan) and continued building nuclear power plants at a sustained rate. In order to mitigate public debate on its new policy, government officials tried to persuade the most scientized faction of the antinuclear movement to collaborate in the modernization of the nuclear sector. This was achieved primarily through handing senior responsibilities over to some of the trade unionists and scientific protesters, who

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<sup>4</sup> See for instance the point of view of Pierre Pellerin who was the head of the Service Central pour la Protection contre les Rayonnements Ionisants [Central Service for Protection Against Ionizing Radiation] during this period ([Pellerin 1980](#)).

<sup>5</sup> See for instance the point of view of Michel Hug who was equipment manager of EDF in the '70s ([Hug 1977](#)).

were to work either within newly created government agencies, such as the energy management agency AFME (Agence Française pour la Maîtrise de l'Énergie [French Agency for Energy Efficiency]), or as energy advisors in the ministerial offices. Furthermore, in the first half of the '80s, the government allowed the protesters access to the recently created CLIs (Commission Locale d'Information [Local Information Commission]). These commissions represented an important modernization attempt within the French nuclear sector at the time because they marked the first step toward the participation of ecologist and antinuclear groups in the production of information on the daily activities and impact of nuclear power plants. GSIEN, CFDT, and local antinuclear organizations and NGOs were invited to join the CLIs. However, a large number of CLIs ceased activity just a few years after they had been set up. Even the CLIs that remained active, such as the one in The Hague region, depended to a large extent on the information provided by the nuclear plant operators during this period (Topçu 2013a). The CLIs, and with them the “co-information model,” thus only partially succeeded. They nevertheless played an important role in the official reframing of the nuclear problem mainly as a management problem.

This shift in focus shaped the trajectory of nuclear energy criticism over the coming years and even decades. For example, the new social mobilizations resulting from the Chernobyl accident were calling, as already mentioned, not so much for a phasing out of nuclear power but for better risk control. Indeed, after the Chernobyl accident, many activists considered that the modernization of the state and its regulatory agencies was a more urgent problem than the elimination of the nuclear industry.

In this new context, the activists (both old and new) attempted to re-politicize the nuclear question by for instance publicizing updated information on the fallout from the Chernobyl accident in different regions of France, the infringement of norms regarding routine ruthenium releases from the nuclear plant at The Hague, and the illegal storage of low-dose radioactive waste in certain waste disposal centers. This new framework was also progressively being supported by the nuclear bodies, how believed “openness toward civil society” would be established as an international imperative of good governance in the years that followed.

### **The Co-Expertise Model: Mobilizing “Lay” Experts as Firefighters (Late 1990s)**

Most STS scholars have documented and theorized “participatory” or “lay expertise” as representing much more than just co-information or participatory information with the aim of revealing its positive role in repairing undone science (Frickel et al. 2010) and scientific uncertainties (Callon et al. 2009). This third model of techno-criticism management, which I call the co-expertise model, refers to cases in which stakeholder participation in expertise production does not happen spontaneously but is organized in a top-down manner. This kind of organization often takes place in contexts of intense polemics and controversies that need to be calmed down.

From the mid-'90s onward, the French nuclear agencies, including first and foremost the IRSN (Institut de Radioprotection et de Sûreté Nucléaire [Institute for Radiological Protection and Nuclear Safety]), became *participatory*, at least in their public discourses. They regularly stressed their desire to break with the technocratic practices of the past. This period saw the creation of services and departments entirely dedicated to the theme of participation. However, rather than opting for a profound restructuring of the existing mechanisms of knowledge production and decision-making, the authorities called for pluralism or

public empowerment only in situations of heated controversies, polemics, or scandals where they needed to restore their public legitimacy.

The emblematic example of pluralistic risk assessment in French nuclear energy history is the GRNC (Groupe Radioécologie Nord Cotentin [Cotentin Peninsula Radioecology Group]). It was set up in the wake of the controversy that broke out in '96–'97 over the possible increase in the incidence of childhood leukemia around the plant at The Hague that had been indicated by the work of epidemiologist Jean-François Viel at the time. Experts from three associations (CRIIRAD, ACRO, GSIEN) were integrated into a multi-year investigation process to work alongside official experts on a study of the pertinence of Viel's findings. However, concerned and lay groups, such as "Les Mères en Colère" (angry mothers), a local protest group set up after the launch of the polemic, were excluded. The GRNC, which was presented as:

"A major opportunity" to reform nuclear governance, received a significant amount of publicity. (President of GRNC, December 3, 2008, Fontenay-aux-Roses)

During its first meeting, its president vehemently stated: "If the GRNC fails, so will pluralism in the nuclear field" ([Estades & Rémy 2003](#)).

However, this expert commission—despite the fact its procedural quality was approved by all participants—ultimately came up against the fact that no—or at least very little—analytical work had been carried out in the field up to that point. Epidemiological accounts were lacking, the health monitoring of residents was not systematic, official measures relating to the plant's atmospheric emissions were insufficient, and so on. While the environmental radioactivity measures produced by ACRO and CRIIRAD in previous years partially remediated the situation, overall, the widespread nature of the ignorance zones made it impossible to demonstrate any causal relationship between the cancers observed and the plant's emissions.

While such situations of uncertainty are not specific to nuclear power, they played a particularly important role in reorienting the debates in the French case. Participation was either dampened down, rendered inactive, or even reduced to mere marketing by the official government bodies. The uncertainties and non-knowledge zones were delineated but remained unresolved for a long time (because producing knowledge requires time and means). More importantly, the GRNC's promoters within the official bodies would later admit they had known it was impossible to demonstrate a single cause-effect relation in this case given the uncertainties and lack of epidemiological data ([Topçu 2013a](#)). The involvement of expert activists in a commission charged with assessing nuclear health risks and harm thus served, above all, to dampen down a heated controversy.

Furthermore, pluralistic assessment or co-expertise was mainly directed at radioprotection and less at other fields such as nuclear safety. A few years after the GRNC experiment, the IRSN attempted to set up a similar pluralistic risk assessment committee, this time around the closed uranium mines in the Limousin region, where the discovery of significant radioactive pollution levels had prompted fierce public debates and protests. The protest movement was led in particular by Sources et Rivières de Limousin (Limousin's Rivers and Water Sources), a local antinuclear NGO. Once again, instead of inviting this NGO to join the envisaged pluralist assessment committee, IRSN turned to counter-expertise NGOs. However, CRIIRAD refused to join this time because they believed that these participatory exercises did not offer the

material means necessary for conducting “real” risk assessments.<sup>6</sup> It accused IRSN of putting together the committee as a publicity and legitimation tool for the nuclear energy promoters. In the end, because IRSN had not managed to recruit the activists it had wanted, Sources et Rivières de Limousin was included in the committee. However, this NGO soon stood down from the committee too, arguing it was an illusion of democracy. One of its members explained to me:

When you scratch the veneer of “pluralism,” you discover that the whole affair is in the hands of the IRSN family. IRSN is the one who coordinates the GEP, it is the one who provides the group with the necessary information and expertise. (Member of *Sources et Rivières du Limousin*, March 31, 2009, Paris.)

In short, both the scientized groups and the more openly antinuclear groups became progressively critical of the participatory tool, and some even started to systematically refuse to serve as “firefighters” for the nuclear industry in the years that followed.<sup>7</sup>

### **The Co-Management Model: Scientization as a Form of Individual Responsibilization (2000s)**

In this fourth and final mode of governing scientized criticism, the focus is on risk (and even harm) management rather than risk assessment. While risk management is conventionally the duty of the state and state-regulated industries, social science research has shown how, in parallel with a risk colonization movement ([Rothstein et al. 2006](#)), risk has increasingly become a neoliberal tool for individual responsabilization and self-government or more precisely for transferring the responsibilities from the state to the individual in the domains both of medical and healthcare ([Clarke et al. 2003](#); [Polzer & Power 2016](#)) and of environmental and disaster management ([Kimura 2016](#)).

In line with these developments, the decision-makers in what I call the co-management model believe that risk management should be assured not only by the state and the industry but also by the citizens. The implicit assumption here is that this offers a triple advantage to the governing bodies: (i) risk management costs will be lowered; (ii) the level of social contestation will be reduced—because individuals and activists will be responsabilized, or “empowered” even, through their involvement within the official settings; (iii) the overall exercise, as a public participation practice, will increase the public legitimacy of the technology or techno-industrial sector in question. While these developments may seem to be a general strategy to better manage nuclear energy and its risks (through more dialogue with the public), their relevance in terms of the government of technocriticism is based on the fact that they have at least partially contributed to blurring the boundaries between the activism of the challengers and the actions undertaken by the official bodies.

The emblematic visibility of the co-management model in France were the participatory rehabilitation projects (also called the “*démarche Ethos*” [Ethos approach] projects) established by think-tanks closely associated with the French nuclear industry. These projects were implemented from 1997 onward in Belarusian territories heavily contaminated by the Chernobyl accident. Declaring their

<sup>6</sup> Paraphrasing interview with a CRIIRAD member, May 14, 2007, Paris.

<sup>7</sup> Interviews conducted with several CRIIRAD and ACRO members in 2007 and in '08, in Paris, Caen and Valence.

commitment to participatory democracy and public empowerment, the Ethos experts promoted a new form of self-government for the victims, who were to take charge of their own destiny by counting and accounting for their daily food intake and daily movements through the continuous use of a Geiger counter and by acting as “rational” individuals through learning to counterbalance the excessive consumption of low-quality (high-radioactivity) food one day by consuming less radioactive food the next (Topçu 2013b). Furthermore, the Ethos experts managed to persuade a number of French organizations (expert NGOs, activist groups engaged in humanitarian aid) to help with transferring competencies (on measuring radioactivity for instance) to local organizations and inhabitants. The Ethos approach was progressively diffused beyond Belarus too. In the 2000s, Ethos-type projects were largely funded by the European Commission and supported by the World Bank (Topçu 2013b). Several European countries, not least France, adopted them as a new disaster management tool for implementation in the post-accident period. Participatory committees like SAGE (Strategies and Guidance for Establishing a Practical Radiation Protection Culture in Europe) and CODIRPA (Comité directeur pour la gestion de la phase postaccidentelle d’un accident nucléaire ou d’une situation d’urgence radiologique [Steering Committee for the Management of the Post-Accident Phase of a Nuclear Accident or a Radiological Emergency]) were set up to establish, in partnership with expert and activist NGOs, guidelines for coping with a contaminated environment. These developments all took place in parallel with the French government’s plans to limit—with the aim of lowering costs—the evacuation zones in the event of a nuclear accident. Especially after the Fukushima accident, when the Ethos approach was rapidly exported to Japan (Kimura 2018), IRSN’s top managers even pretended publicly that rather than evacuating the victims in the event of an accident, they should be taught how to carry on with their normal lives in a contaminated environment. For all these reasons, the co-management model engendered strong criticism and was even rejected by certain mobilized publics and expert activists. It caused a divide within the French antinuclear protest groups of the 2000s, with some organizations accusing those involved in the Ethos-type projects of:

... selling out to the nuclear lobby. (CRIIRAD spokesperson, September 12, 2008, Paris).

The RSN expressed similar criticisms, which led several of its members to leave the network (because they felt offended). Some of the more radical activists even sabotaged meetings and conferences organized within the context of Ethos-type projects. They denounced the fact that,

... the nuclear lobby wants to teach people how to eat becquerels and at the same time shamefully pretend to empower them (RSN activist, November 26, 2007, Paris).

### Surviving the “Models” of (Good) Governance?

The divisions created by the co-management projects as well as the rifts caused by the disputes over the best strategies to adopt to combat the nuclear industry’s attempts to *greenwash* itself as an ecological solution to the global climate change strongly impacted the French antinuclear landscape in the late 2000s. By March ’11, when the Fukushima Daiichi power plant was hit by chain nuclear explosions, it was clear the antinuclear protest had weakened in France. Fewer than three hundred people joined the protest marches in Paris, compared with some sixty-thousand people who took to the streets in Germany the same weekend to say “no” to nuclear energy. In addition, the counter-expertise groups didn’t manage to politicize the nuclear

problem the way they had in 1986. The Fukushima radioactive cloud did not have the same material or symbolic impact in France as the Chernobyl cloud had twenty-five years earlier. The official bodies neither hid information nor pretended that such an accident could ever happen. The antinuclear protest nevertheless began to strengthen again in France the following year. In spring 2012, almost sixty-thousand people formed a human chain stretching over 230 kilometers (between Lyon and Avignon). A year later, a public hearing (*débat public*) on France's giant nuclear waste repository project CIGEO (Centre Industriel de Stockage Géologique [Industrial Geological Storage Center]) was interrupted by local opponents claiming the consultation process was a falsely democratic exercise. They were quickly stigmatized by state and industry spokespersons as a "noisy, sometimes provocative, even violent minority" that threatens "the very existence of democracy" (see [Chevènement et al. 2013](#)). In 2016, new mobilizations emerged, led by young—new-generation—activists (mostly of a libertarian-anarchist persuasion). These new activists refused to engage in participatory exercises, which they saw as a means of technicizing the nuclear question and scientizing environmental activism. They criticized the old-generation activists for not taking radical enough action against the "nuclear mafia," and they profoundly modified existing action forms by prioritizing physical/bodily resistance and in particular the long-term occupation of land around the area in which the CIGEO project is implemented ([D'Allens & Fuori 2017](#)). Together with similar occupation movements (in particular the protest against the recently canceled airport project at Notre-Dame-des-Landes), whose commonality is the desire to reinvent the political through daily, autonomous, community experiences of living, doing, and resisting (capitalism, the state, and large, destructive industrial projects), this new form of antinuclear protest progressively rendered the institutional strategies of dialogue with civil society outmoded. While the protesters reframed the antinuclear struggle as an indivisible conflict, exclusion and repression once again became the preferred modes of state intervention from '16 onward.

## Conclusion

In highly technocratic domains like the French nuclear decision-making system (which led to the creation of the world's most nuclearized country in under two decades), the recourse to science and expertise has not only become an important legitimation tool for social movements, which is a general tendency in contemporary knowledge societies, it has also largely disciplined certain forms of protest, to the point where the scientificity of criticism on—or public reactions to—innovations still seem to be the main criteria through which the decision-makers define what the "responsible," "desirable," and even "authorized" ways of evaluating technosciences are ([Wynne 2006](#); [Welsh & Wynne 2013](#)).

Building on these observations, this article offers at least two types of demonstrations as well as insights for future research, reflection, and discussion. The first insight is that in the medium and long term, the asymmetry of power (public relations opportunities, material means for producing expertise, access to media and policy-making) between official experts and activists (or counter-experts) may limit the activists' potential to *permanently* politicize science and expertise and to use this to force the abandonment of the contested innovation or project. As has been shown, activist groups are highly conscious of and reflexive about such risks, which pushes at least some of them to revise their strategies regularly. Social movements seem to derive the greatest benefit from scientific action or participatory exercises (in terms of their potential for politicizing the problem targeted) not through the homogenization of action forms (as in the post-Chernobyl period for instance, which saw the transformation of expert activism into a movement



in itself) but through a coexistence of outsiders, insiders, expert activists, experts who refuse to play the activist role, radical opponents, and the more moderate scientific critics, who together are able to *form the movement*. Recent developments in the French antinuclear protest provide such an insight. The main advantage of this kind of strategy of unification without homogenization in the context discussed here would be that the governing bodies would not be able to easily stigmatize one particular form of protest (for instance the most radical one) by highlighting or commending another (for instance the most scientific form). Put differently, the fact that the radical forms of protest act together with the most scientific ones in certain circumstances potentially renders the implementation of the “divide and rule” strategy more difficult.

The second insight is that while it is well documented that state and industry officials and policy-makers conduct active political work on protest movements ([Boltanski & Chiapello 2007](#); [Hess 2015](#)), this study clearly shows the diverse and often ambiguous ways through which the scientific and political elites deal with scientific criticism or scientized protests. There is no pre-existing automatic recognition, inclusion, or valorization of any form of protest, and this is especially true if the contested project or innovation can still be abandoned or is reversible. When a given technical system is materially implanted, scientific criticism is often among the first to be positivized by the official bodies or included within expert circles. This does not happen automatically as an act of democratic “good sense” but is instead mobilized with the aim of re-establishing public trust or dampening down a heated public controversy or scandal. The inclusion of scientific criticism is also often fragile, sector-sensitive (radioprotection rather than safety in the case analyzed here), and subject to change. Furthermore, in contrast to what has been suggested by some other case studies ([McCormick 2006](#)), lay knowledge or expertise does not always lead to the de-scientization of official or public debates. On the contrary, it can become marginalized especially when there are too many uncertainties or zones of non-knowledge.

For an in-depth understanding of these dynamics in terms of their impact on social movements and reflexive scientific citizenship, sociohistorical approaches focusing on transformation studies in the medium and long term (by simultaneously building on detailed or micro case studies) prove to be a fruitful methodological approach. This at least is the path followed and advocated by the present article. It is hoped this study will also enrich the existing literature in three further directions insofar as: (i) it offers a joint transformation analysis of antinuclear movements and the governing bodies in relation to science and politics over several decades; (ii) it shows that scientization can be analyzed not only as a top-down, negative process but also as a diffused process (which aims at self-government and self-discipline) that is subject to different evaluations and reflexivity; (iii) it advocates for the analysis of public participation discourses and practices not in isolation but in combination with other ways of governing techno-criticism with the aim of better distinguishing the “instrumental” participatory devices ([Goldman 2001](#); [Topçu 2013b](#)) from those that have the potential to democratize information, expertise, and decision-making. Indeed, such a distinction seems crucial, especially since democratic participation in the building of technoscientific trajectories remains and indeed should remain the approach to experiment and explore for the future, not only in relation to social movements but also with regard to the social sciences, whose normative positioning in these affairs counts for a great deal.

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