

LAY KNOWLEDGE AND PUBLIC PARTICIPATION IN TECHNOLOGICAL AND ENVIRONMENTAL POLICY

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The aim of this paper is to attempt to answer a key question of current STS scholarship and activism alike. Namely, what role should lay knowledge play in an adequate managing of technology and environment-related issues? On the basis of the intrinsic limitations of expert knowledge, the potential utility of local knowledge, and the need for political legitimacy, we argue for an active role for lay knowledge in technological and environmental policymaking. In our view, public participation should not end with a political sensitivity to public perceptions or public opinion; it should actively involve lay knowledge in order to achieve firm political legitimacy and a technically efficient policymaking in environment or technology-related issues. In the second part of this paper, we will apply our general argument to a case study of forestry policy: the so-called "eucalyptus problem" in Asturias, northern Spain.

This paper is not an elaborated and finished work but a research project still under development by an interdisciplinary working group within INVESCIT, a Spanish interuniversity research center in science and technology studies.

The central question of this paper—to repeat—is: What role should lay knowledge play in an adequate management of technology and environment-related issues?

Some Procedural Points

What is meant by "expert or lay knowledge" and by an "adequate" policy concerning technology or environment-related issues?

An *adequate policy* will be understood here as a policy which is both efficient and legitimate.

We consider an *efficient policy* to be one that counts on sufficient resources (cognitive, material, and organizational) in order to fulfill given aims within a set agenda.

We will not enter into the question of the contextual dependence of the concept of efficiency. There is no such thing as a general or objective way for actions or processes to be efficient. It always depends on the measuring rod. Still, emphasizing this point would only render stronger our general argument here in favor of active public participation. (See Mitcham, 1994: 225 ff.)

And a *legitimate policy* is a policy that has social support either in the form of a positive public perception or in some form of explicit democratic support (e.g., referenda or parliamentary decisions).

Of course, both requirements are causally related in the actual world because (i) a *prima facie* efficient policy can fail because of social resistance, and (ii) the efficiency of a given policy can bring about its social acceptance, but they should still be independently considered given that their relationship is not a necessary one. (For the relevance of organizational aspects in the characterization of technological or environmental policymaking, see González García *et al.*, 1995.) Thus efficiency and legitimacy will be seen here as individually necessary and jointly sufficient for an adequate policy.

Concerning *knowledge*, adopting a pragmatist (instead of a realist) standpoint, we view this as a network of beliefs enjoying the property of warranted assertability.

This characterization of knowledge, of course, contextualizes knowledge as the claims or assertions which are generally accepted as warranted within a given social (cultural and historical) context.

Accordingly, it is the cultural variable (within the social context) that makes the difference between lay and expert knowledge: it is the difference between claims held as warranted by the relevant scientific community or by corresponding lay believers.

Who are those "corresponding lay believers"? These will be taken as all

those people who have some knowledge in virtue of their direct involvement or their personal interests (political or otherwise) concerning the problem at stake (e.g., agricultural regulations, waste disposal, energy consumption, fishing policy) and do not hold relevant scientific credentials. When speaking of those directly involved we will refer to "local knowledge"; a more general category, also including those politically concerned (such as green activists), will be referred to by the term "lay knowledge." Due to the pragmatic character of these concepts, it is only through case studies that more precision can be obtained.

The Problem in Focus

In our view the role of lay knowledge in adequate policy formulation depends on the following:

First, on the nature of expert knowledge, i.e., whether or not the social context of expert knowledge provides it with an epistemic excellence which renders it self-sufficient for dealing with given technological or environmental problems (as asserted in the academic tradition and criticized in STS studies).

Second, such a role also depends on the potential utility of lay knowledge in order to contribute in the long run to an effective (not merely legitimate) solution of the problems currently tackled by expertise.

We next discuss these two points in turn.

The Character of Expertise

To begin with, we consider expert knowledge to be knowledge negotiated under certain constraints (see, e.g., Longino, 1990). These are the constraints which result, in Kitcher's terms (1993), from interactions with nature and social exchange. Thus expert knowledge is knowledge negotiated with respect to a double interacting tribunal: nature and society. (There is no novelty in this.)

Let us now notice some features of interactions with nature and social exchanges when approaching technology and environment-related issues. These features will show how expertise is far from self-sufficient in dealing adequately

with these issues because of both the epistemic limits of expertise and its social conditioning. So these features will also constitute, in our view, an argument for public participation in policymaking.

Expertise as Interaction with Nature

Technological innovation and environmental intervention take place within given social systems. Drawing an analogy with ecosystems in ecology, a social system can be considered as a complex, multidimensional equilibrium of functional interdependence, that is, as a complex system involving social, cultural, political, economic, and environmental parameters. The introduction of a new technology or a new form of environmental intervention within a given social system changes its former equilibrium, developing new interdependent links with other technologies and with a variety of social, cultural, and other parameters. As we see it, the main purpose of technological and environmental policy is to maximize positive impacts and to minimize negative ones concerning technological innovation and environmental intervention. To this end, the significant changes with the social system which can be brought about by such an innovation or intervention must be anticipated.

In turn, the main purpose of expert advice is precisely to forecast these possible changes in order to develop effective technological and environmental policies—that is, appropriate legislative and administrative regulations and the appropriate implementation of such regulations. (This is the role of expertise in general technical studies as well as in technology assessment and environmental impact analysis.) But the complexity of the social systems in which innovation and intervention takes place usually reaches such a magnitude that expert knowledge must necessarily reduce this complexity (e.g., by selecting relevant dimensions and parameters, along with their variability ranges) and must introduce a number of suppositions (e.g., concerning initial probability distributions) in order to satisfactorily anticipate the evolution of the social system, i.e., in order to handle tractable problems.

Furthermore, no omnicomprehensive "alternative science" exists to avoid such a simplification of technoscientific problems within the contemporary world. Experts' biases are unavoidable since they result from the necessary reduction of uncertainties and indeterminacies needed to forecast the development of

technological systems and assess possible risks (see Wynne, 1992a). It is the only game in town, and it is only dangerous as long as it is ignored or used politically.

This complexity reduction raises the problem of facing uncertainties and indeterminacies. It is in Wynne's sense (1992a) that we are using these terms, "uncertainty" and "indeterminacy." He differentiates between these and "risk" or "ignorance." Whenever the system's behavior is basically well known, so that we know the odds, we can talk about risk. We are able to talk about uncertainty when we know the main system parameters but not the probability distributions. If we do not know what we do not know, then we are facing ignorance. By "indeterminacy," Wynne means open networks or open causal chains. Thus, while risk, uncertainty, and ignorance can be considered along one dimension, indeterminacy in our opinion belongs to another category, since it is embedded within the very definition of risks or uncertainties. As we see it, the point here is that different probability distributions and system descriptions, and thus different kinds of risk and uncertainty, are always compatible with particular judgment elements (say, empirical evidence).

Thus, in terms of expertise as the result of interactions with nature, expert knowledge is not epistemically self-sufficient: it is constrained but not dictated by nature. Other well known lines of argument lead to this conclusion, both in the social sciences when handling the problem of reducing indeterminacy in technology forecasting, and in philosophy when approaching the problem of the underdetermination of scientific theories by empirical data.

Expertise as Social Exchange

Another well-known and complementary constraint upon expert knowledge comes from society. (See, in general, González García *et al.*, 1995.)

But from society in a restricted sense. First, the relevant scientific or engineering community. Second, the social interest groups which, through a particular allocation of resources, set the R&D agenda (by identifying initial problems, favoring specific research lines, establishing policy goals, etc.). It is such a contextual dependence that, according to the traditional analysis in sociology of scientific knowledge (e.g., Barnes, 1982), critically broadens the social context of the scientific community, thus revealing its cultural and

evaluative commitments, and therefore cancels the evaluative self-sufficiency of expertise in the face of technological or environmental problems.

Expertise is thus contextually dependent (historically and culturally relative), so that the way science is done largely depends on the way science is sponsored by public or private capital; that is, it depends on the values and interests underlying the R&D agenda. This is one of the senses in which science, or expert knowledge, can be said to be a social process. (For the extensive and heterogeneous literature, see, e.g., Barnes, 1982; Bijker *et al.*, 1987; Bloor, 1976; Collins, 1985; Fuller, 1988; Jasanoff, 1995; Knorr-Cetina and Mulkay, 1983; Latour, 1987; Longino, 1990; Ravetz, 1971; Pickering, 1992; and Woolgar, 1988.)

Another sense in which expertise can be called a social process is more popular among STS activists. We mean the social consequences of expertise. The increasing role of expert knowledge in the management of contemporary societies renders expertise an important social dimension of the public interest. (See, e.g., Chalk, 1988; Collingridge, 1980; Dickson, 1984; Durbin, 1987; Goldman, 1989; Hickman, 1990; Lewontin, 1993; Maxwell, 1984; Mitcham, 1994; Mitcham and Mackey, 1983; Nelkin and Tancredi, 1989; Sanmartin, 1990; Shrader-Frechette, 1991; and Winner, 1986.)

Thus, given the antecedent and consequent social dimensions of expertise that make expertise a social process producing negotiated knowledge (neither autonomous nor neutral), one important reason for taking public opinion into account within such a process is to transform a social process into a democratic one, i.e., to render it politically legitimate.

The Utility of Lay Knowledge

Our target here goes far beyond public opinion and concerns public or lay knowledge. We consider that taking into account lay knowledge (and not only that public opinion which provides legitimacy), in the process of producing negotiated expert knowledge, could optimize expertise by providing *useful information* and *new perspectives* in order to solve given technological or environmental problems.

We must now clarify the difference between public perception, public opinion, and public or lay knowledge. Lay knowledge, as pointed out above, is understood here as a network of beliefs which are held as warranted within a certain lay context. This is what we would traditionally call "informed opinion" (although it is, of course, contextually dependent). Thus, having knowledge on a certain topic involves having an opinion about it (i.e., some interrelated beliefs on the matter). But the opposite is not true: one could have an opinion about something without this necessarily being an articulated or informed opinion, i.e., if one has no social or empirical guarantees for one's assertions. Frequently, an opinion on a topic embodies or involves a (conditional) evaluative stance on it: in virtue of such and such considerations (which have no guarantee in the case of mere opinion), one believes that something is right or wrong in relation to a given end or under certain circumstances. Finally, under normal conditions, having an opinion on a subject involves having either a negative or a positive perception of it, assuming a particular moral valuation. Perceptions in themselves do not have a propositional content expressed by beliefs, although they produce agreement or disagreement with respect to speakers' assertions.

Local knowledge can provide useful information concerning known parameters (e.g., economic or biological variables) and their relative significance for the social system's equilibrium. And local knowledge can also point out new perspectives in the sense of showing the relevance of dimensions (e.g., culture and traditions, local economic practice) that have so far been omitted from expert knowledge claims. Besides, the inclusion of lay knowledge in policymaking, with the consequent promotion of an active public participation, can avoid a negative public perception and consequent social resistance, as well as the temptation to political manipulation of public opinion.

Another positive effect of the inclusion of lay knowledge in policymaking is discussed and exemplified by Wynne (1991, 1992b). It can show the nature and measure of experts' indeterminacies and uncertainties, and thus point to a more cautious and flexible way of decision making. This in turn could contribute to preserving the truthworthiness of expert advice and to avoiding social mistrust about policymaking. Still, we do not pretend that including lay knowledge will provide a remedy against necessary expert biases; rather it may counterbalance (in a democratic direction) those biases by contributing to the production of generally acceptable solutions and the heading off of mutually unacceptable ones.

Thus, besides providing firm legitimacy, local knowledge can even render expertise more efficient by purely technical standards such as the ratio of outputs to inputs. The reason, in this case, is not because lay knowledge constitutes better knowledge; it is because, as pointed out above, local knowledge can provide the expert and the policymaker with information and judgments which they may need in order to reduce appropriately the complexity of a given social system and to deal with uncertainties and indeterminacies so as to effectively anticipate the eventual consequences of technological innovation or environmental intervention.

One more interesting point is the relationship, arising in particular social controversies, between alternative expertise and lay knowledge. It is precisely from local knowledge that alternative expertise (e.g., that provided by green activists) frequently draws a number of the arguments put forward in the public arena. A feedback relation between local knowledge and alternative expertise is usually developed as the controversy grows in the media. This is exemplified in the case study below and constitutes, in our view, one more reason to actively involve and institutionalize public participation understood as lay knowledge. (Concerning the political mechanisms for such an institutionalization, this important point lies far beyond the scope of this paper. See, notwithstanding, Burns and Ueberhorst, 1988; Petersen, 1984; Roberts and Weale, 1991; or Shrader-Frechette, 1985 and 1991.)

General discussion must stop here. It is time for our case study on forestry policy. This we hope will help to clarify and make more precise the above hints.

Forestry Policy in Northern Spain

Forestry policy in northern Spain, and particularly the promotion of reforestation with fast-growing exotic species in the autonomous region of Asturias, is a good example of technocratic policymaking where lay knowledge has been totally disregarded. This is the so-called "eucalyptus problem." Asturias is located along the northern Atlantic coast of Spain. Its population is slightly over one million people, distributed within a geographic area of 10,565 km². The area occupied by eucalyptus plantations has been estimated at around 400 km². The *Eucalyptus globus*, or white eucalyptus, comes originally from Tasmania, and was introduced into northern Spain at the end of the nineteenth

century. The rapid growth of this species, the characteristics of its wood (especially appropriate for the paper and mining industries), and its excellent adaptation to the climatic conditions of the Cantabrian and Atlantic coasts, are the major factors responsible for the massive eucalyptus forestation that took place in Spain during the dictatorship of Franco (1939-1975). This policy, in the beginning, was exclusively based on economic criteria (see Groome, 1990, and *Quercus*, 1985). No significant changes in soil exploitation took place in the decade following Franco's death. The transformation of a rural economy based on cattle raising and multipurpose mixed wood forests, already in progress due to factors such as industrialization, the migration of the rural population, and the agricultural policy of the European Community, was merely accelerated by the introduction of eucalyptus to northern Spain. (On economic and ecological impacts of eucalypts, see, e.g., FAO, 1981; González Bernáldez *et al.*, 1989; Greenpeace, 1991; and Poore *et al.*, 1987. For details concerning the case study, see González García, 1993; González García and López Cerezo, 1994; López Cerezo, 1993; and López Cerezo and González García, 1993a and 1993b.)

Eucalyptus forestation in this area has recently produced a strong social controversy. The Asturian landscape, society, economy, and culture are all undergoing transformations partly derived from the proliferation of eucalyptus plantations. Popular actions such as the one carried out in 1988 by the people of Tazonés (a small coastal village in Asturias)—uprooting a private eucalyptus plantation and facing the Spanish federal police (*Guardia Civil*)—are only the tip of a troublesome iceberg of expertise confronted and political stances involving agriculturists and stockbreeders, biologists and forestry engineers, wood and paper industry managers, ecologists and nationalists, economists and politicians, and laypersons in general.

A political reaction by the autonomous government did not take long. But in spite of a number of important and socially sensitive legislative measures beginning in 1990 (Decree 54/90 is still the main legal framework), negative public perceptions and social controversy are still very much alive. How has all this trouble arisen if, as claimed, politicians were supposed to develop as the best forestry policy a socially sensitive policy which was additionally supported by the best available forestry expertise?

The Technicization of a Social Problem

Put simply, the legislative construction and implementation of such a policy—although it may be considered a political response to an increasing social sensitivity on environmental issues—has been exclusively pursued by technical experts, mainly biologists and forestry engineers. No public participation and no interest groups except that of politicians, private industry (in the shadows), and the experts themselves have been involved in the technocratic policy process. And the technical assessment carried out by these experts, far from sufficient in determining the most adequate political measures, has been mostly a political smokescreen used to transform a social problem into a supposedly technical issue (López Cerezo and González García, 1993a). Moreover, the technicization of the eucalyptus problem, excluding public hearings and participation, has produced an inadequate reduction of the problem's complexity; and this, in turn, has resulted in unforeseen consequences of a cultural, environmental, social, and even political kind.

Our point here is that the consideration of lay knowledge could have anticipated and prevented some of these negative consequences. Indeed, as a result of an inadequate technocratic management of eucalyptus planting, a number of transformations are taking place in the Asturian rural milieu. There is, of course, no general agreement about the extent and significance of such transformations, but the Asturian population at large and opponents of eucalyptus perceive them as negative and claim irreversible changes as a result of them. As seen by the critics, the changes consist, on the one hand, in a deep transformation of the natural environment and, on the other, in the entrenchment of specific forms of socioeconomic organization.

The Transformation of the Social System

The principal factors which, in this majority evaluation of the consequences of eucalyptus reforestation, contribute to such an irreversible transformation of the natural environment are the following:

(a) *Loss of autochthonous flora and fauna:* Many autochthonous trees and animal species in Asturias, some of them endemic, are at risk of extinction. They are plainly incompatible with eucalyptus plantations. Moreover, eucalypts have been the cause of a dramatic increase in forest fires because of, among other

things, the high igneous potential of the species.

(b) *Pollution by the paper industry*: The massive eucalyptus reforestations in northern Spain go hand in hand with the activities of the paper firms, an industry closely related to eucalypts. The production of wood pulp is a major pollutant, particularly during the whitening stage. In the cellulose industries of our target area, the whitening stage makes use of chlorine, and this eventually results in extremely toxic wastes being released into the air and water.

(c) *Transformation of the traditional landscape*: This factor refers to the traditional Asturian landscape of meadows and autochthonous forests of oak and beech trees, which are being progressively reduced due to eucalyptus planting.

(d) *General degradation of the environment*: Eucalyptus plantations do not only mean the loss of biodiversity and reforested meadows; they also produce an impoverishment of the soil and affect the neighboring land in a negative way. The trees themselves create barriers, screening off the sun light. Their leaves—very resistant to biological degradation—form a rotting layer which settles on nearby crops. They also use great quantities of available water, and, furthermore, when placed in inappropriate locations using aggressive plantation techniques, they increase erosion.

Among the principal factors which are generally perceived as contributing to the irreversible transformation and entrenchment of a specific social-economic milieu, we may mention:

(a) *Cattle abandonment*: Raising cows has traditionally been the main occupation of Asturian farmers. The mercantilist policy promoting monocultures such as the eucalyptus, as well as the imposition by the European Union of very restrictive quotas upon Spanish milk production, have forced many farmers to change their activities.

(b) *Migration to urban areas*: The intense economic growth which took place in Franco's Spain during the 1950s and 60s produced a massive migration from the countryside to the cities and the appearance of a new economic conflict: the urban landowner holds interests clearly in contrast with those of the farmers who have not changed their traditional way of life. Migration to urban areas, on

the one hand, and Spanish forestry policy, on the other, set up a feedback relationship: simultaneously supporting and forcing the rural economy to become industrialized.

(c) *Changes in the rural economy:* There has been a disappearance of traditional multipurpose forests such as those of oak, beech, and chestnut trees—which traditionally were for such communal uses as cattle raising, wood gathering, and fruit harvesting. Moreover, other traditional harvests are also incompatible with eucalyptus planting. Indeed, the recent escalation of the eucalyptus problem shows that the social controversy is highly resistant to the cleansing of expertise. Far from disappearing, the original problem has come to the fore with an increased intensity as the situation is perceived by the general population to be more and more irreversible.

The Utility of Local Popular Knowledge

Our point is that some of these negative consequences, which have been partly recognized by the public administration, could have been anticipated and avoided by taking into account public opinion and local knowledge in the policymaking process.

First, taking into account public opinion and not only public perception—promoting the active involvement of such interest groups as farmers, stockbreeders, green activists, and nationalist parties, instead of constraining the "social sensitivity" to media reactions and controversial opinion polls—was important in order to avoid the temptation (eventually fulfilled) of public manipulation through the media, which has periodically provoked social resistance against the prevailing forestry policy. Social instability could have been prevented by public hearings and participation.

Second, and more important for our point here, the lay knowledge embodied in public opinion was relevant in order to develop not only a legitimate forestry policy but an efficient one too. Relevance we mean in two senses: providing useful information about the social system in which such a forestry policy was going to be developed; and providing new perspectives for considering unexpected impacts of such a policy.

Within "useful information" we include the familiarity of rural people

with the natural and social environment in which they live, which provides them with useful and detailed knowledge of a full variety of aspects related to the effects of eucalyptus. This information could have been used to anticipate some of the negative consequences listed above. For example, lay knowledge could have provided information about the economic value for the surrounding community of alternative (e.g., traditional) uses of land, about the ecological impact of fast-growing species on nearby harvests, about the paper industry's strategy of actively deceiving local communities, about endangered animal and vegetable species present in target reforestation areas, and so on. This information was either omitted or discounted or only partially considered in expert reports, including general technical studies and environmental impact analyses which were used as a basis for legislative regulation.

Also, lay knowledge could have provided *new perspectives* in the sense of showing the importance of the cultural dimension, related to the traditional landscape of autochthonous forests which were perceived by the general population as threatened by eucalyptus reforestation. And the relevance in a rural economy of communal, multipurpose forests. These might not produce the same global benefits as eucalyptus monocultures, but it is part of the communal well-being and is also important for a number of services and productive activities within the rural environment.

A similar case study, but focused on pulp production instead of forestry policy, is discussed in Richardson *et al.* (1993). Their target here is a pulp mill in Athabasca, Alberta, Canada, the world's largest single-line bleached pulp mill. Its wood supply area—of boreal mixed wood forest—is approximately the size of Austria. An interesting point made by the authors is the ethnocentrism which affected the scientific standards for estimating dioxin concentration in fish. Neglecting local knowledge in their environmental impact assessment, experts estimated risks in terms of average fish consumption in the general population, not the (much higher) average fish consumption among the native Canadians—who also eat fish liver, where toxins mostly concentrate. The parallelism with our forestry case is striking, for the technical estimates of eucalyptus impacts have been largely "urbanocentric." For instance, when estimating economic benefits of eucalyptus plantations in standard EIAs, the concerns of individual landowners with small plantations (typically an urban population) take precedence over the concerns of farmers whose harvests are spoiled by adjacent eucalyptus plantations, or of the rural population who can no longer make communal use of

those lands now reforested with monocultures. Even estimating the aesthetic value of eucalyptus, the view from roads receives primacy over the view from nearby villages; urban citizens use the road, rural inhabitants have to live with the reforested hill.

Another similar case study—elaborated by Brian Wynne (e.g., 1991, 1992b) with respect to the public perception of risk in northern England after the Chernobyl radioactive fallout—shows that lay people's reception and understanding of expert advice does not depend on their technoscientific literacy (either that of the lay people or experts), but on the trust and credibility they invest in the expert knowledge at stake. In turn, this credibility is based on the social relationships among the different groups involved in the issue. Failing to take into account lay knowledge in this case resulted in an inadequate policy, both inefficient (because the uncertainties were artificially cancelled) and illegitimate (because it produced social opposition).

Enrollment Strategies Based upon a Defensive View of Public Participation

It may now be worthwhile to point out a number of enrollment strategies of social agents which, based on a restricted conception of public participation, have been put to work in public administration and private industry. These are strategies which depend on a technocratic view of public participation as a way of reactive participation (Krimsky, 1984) restricted to public perception or, at most, public opinion. These enrollment strategies are considered here as forms of politically illegitimate public manipulation (see above).

Concerning the view of public participation as something restricted to public perception, it is interesting to notice how opinion polls can be manipulated by constructing their results through sampling techniques and statistical methods to provide some sort of political legitimacy and silence any further "undemocratic" revolves. Once in the media, these poll results of course contribute to the molding of public opinion. It is a case of the well-known self-fulfilling prophecy. This manipulation seems to be the case in our study.

So as to avoid past mistakes, and in order to avoid social resistance to the new Forestry Act (still a project in early 1995), the new autonomous government

undertook an opinion poll in 1994 to determine public perception of forestry policy. This poll was taken in cities with over 25 thousand inhabitants and a high forestry area (according to data provided by the administration—see *El Bosque de Asturias*, no. 3, 1994, p. 14). In spite of the higher sensibility of the Asturian sample to those social segments more affected by current forestry policy, it was little wonder what the results turned out to be: in relation to the different alternatives for land use, about 50% were in favor of production, while only about 20% were in favor of combining the three alternatives (production, conservation, and leisure); concerning fast growing species (pine trees and eucalypts), 54% did not consider them either good or bad, depending on the concrete reforestation area. But these results are largely constructed out of the selected sample. The main opposition to eucalyptus planting does not arise in medium-large cities with high forestry areas, for a large number of rural estate properties and most eucalyptus plantations (eucalypts being an absentee harvest) belong to small private owners who live in that kind of city. On the contrary, strong opposition to eucalyptus planting usually arises in bigger cities without nearby natural resources or with an industrial environment (where there is a higher ecological sensitivity) as well as in the rural environment (small villages and isolated houses—a common mode of population distribution in Asturias) where stockbreeders and farmers live and are impacted by the negative ecological and economic effects of eucalypts.

In relation to the conception of public participation as something restricted to public opinion, public hearings have serious limits as participatory mechanisms. For, being reactive in character, and deprived of adjudicatory powers and a regular institutional forum, politicians can use these hearings to gain social credibility rather than political legitimacy or valuable information. (Besides, in this sort of merely reactive participation, relevant problems and alternatives are defined beforehand with little room for socially produced innovative proposals or drastic solutions.)

This again is a danger that appears in our case study concerning the elaboration of the new Forestry Act. The aim of searching for consensus by means of public hearings (where different interest groups are represented) should not substitute for the promotion of public debates nor the creation of institutional mechanisms for democratic decision making (see Wynne, 1975, and Rip, 1986). Otherwise policy making is left to the Kantian good intentions of politicians. (A local green group, Aedenat-Asturies, has already denounced this situation.)

Also, the private paper industry (Celluloses of Asturias, Inc., CEASA) has recently carried out a number of enrollment strategies based on a manipulative conception of public participation. These strategies have consisted in the active involvement of small plantation owners in line with industry interests, as well as in the promotion of a change of image supported by the diffusion of a number of biased arguments in the local media.

First, the paper industry abandoned its former strategy of wood production by direct eucalyptus reforestation. This was negatively impacting its image and causing administrative problems related to eucalyptus planting. Now, wood is purchased from particular small plantations which do not generally serve as the focus of social protests and are beyond administrative control. An important social segment is thus mobilized and aligned to CEASA's interests.

Small plantation owners are, moreover, subsidized through the CEASA program's "assistance to the rural milieu" in a way in which social controversy or administrative control is easier to escape. This happens by a sponsoring of cold-resistant eucalyptus so as to colonize areas with little negative public perception or administrative regulation—because eucalypts there are still rare (see *El Bosque de Asturias*, no. 3, 1994, p. 5).

Second, an image change is promoted by the use of "cleaning" strategies. These include the promotion of endangered autochthonous trees (such as the holly tree) by means of CEASA research programs (e.g., Biogenie), the creation of an assistance office for local farmers, educational programs for Asturian students who visit the industry site in guided tours organized by a government initiative for environmental education (see "Arboleda," *La Nueva España*, 5/10/95, p. 22), and the media dissemination of a series of pro-eucalyptus arguments (eucalyptus's potentiality to produce services and goods not yet exploited, e.g., green filter, byproducts such as honey, spirits, candies, cleaning products, etc.), the vagueness of the autochthonous vs. non-autochthonous distinction, as well as the distinction between "culture" and "forest."

The second argument perhaps deserves more attention. It is interesting to note how this argument has been used to transform an ecological problem of social interest into an economic question of technical concern. Actually, pro-eucalyptus parties defend the view that eucalyptus plantations must be considered

as another kind of crop, like corn or bean crops, instead of as forestry areas, like oak or beech trees. On the basis of such an assumption, of course eucalypts would not be in competition with the autochthonous forest but with other forms of agricultural exploitation. (Even some sort of compatibility seems suggested by this argument, implicitly distinguishing between "object of conservation" and "object of exploitation," or between ecological and economic considerations.) The obvious question on this point, which reveals the biased character of such an argument, is about the vegetable species that are in competition with eucalypts before the task of reforestation for wood production. Not beans, of course. Eucalyptus plantations clearly have some features of agricultural cultures. However, their competition range is not ordinary crops but forestry plantations. Nobody uses beans for hill reforestation nor for wood production. (On the relevance of rhetorical mechanisms in the enrollment of social agents in a particular problem definition, see, e.g., Latour, 1987. On the success of the dissemination of this argument, two examples are the use of the term "eucalyptus culture" in the discourse of green groups, and the assumption of the "culture vs. forest" distinction in educational material of public bodies; see, e.g., Barroso Díez *et al.*, 1993.)

Conclusion

Let us now summarize the argument developed thus far. In our opinion, given the complexity of the problems to be confronted by contemporary expertise, the social dimensions of expertise, the potential utility of lay knowledge to solve "technical" problems of social interest, and, of course, given the right to commit our own mistakes within a democracy, lay knowledge should have an active role in technological and environmental policies.

Legitimate and efficient answers to complex social problems require much more than keeping an attentive eye on public perception, or considering public opinion as a necessary external interference; it requires lay knowledge and the active participation of society.

Moreover, in an epoch of increasing social sensitivity and decreasing scientific arrogance concerning technological and environmental issues, and given widespread awareness that there are as many different measuring sticks for "efficiency" as there are interest groups giving significance to the concept of

"legitimacy," technical efficiency and political legitimacy come to be one and the same thing.

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