The precautionary principle between intrinsic uncertainty and bounded rationality

by Gavino Zucca[*]

The precautionary principle (PP) is a legal decision-making tool originally devised for the taking of technological choices when, despite scientific uncertainty or ignorance, there are grounds for believing that a particular activity may have very extensive, and above all irreversible, harmful consequences. The principle first made its appearance in West Germany during the 1970s, at a time when major public concern had been provoked by the discovery of severe environmental problems. The *Vorsorgeprinzip* envisaged direct action by the authorities to protect the environment and to safeguard present and future generations, even in the absence of sufficient scientific evidence of a correlation between a given cause and a given environmental effect. Since then the PP has spread to other national and international settings, and its application has extended beyond simple environmental protection to encompass the health of people and animals. The main milestones in this process have been the Rio Declaration of 1992 and the Treaty of Maastricht. The PP has thus become part of international regulatory instruments and is now incorporated into all treaties on environmental protection.

However, as the PP has spread, its meaning has changed. The original German formulation was essentially socio-political in nature and addressed the concerns of public opinion. It was then flanked, mainly in Great Britain, by a technical-scientific version which required precautionary actions to be justified by scientific calculations and rational arguments. Some sort of compromise between the two positions was reached by the European Union, which in a Communication of 2000 laid down guidelines for implementation of the principle. Despite the extremely widespread currency of the PP, however, its acceptance by such bodies as the UNO and the EU and its inclusion in diverse national legislations (its inclusion in the Constitution is currently being discussed in France), the principle has also been fiercely contested. In the USA, for example, the courts usually require the proponents of precautionary measures (including the EPA) to furnish convincing scientific and rational justifications for their use. Moreover, US federal law makes no reference whatever to the PP. Owing to this difference of view, in recent years the principle has been at the centre of economic disputes in which the USA and the WTO have contested certain precautionary measures as raising unjustified barriers against free trade.

Put very briefly, the main criticisms brought against the PP are that it is non-scientific and anti-scientific, and that it may hamper, or even halt, progress and scientific research. Moreover, there exist numerous and ambiguous definitions of the principle. This has a number of consequences: the disguising of protectionist measures; the diverting of valuable resources to irrelevant actions; the producing of outcomes even worse than those which the PP is intended to solve. However, when the situation is analysed carefully, one often gains the impression that the disputes centre more on words than on facts, and that much of the controversy on the PP derives from attempts to defend positions of power. Almost no one, in fact, contests the idea of precaution *per se*. What seemingly creates the problem is its normative definition. It is true, for example, that there are different versions of the PP ranging from radical to much more moderate. But is equally true that those involved in controversies on the principle have no desire to give it an unequivocal definition. If the PP is to be

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considered a norm of international law, the reference should necessarily be to the UNO's definition as set out in the Rio Declaration. But almost invariably, both the proponents and opponents of the principle instead refer to a much more radical – and unofficial – version more properly called the 'abstention rule' and which can be summed up in the motto 'if in doubt, abstain', or do not act until you are absolutely certain. It consequently happens that there are those who demand that an activity must not be permitted until science has furnished certainties, to whom the scientists reply that science is never able to furnish certainties and that consequently a principle that requires something impossible to furnish is absurd. But this has very little to do with the PP, at least in its version enunciated by the Rio Declaration, which acknowledges that scientific uncertainty is inevitable, but precisely on the basis of this uncertainty asserts a right: that of being able to take precautionary measures in order to protect present and future generations should there be grounds for believing that there exist extensive dangers which, are no longer reversible.

A brief logical analysis of the above two assertions may aid understanding of this radical difference. The strongest version of the PP states that 'precautionary measures *must* be taken when science is unable to guarantee the safety of a particular activity with certainty'. But the principle formulated by the UNO is very different from this: 'although science has not established the existence of a risk, no one should be impeded from taking precautionary measures to protect the environment and the health of present and future generations when there are reasons for believing that this risk may cause extensive and irreversible damage'. In other words, the Ppstates not an obligation but a right. It simply affirms that, because science is unable to furnish absolute certainties about the safety of a particular activity, when the stakes are extremely high and the decision is urgent, everyone must have the right to take precautionary action in order to protect themselves.

The situation has numerous similarities with what happened during the eighteenth century in regard to definition of the right to freedom. Then as now the situation was confused: to the point, indeed, that Montesquieu remarked that "No word has received more different significations and has struck minds in so many ways as has liberty". And many of the accusations today levelled against the PP could in Montesquieu's day have been directed against the notion of freedom as a fundamental human right. Yet, despite the different ways in which this fundamental right has been applied in different societies, and despite the sometimes deleterious consequences, no one today would doubt its general validity. Today, therefore, stating that everyone has the right to take precautions should have the sole purpose of giving unequivocal form to a principle which is universally acknowledged. The Rio Declaration lends itself well to this purpose. It asserts a political and practical principle, not a scientific principle: the right to apply one of the fundamental heuristic strategies of every living organism, that of proceeding with caution when venturing into the unknown, gathering evidence from the surroundings, and using the decision and action strategy best suited to the situation. Taking precautions is therefore nothing more than applying the commonsense rules which recent negative experiences have reaffirmed in more formal manner. The real problem is therefore finding ways to restrict or to regulate the principle so that abuses are prevented. This problem in its turn rotates around the definition of 'plausible risk' and requires answers to such questions as 'by whom and how are potential risks to be identified and their plausibility determined?'; 'by whom and how are the appropriate measures to be decided and their efficacy assessed?'.

There are therefore two main courses of action. the first is to identify epistemic and practical criteria with which to measure the plausibility of risks and the adequacy of the measures proposed. The EU has taken such action by formulating criteria with which the application of the PP must conform: proportionality, non-discrimination, consistency, examination of the costs and benefits of action and non-action, review of measures in the light of new scientific evidence).

The second course of action is to define practical methodologies for the decision-making process. Applying the PP requires social decisions to be taken in conditions of uncertainty or ignorance. Its implementation is difficult because each of the three components of this definition (the taking of a social decision, scientific uncertainty, and the assessment and management of technological risk in conditions of uncertainty or ignorance) concerns the crisis or revision of a particular kind of rationality: economic, scientific, technological and political.

As regards the first kind, the theory of bounded rationality has shown that real decisions are subject to two constraints, which arise from environmental pressures on the one hand, and cognitive limitations on the other. The underlying idea is that when we make decisions we use 'fast and frugal' heuristics – ones which are simple but efficient from an ecological point of view – in order to adapt to situations, and that when we make choices we seek not to satisfy utility but to maximize it by adjusting our aspirations with respect to our goals. Consequently, and contrary to the claims of classical economic theories, it is not possible to make individual choices that are optimal in the absolute sense. And when decisions are taken by natural groups, the idea that optimal decisions are possible is complicated even further by other problems: the existence of distributed knowledge and abilities; diverging and opposing goals, motivations and values; differences among methods, criteria, heuristics, strategies; opportunities for free riding; the existence of different weights (status, prestige) in the decision-making process. Moreover, the best choice often depends also on what the other actors are doing and on the level of reciprocal trust among those engaged in the deliberation. Far from being optimal, therefore, the decision may only be more or less 'good' for the group from an adaptive point of view.

As regards scientific rationality, the cultural legacy of the twentieth century has undoubtedly been its discovery of the ineradicable uncertainty inherent in scientific knowledge. This does not detract from the theoretical and practical value of scientific knowledge, of course, but it does give better understanding of the value to be attributed to the regularities described by scientific laws, and of what are instead their intrinsic limitations. The PP substantially concerns complex adaptive systems (the environment, ecosystems, living organisms) whose behaviour is unpredictable in time and space. In these cases, laboratory models are often unable to furnish a sufficiently accurate description of what happens in reality. Many of the innovations to which the PP applies have only one real laboratory, and it is constituted by the real world in which they are implemented. Moreover, there exist in this laboratory other forms of knowledge which are often ignored: the practical knowledge of those who live in the laboratory, so-called profane and local knowledges which often comprise crucial notions neglected by technical experts. Furthermore, there is today a growing tendency to see the pluralistic, and in certain respects contingent, dimension of the scientific enterprise and to acknowledge the importance of values and other expressions of human emotionality to which scientists are not immune. In some sectors especially, there may be several competing theories and minority opinions which cannot be ignored.

The third point concerns the assessment and management of risk, which are activities traditionally kept separate and assigned respectively to science and politics. But it grows increasingly obvious that it is unrealistic to think that every problem can be solved by simply assessing an objective risk, especially in the case of complex and little known situations. On the one hand, this objective assessment must deal with a quantity of knowledge often beyond any capacity of control. On the other, there is the major problem of how to take account of qualitative aspects. To a large extent, risk is socially constructed, and however much experts may dismiss as irrational opinions at odds with objective evaluations, they must accept that politicians have to respond to risk as it is perceived by the community, because ultimately it is to the community that everything must be addressed, including technological innovations. The traditional paradigm of technological risk management, which has always been largely based

on the engineering approach to complex systems, is proving increasingly unable to handle such systems. The most suitable reference is probably to medicine, with its strategy based on three factors: symptoms, treatment and prevention, which in the case of technological risk management may correspond respectively to early warnings, control parameters with which to act upon the system, and the precautionary approach.

It is now possible to draw some conclusions from the foregoing discussion. First, the notions of bounded rationality and the intrinsic uncertainty of science suggest that the demands cannot be fulfilled of those who:

- on the one hand, like the proponents of the PP, believe it possible to conduct exhaustive examination of alternatives and the possible consequences of a given activity or product, or who demand prior certainty about them, assigning the burden of proof entirely to the producers;
- on the other, like the opponents of the principle, demand 'strong' scientific and rational proof (based on so-called 'sound science') before giving their assent to precautionary measures, assigning the burden of proof entirely to the proponents of those measures.

If present and future technological challenges are to be adequately addressed, it is instead necessary to find a way to reconcile the uncertainty intrinsic to every human activity involving a complex system with the need to continue to improve the human condition by making the best use of scientific knowledge and minimizing as far as possible the risk that may derive from application of that knowledge. This, in fact, is a strictly political problem connected with an ongoing process of technological democratization of which the PP is an integral part, and which concerns decisions on technological innovations that may affect the lives of everyone, even those not involved. The dilemma faced by political decision-makers is that they must reconcile two fundamental freedoms: on the one hand, the freedom of a community to take precautionary measures should it deem them necessary to protect itself, its environment and future generations; on the other, economic freedom and private enterprise and the right to enjoy the benefits deriving from technological innovations. The search for rules governing implementation of the PP coincides with the search for rules with which to reconcile those two freedoms.

Thus apparent is the unique and irreplaceable value of plurality. No one, not even scientists, possesses the whole truth and the solution to complex technological problems. Yet a good (in the adaptive sense) decision for everyone can be found by adjusting the aspirations of all while at the same time exploiting the higher-level knowledge distributed among the particular knowledges of everyone. Decision-making must consequently become a collective and reflexive process of dialogue, inquiry and learning which involves all those who possess knowledge or motivation of relevance to the decision to be taken. It is evident that there does not exist, nor could there exist, one single way to deal with problems. What should instead be sought is a range of participative methods from which to choose and adapt according to the situation and in function of parameters like the urgency of the decision, familiarity, technicality, the level of controversy, and the 'locality' of the issue. These processes should also comprise procedures with which to evaluate the epistemic and practical validity of decisions in light of the plausibility of risks and the suitability of the measures proposed. However, it should be borne in mind that the final decision of *whether* and *how* to implement a precautionary measure is an eminently political one, even though it is morally constrained to the pronouncements of the community.

A participative approach can respond to many of the difficulties raised in the foregoing discussion. It is above all a method with which to deal with the limitations of rationality, especially when applied to social issues, because it increases the number of alternatives among which to choose and contributes creativity and unconventional approaches to the debate. It also helps reduce the intrinsic uncertainty of scientific knowledge, or ignorance, by means of comparison and integration with minority scientific hypotheses and local and

profane knowledges. As regards the perception of risk, it enables account to be taken of the concerns, values, motivations, and needs of all those affected by the decision, seeking adjustment of aspirations to multiple, contrasting and incommensurable criteria. Another positive effect is the diffusion at all levels of knowledge and awareness of the margins of scientific uncertainty and of the other values and interests at stake. This too helps reduce the public perception of risk by increasing familiarity, capacity for control, fairness, and so on. The participative process has the further advantage that it makes everyone feel themselves involved in a social choice which may also affect those who are not directly concerned, with consensus on the solutions proposed and a reduction of social conflict.

Finally, also science – today increasingly at risk of exclusion from decisions concerning technological innovation – has much to gain from a participative approach. The PP, in fact, does not have (or should not have) anything to say about the freedom of research, because it concerns solely the knowledge that, on assuming technical form, may have an impact on the lives of people, also those who are not interested. By participating, science can contribute to these decisions both in terms of critical-rational methodology and in terms of knowledge which, however limited and incomplete, is never non-existent. In other words, whenever a technological dilemma arises, we are never entirely ignorant; at most, we are profoundly uncertain. The alternative today seems to be that even the little that science knows tends to be entirely ignored, and this is a risk that contemporary society cannot afford to take.