Essay

Towards a new paradigm of science

in scientific policy advising

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Introduction: Paradigm of science

Science is a logic inductive process leading to theory formulation, while all the way put through critical tests that have been deductively derived from the theory; Popper's critical rationalist concept of science is an objective progression toward the truth. In contrast, Kuhn positions science in its non-rational context of cultural and historical values; the exercise of scholarly activities is subject to the prevailing paradigm. The term paradigm refers to a set of practices, such as methods of observation and interpretation, that define a scientific discipline during a particular period of time. Kuhn interprets science as a process of peaceful 'puzzle-solving' punctuated by scientific revolutions. A scientific revolution or paradigm shift may occur when shortcomings of the basic assumptions in the prevailing paradigm build up and cannot longer be ignored. During the revolutionary period, new ideas and perceptions are discussed, which involves competition between incommensurable paradigms. The new paradigm better fits the evolved context where science makes part of. (1)

The prevailing paradigm of science is not suitable for the science policy context with its different perceptions of reality and presence of great scientific uncertainty and ignorance. A paradigm shift is argued by the concept of post-normal science, which emerged from dissatisfaction with knowledge arising from the gap between policy questions and scientific answers. Scientific policy advising in normal and post-normal context exemplify the line of reasoning.

Normal science

The term normal science refers to the routine work of scientists within a paradigm; slowly accumulating knowledge in accord with established theoretical assumptions. Kuhn identified this mode of science as being a form of puzzle-solving. The paradigm is enlarged and frontiers of knowledge and techniques pushed forward. (1)
Normal science is also named academic science or mode 1. The exercise of scholarly activities is defined by the dominance of the Mertonian CUDOS norms of science. They include:

- (C)ommunalism - the common ownership of scientific discoveries, according to which scientists give up intellectual property rights in exchange for recognition and esteem;
- (U)niversalism - according to which claims to truth are evaluated in terms of universal or value-free criteria;
- (D)isinterestedness - according to which scientists are rewarded for acting in ways that appear to be selfless;
- (O)rganized (S)kepticism - all ideas must be tested and are subject to structured community scrutiny. (2)

Normal science in policy-making

Routine puzzle-solving by experts provides an adequate knowledge base for policy decisions. The policy environment is a 'normal' setting where experts do routine work on small-scale problems. (3) A reductionist method is applied for generating scientific knowledge; focusing only on a small and well-defined view of reality. The success of reductionism lies in its abilities to make complex problems simpler, to get rid of taboos and traditions and to focus on a single aspect of reality when dealing with specific problems - one at a time. It assumes that reality can be known and that, therefore, sooner or later scientists will achieve adequate

knowledge. (4) All that is needed to achieve this goal is more money and time, a provision that fundamentally conflicts with the action-oriented policy actors who must act under time constraints and with limited budgets. (5)

'Normal' scientific policy advising

National research institutes have an advisory role towards policy-makers, which usually is only a small, though certainly not a negligible task amongst their total scope of activities. Their work programme is influenced by the policy agenda, which is in turn influenced by identified priorities and needs in the research field. The 'research-oriented advisory bodies' conduct 'normal' scientific policy advising. They report research findings and conclusions to authorities and this way carry out a legitimating and instrumental function and, every now and then, an enlightenment function in the policy process. Instrumental knowledge is grounded in a specific research context, which affects selection and shaping of data and conclusions. Hence, scientific information and advice lack certain objectiveness. On the policy side, science can be abused when used only in case it provides supportive evidence for the preferred and predetermined policy direction. (5) In order to prevent these pitfalls, clear task demarcation between research institutes and authorities is advocated. The demarcation is meant to ensure that political accountability rests with policy-makers and is not shifted, inappropriately, to the scientists, while it similarly serves as a means of protecting science from the political interference what would threaten its integrity. (6) Constructing the right form of demarcation between science and policy is most important and largely subject to the type of boundary arrangement between scientific experts and policy actors. Too great separation can result in the scientific institutes putting the policy process in a certain direction as might be the case in a technocratic or enlightenment arrangement. Too small separation can aggravate rather than resolve the risks of political interference in science, as is the risk in a bureaucratic or engineering arrangements. In contrast to demarcation construction, pragmatic arrangements co-ordinate the science-policy relationship as dependent on the topic of advice. This boundary arrangement seldom exists in 'normal' scientific policy advising while being most common in a post-normal setting. (5, 6)

Post-normal science

A new concept of science was introduced by Funtowicz and Ravetz during the 1990s in response to the crisis in the reductionist paradigm. (4)
Kuhn already emphasized on the important role of human factors, such as intuition, imagination and receptivity to new ideas, in the exercise of scholarly activities. The concept of post-normal science goes beyond the traditional assumptions that science is both certain and value-free. Post-normal situations have in common that facts are uncertain, values in dispute, stakes high and decisions urgent, unlike normal science situations where these elements are small. In addition to the application of routine techniques, also judgement becomes necessary as well as involvement of extended peer communities. This new social organisation of science is also named post-academic science or mode 2. The exercise of scholarly activities is defined by the dominance of goal orientation where scientific goals are controlled by political or societal actors. (3) Science operates in a strong two-way dialogue with society. (4)

Post-normal science in policy making

According to the post-normal concept of science, commitments of scientific advisors can legitimately influence judgements of decision-makers on issues where there are deep and

irresolvable uncertainties. Science should be engaged in the policy process. Scientists' integrity lies not in disinterestedness but in their behaviour as stakeholders. (3) Normal science made the world believe that scientists should and could provide certain, objective factual information for decision-makers. But when there are problems not of how things work, but rather issues of what should be and why, the narrow focus and single solutions have shortcomings. Facts are still necessary, but no longer sufficient. The guiding principle of normal science - the goal of achievement of factual knowledge - must be modified to fit the post-normal principle to achieve the goal of quality. For this purpose, post-normal scientists should be capable of establishing extended peer communities and allow for 'extended facts' from non-scientific experts. Proper interpretation and weighting of various knowledge claims is crucial to conform to quality criteria. In post-normal science, the maintenance and enhancement of quality, rather than the establishment of factual knowledge, is the key task of scientists. (4) This new role of scientists is challenging and requires different professional capabilities, as well as incorporation of several new features in the methodology of science (3).

'Post-normal' scientific policy advising

Scientific advisory councils and committees are policy-oriented as they aim to support the policymaking process with issue-specific knowledge on the state of science, based on actual research findings and scientific data supplemented with knowledge of the societal context. Scientific facts are only one part of the relevant knowledge that is brought in as support to a decision or policy process. Besides their legitimating, instrumental and enlightenment function, scientific policy advisers fulfil 'post-normal' tasks. They have an interpretative function in reflecting, improving and sharpening judgements of policy makers regarding social, cultural and institutional factors, which might have a negative or positive impact on the policy issue. Furthermore, it is the task of 'post-normal' scientific policy advisers to catalyse the process of consensus building among different actors or stakeholders in the policy process. (5) During this exercise a plurality of co-ordinated legitimate perspectives (each with their own value commitments and framings) is accepted. Even the strength and relevance of scientific evidence is amenable to assessment by citizens.

The existence of a pragmatic relationship between scientific, policy and other societal actors is a necessary condition for 'post-normal' scientific policy advisers to co-ordinate this co-production of knowledge in extended peer community setting. (5, 6) Findings from a comparative research project in advisory bodies in France, Germany and Poland show that 'post-normal' scientific policy advising is gaining importance in policy-oriented advisory councils. In general, structured public and stakeholder consultations are common practice, whereas the internal advisory process still includes only scientific members who are voluntary-operating professionals with a main occupation at research institutes. Two French advisory councils engage further in exercising post-normal scholarly activities by appointing non-scientific members, such as legislators and industrial and public representatives. Despite extended peer evaluation and inclusion of different perspectives and expertise, they encounter a problem in verification of the scientific quality of their advisory reports. (5) Scientific quality is still assessed according to the universal norm or value-free criterion of normal science.

Conclusion: Towards a new paradigm of science

The paradigm shift implied by the concept of post-normal science is due to (i) existence of different perceptions of reality and (ii) presence of great uncertainty and genuine ignorance in the exercise of scholarly activities.

The paradigm shift suggests to abandon assumptions typical of reductionism, of which most important the assumption to make possible substantive models of reality. The paradigm shift is particularly needed for science used in policy processes. Within the new paradigm decision-making is no longer based on 'optimal' solutions provided by scientists. Science for policy is more often than not dealing with complex, uncertain and ambiguous topics. Decisions should be based on negotiation among the social actors. Involved social actors must agree on the definition of perceptions, narratives, interpretation of models, data and indicators that are selected by the scientists. The role of scientists still remains crucial, though it is somewhat changed. They have to contribute to the definition of acceptable compromises. For this purpose, scientists have to contribute to society by learning as quickly as possible about different perceptions towards options, problems and constraints, instead of seeking deep ultimate knowledge. In a 'post-normal' world, scientists still have to guarantee the quality of their work where the definition of quality has to include many more criteria of performance than those required for normal science. (4) The paradigm shift would create the opportunity for development of new methods of knowledge quality assessment. Policy-oriented scientific advisory bodies would certainly welcome such a revolution.

References

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