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## On a New Mode of Scientific Activity

*The new production of knowledge*<sup>1</sup> is an attempt to show that contemporary science undergoes fundamental change, which is manifested by the formation of a new mode of production of scientific knowledge. It is assumed that “a new mode of knowledge production affects not only what knowledge is produced, but also how it is produced: the context in which it is pursued, the way it is organized, the reward systems it utilizes, and the mechanisms that control the quality of that which is produced” (p. vii).

So, the main assumption of the book is the view that knowledge is produced in much the same way as economic goods. Hence the focus is on production/organization and economic/market aspects of scientific activity: the authors distinguish a new Mode 2 of scientific production which, they contend, differs radically from the old Mode 1.

The two modes can be defined as follows. “Mode 1: The complex of ideas, methods, values and norms that has grown up to control the diffusion of the Newtonian model of science to more and more fields of enquiry and ensure its compliance with what is considered sound scientific practice.”

“Mode 2: Knowledge production carried out in the context of application and marked by its: transdisciplinarity; heterogeneity; organizational heterarchy and transience; social accountability and reflexivity; and quality control which emphasizes context — and use-dependence. Results from the parallel expansion of knowledge producers and users in society” (p. 167).

The differences occurring between those modes are defined thus: “in Mode 1 problems are set and solved in a context governed by the, largely academic, interests of a specific community. By contrast, Mode 2 knowledge is carried out in a context of application. Mode 1 is disciplinary, while Mode 2 is transdisciplinary. Mode 1 is characterized by homogeneity, Mode 2 by heterogeneity. Organizationally, Mode 1 is hierarchical and tends to preserve its form, while Mode 2 is more heterarchical

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<sup>1</sup> Michael Gibbons et al.: *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London, Sage Publications 1994.

and transient. Each employs a different type of quality control. In comparison with Mode 1, Mode 2 is more socially accountable and reflexive. It includes a wider, more temporary and heterogeneous set of practitioners, collaborating on a problem defined in a specific and localized context" (p. 3).

The definition of the nature and role of the new model of knowledge production in the form of "Mode 2" is the principal substance of the book. However, the arguments the authors employ raise doubts as to whether the changes in the character of scientific activity are indeed a breakthrough, and so, whether one can justifiably speak of a new model of science.

The chief attributes of knowledge production in "Mode 2" include: 1) the context of application, 2) transdisciplinarity, 3) heterogeneity and organizational diversity, 4) social accountability and reflexivity, and 5) quality control.

**The context of application** is defined as "problem solving and the generation of knowledge organized around a particular application. Not merely applied research or development. Includes the milieu of interests, institutions and practices which impinge upon the problem to be solved" (p. 167). The context of application is not a lucidly presented concept, however. It seems to boil down to the thesis that in scientific activity there has developed a practice of taking up and solving research problems, tailored to specific applications, that are created in a community interested in their results. It is not only applied research that is involved, but also a research useful for some specified practical purposes. Hence, the idea of application does not refer to the specific nature of applied research, but to a social community in which the need for concrete research results is generated. The effects are a considerable diversification of and increase in the number of producers of knowledge and places where it is produced, and a close relation between its generation and use. In the authors' words, "knowledge production becomes diffused throughout society" (p. 4). It should be noted at this point that the very concept of the context of application, while being the starting point for reflections, does not contribute much to the understanding of changes taking place in scientific activity. It is purely 'phenomenalistic' in nature and does not elucidate the connection between the new forms of knowledge production and its character. In this respect, an example of a much deeper concept is that of Böhme's (1973) science finalization, as it presents specific alternatives of the development of knowledge conditioned by its openness to external (economic, social and political) aims.

**Transdisciplinarity** is the main component of the new model of knowledge production. The authors of the book list four features marking it (p. 5):

1. Transdisciplinarity "develops a distinct but evolving framework to guide problem solving efforts. This is generated and sustained in the context of application, and not developed first and then applied to that context later by a different group of practitioners."

2. "Transdisciplinary knowledge develops its own theoretical structures, research methods and modes of practice, though they may not be located on the prevailing disciplinary map."

3. "The results are communicated to those who have participated in the course of that participation and so, in a sense, the diffusion of the results is initially accomplished in the process of their production."

4. “Transdisciplinarity is dynamic. It is problem capability on the move” (p. 5).

Transdisciplinarity is an attempt at the conceptualization of many phenomena that can be found in researchers’ co-operation and team work which clearly go beyond the boundaries of the organizational division of the academic system into scientific disciplines. The authors claim: “Disciplines are no longer the only locus of the most interesting problems, nor are they the homes to which scientists must return for recognition or rewards. (...) In transdisciplinary contexts, disciplinary boundaries, distinction between pure and applied research, and institutional differences between, say, universities and industry, seem to be less and less relevant” (p. 30).

Without denying the significance of change taking place in the nature of co-operation and scientific team work transcending scientific disciplines, the following remarks should be made on the subject:

1. Research expertise is achieved primarily within a scientific discipline or a combination of disciplines; it is in this framework that this knowledge is used to solve the most complex problems; thus, the problem of “transdisciplinary” expertise arises.

2. The formation of new complex or borderline disciplines certainly destroys and rearranges the traditional divisions of sciences, but it still follows a disciplinary rather than a transdisciplinary pattern.

3. The concepts of transdisciplinary research do not involve a new methodology of scientific research, as they still employ its traditional structure; in this respect, they do not differ from multi- and interdisciplinary ones.

**Heterogeneity and organizational diversity** of knowledge are the next properties marking the new mode of its production. Heterogeneity “refers to the bringing of multiple skills and experiences to bear on any particular problem” (p. 167). “It is marked by: 1) An increase in the number of potential sites where knowledge can be created; (...) 2) the linking together of sites in a variety of ways — electronically, organizationally, socially, informally — through functioning networks of communication; 3) the simultaneous differentiation, at these sites, of fields and areas of study into finer and finer specialities. The recombination and reconfiguration of these subfields form the bases for new forms of useful knowledge” (p. 6).

This is accompanied by organizational diversity. It is claimed that “the types of organization may vary greatly and research groups are less firmly institutionalized. Mode 2 knowledge is thus created in a great variety of organizations and institutions, including multinational firms, network firms, small hi-tech firms based on a particular technology, government institutions, research universities, laboratories and institutes, as well as national and international research programmes” (p. 6). However, the concept of heterogeneity and organizational diversity does not seem to supply new arguments for the new mode of knowledge production being formed, but only reinforces those given earlier when characterizing transdisciplinarity.

The next features of the new mode of knowledge production are **social accountability and reflexivity** in scientific activity. They are shaped by the growing public concern about issues to do with the environment, health, communications, privacy and procreation. They are a manifestation of the researchers’ increasing

sensitivity to the broader implications of what they are doing. "Social accountability permeates the whole knowledge production process. It is reflected not only in the interpretation and diffusion of results, but also in the definition of the problem and the setting of research priorities" (p. 71).

The increase in social accountability springs from greater reflexivity of all Mode 2 participants. This feature is defined as "Reflection on the values implied in human aspiration and projects. The process by which individuals involved in knowledge production try to operate from the standpoint of all the actors involved" (p. 168). It is emphasized that those are values and preferences of different individuals and groups that have been seen as traditionally outside of the scientific and technological systems, who can now become active agents in the definition and solution of problems as well as in the evaluation of performance. It also gives a new impulse to those humanistic studies which satisfy the demand of those individuals and institutions that need practical or ethical guidance on a vast range of issues.

On critical consideration of these concepts, social accountability and reflexivity cannot be seen as new phenomena providing a basis for some new model of scientific activity. Rather, they are a manifestation of a certain steady tendency connected with the growing role of science in the solution of practical problems. Naturally, it makes researchers more sensitive to social demand.

A new character of the **quality control** of knowledge is the last feature distinguishing Mode 2 knowledge production. Apart from the control proper to particular scientific disciplines and consisting in the evaluation of works through peer view judgements, additional criteria of knowledge quality are introduced into the model through the context of application. It "now incorporates a diverse range of intellectual interests as well as other social, economic or political ones. (...) Further questions are posed, such as 'Will the solution, if found, be competitive in the market?', 'Will it be cost effective?', 'Will it be socially acceptable?'" Thus, "quality is determined by a wider set of criteria which reflects the broadening social composition of the review system" (p. 8). The authors of the book set great store by this change in the character of quality control of knowledge; they see it as the principal feature differentiating Mode 2 knowledge production from Mode 1.

Having discussed the main characteristics of Mode 2 that set it apart from Mode 1, the authors seek to elucidate the concept further with reference to the exact sciences, technology, social science and the humanities. In doing so, they devote much attention to the evolutionary aspect and relations with higher-level education. They consider the problem of the shaping of knowledge production in the context of international economic competitiveness, collaboration and globalization, institutionalization processes, and changes in the character of scientific policy. The last issue is thought to be gaining prominence recently. Scientific policy enters a new, third stage of change, viz. a policy for technological innovation. It is imposed by the new conditions of international competition at the global scale, and is characterized by a social distribution of knowledge. The latter phenomenon is connected with mass access to higher education and increasing social participation in research.

The arguments advanced by the authors for distinguishing a new model of science in the form of Mode 2 are not convincing, although they do indicate the appearance of many phenomena and changes occurring in the social and economic

controls of scientific activity. I believe they give rise to many reservations and critical remarks, but I shall confine myself to only three matters: 1) the conception of the book, 2) the foundation of the difference between Mode 1 and Mode 2, and 3) the criteria used to distinguish the new Mode 2 model.

**Re 1.** The conception and scope of *The new production of knowledge* are basically in the domain of the sociology of science. It is an arena of many arguments and many programmes of its pursuit. They mainly turn around the deforming or constructive influence of social factors on scientific activity and the structure of scientific knowledge. The authors are not explicit in their assumptions concerning the sociology of science, nor do they refer to its programmes. I believe they may have avoided taking a stand on purpose. This is perhaps intended to reinforce the impression of the book's being original and different. Its approach to scientific activity, however, seems to be close to constructivism in the sociology of science, which treats it as a set of various research practices devised to solve particular problems; science is more a way of producing something than of learning about the world. This approach disregards both, epistemological aspects of the generation of scientific knowledge and its theoretical structure.

**Re 2.** The foundation of the difference between Mode 1 and Mode 2 is perceived to lie in the social, and not cognitive, aspect. It is worth noting that the initial definition of Mode 1 as a Newtonian model identified with basic science is cognitive in nature, even though it is then supplemented with social features. The characteristics of Mode 2, in turn, are purely social. The definition of Mode 1 is too narrow anyway, as it restricts it to the basic sciences only. Such a limitation is justified by the authors' view that the remaining research fields (applied and technological sciences) fall within Mode 2.

The characterization of Mode 2 in social terms is one-sided. When taking into account the social aspect of scientific activity, one cannot ignore its cognitive aspect, because science is a socio-cognitive activity or system. Irrespective of the interpretation given to the epistemological sense of the etiology of knowledge (cf. Kořakowski 1982), the cognitive aspect remains an indispensable component of science. Otherwise, science can be reduced to the ability to induce and control phenomena. This either escapes the authors' attention, or they ignore it.

**Re 3.** The properties used as the criteria of distinguishing Mode 2 from Mode 1 do not prove any fundamental differences between the two. Such features as the context of application, heterogeneity and organizational diversity, social accountability and reflexivity, as well as quality control, are not specific to Mode 2, but to a greater or lesser degree can be predicated of any scientific activity dealing with problems of some utility or practical value. In addition, the fuzziness of their notional scope makes their use as criteria of division rather difficult. Neither does transdisciplinarity seem to be a likely criterion. This concept is not so deep as the book suggests, because it does not free a context-of-application type of research procedure from the role of scientific disciplines in it. This is so because we either have particular disciplines collaborating at the same level, or arranged hierarchically according to use. It is hard to differentiate between an interdisciplinary research and a transdisciplinary one as the authors understand it.

Generally speaking, it should also be emphasized that it is hardly appropriate to consider scientific activity without its cognitivist analysis in the meta-scientific aspect, as the authors do, and regard mere social determinants as satisfactory foundations for establishing models of science.

## References

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