INTEGRATING KNOWLEDGE IN TECHNOLOGY DEVELOPMENT

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Summary

Science, especially the university, has been exposed ever more in recent decades to the sociopolitical expectation that it produces greater returns of investment by yielding technological innovations and economic payoff. This has led to the increasingly popular thesis of the advent of "postacademic science." Distinguished by its amalgamation with contexts of application, postacademic science is said to represent a new mode of scientific knowledge production. The following article briefly assesses this thesis and then analyzes the relation of scientific knowledge production to technology development and industrial innovation. As the techno-economic order of society becomes ever more science-based, society must necessarily create social arrangements designed to direct and control the process of scientific knowledge production from start to finish. The growing "scientification" of industry hereby yields as its functional correlate a "heteronomization" of science. A heteronomization of science is thus the other side of the scientification of society. The systemic reason for this correlation is scientific knowledge's structural tendency to produce uncertainty.

1. Introduction

In the 1960s, discussion began on the transformation from industrial to postindustrial society. Today, there is widespread agreement that the world's leading industrial nations have become postindustrial societies—often characterized as knowledge societies. In most theoretical constructs, the concept of a knowledge society does not refer to the

cultural or political sphere of contemporary society, but to its techno-economic order (i.e., primarily the knowledge-based economy). From this social-theory perspective, knowledge represents the central source and productive force of society. More precisely, it is a specific form or kind of knowledge that plays this essential role for contemporary society (while knowledge in general is a constitutive element of all human action). This specific type of knowledge is codified, theoretical knowledge—and this means, above all, scientific knowledge. The contemporary transition from industrial society to a postindustrial knowledge society is therefore characterized by the extension of the application of scientific knowledge to problems of economic production.

In the course of this development, the advanced industrial nations have proceeded from having a policy for science via a short intermezzo of a policy through science to a science policy oriented toward yielding technological innovations and economic payoff. Since the 1980s, economic globalization has led politicians and other political actors to view science primarily as a tool in the national pursuit of economic competitiveness and prosperity. In this context, the university has been criticized as a site of autonomous, academic, disciplinarily structured science orientated exclusively toward internal goals, problems, and criteria. In both its research and training endeavors, the university is increasingly exposed to pressures of economic functionalization. However integrated the production of scientific knowledge in economic or other use contexts may actually have been historically, there is general ideological agreement since the nineteenth century that autonomy is indispensable for the "republic of science."

In the late twentieth century, however, the thesis of postacademic (or postnormal) science has emerged. It claims that the amalgamation of scientific knowledge production with its societal contexts of application is a constitutive feature of postacademic science. This postacademic mode of scientific knowledge production seems to make the old positivist dream of a deliberate, systematic process of technological development, even of social change in general, come true. For this reason, and independent of other interests, it is not surprising that myriad political actors—representing the state, the business, social interest groups, and the scientific establishment respectively—readily take up and propagate the thesis of a "new mode of knowledge production."

2. Postacademic Science: A New Mode of Knowledge Production?

Exponents of a postacademic science claim that a basic transformation in the mode of knowledge production has occurred. They argue that postacademic science is completely integrated in societal utilization contexts while academic science pursues internal goals and generates knowledge without regard to its prospects of external utilization. Postacademic science, because its knowledge production is carried out from the start in societal application contexts, promises to provide knowledge which is useful with respect to sociopolitical, economic, or ecological problems and goals—not only accidentally and *ex post facto*. The constitutive feature of this new mode of knowledge production is its amalgamation with some local and specific context of application. From this symbiotic integration follow other characteristics of postacademic science: transdisciplinarity; heterogeneity; organizational heteronomy, and transience; social

accountability and reflexivity; and quality control, which emphasizes context and use dependence.

Unfortunately, the concept of this allegedly new type of scientific knowledge production is not very elaborate and well defined. Above all, it is not clear whether postacademic science will transform scientific knowledge production in general, thus becoming the predominant mode of science (the strong thesis), or whether it is only another mode of knowledge production which establishes itself alongside academic science (the weak thesis). One could easily point to further problematic aspects. For example, even the weak thesis—which is not very interesting—strikingly refers to a very limited empirical basis so that postacademic science seems to be restricted to the small range of highly politicized fields in need of justification vis-à-vis the general public (mostly environmental issues and technology assessment). Another problematic aspect is the normative component which would have the public to believe that postacademic science produces more rational and socially robust knowledge: it is hard to understand how an installation of "hybrid fora" of scientists, policy makers, people directly affected by the consequences of scientific knowledge, and representatives of social pressure groups and social movements will bring about this socially accepted "good" knowledge. And yet another problem relates to the postacademic science structure of only local and transient research networks: How is knowledge accumulation and scientific progress possible? How, then, are advances in the various fields of knowledge communicated, and the respective states of the art documented, and is this at all possible without disciplinary order schemes?

Because the concept of postacademic science remains theoretically rather vague, it is impossible to give a comprehensive and detailed evaluation of this proclaimed new mode of knowledge production. Therefore, proceeding from the vogue term "transdisciplinarity," only the core problem with postacademic science will be discussed in this article. There is a general theoretical problem with the fashionable term transdisciplinarity, as there is no generally accepted or at least current definition of the term (see *Unity of Knowledge and Transdisciplinarity: Contexts of Definition, Theory and the New Discourse of Problem Solving*, see *Methodology of Transdisciplinary Research*). This general problem of different transdisciplinarity concepts, however, need not be considered here. Instead, the following critique refers exclusively to the concept of transdisciplinarity proposed by the exponents of postacademic science (it is an open question whether these critical remarks apply to other transdisciplinary concepts as well).

Obviously social or ecological problems and application contexts are virtually never structured along the lines of scientific disciplines. In order to deal with such problems, academic science operates interdisciplinarily. A routine approach long integral to academic science, interdisciplinarity refers to an organizational setting in which scientists from various (sub)disciplines—and also technicians, engineers, and other specialists—are brought together to work on a certain problem. The term transdisciplinary, however, suggests overcoming disciplinary boundaries, and that ultimately means a sublation of the process of scientific disciplinary specialization. Transdisciplinarity means more than interdisciplinarity and can therefore not be conceived of in institutional (organizational) terms alone. There are two problems with

this concept. The first one, only briefly mentioned here, is the need for it to be evaluated from the perspective of general modernization theory. The second and crucial one is its epistemological—instead of an institutional—meaning.

Disciplinary specialization in science represents but one aspect of functional differentiation in general. Since about AD1600, functional differentiation has become the crucial evolutionary mechanism and organizing principle of modern society. It paved the way for rationalization in all spheres of society, leading to enormous advancement and progress in many fields, not least in those related to science and technology. Since about AD1960, however, functional differentiation has been increasingly criticized for causing social and ecological problems (i.e., for itself being a source of problems). It is thus quite understandable that, in order to avoid such negative consequences of functional differentiation, there is a growing number of people calling for some kind of "de-differentiation" which is hoped to be more rational and reflexive than the rationalization process society has undergone hitherto. But as the principle of functional differentiation is the product of social evolution and corresponds to the developmental level of modernity it is hard to see how de-differentiation (and the same applies to trans-disciplinarity and de-specialization) could become more than a well-meant idea. Certainly, a definite answer to the question of whether modernity will ever be replaced by some "reflexive modernity" and functional differentiation will ever progress into a more rational evolutionary mechanism and structuring principle of society must be left to the future. None of the theories proclaiming such a new kind of modernity, however, are remotely convincing at all. But even if one assumes the existence of a postacademic science, a second problem with transdisciplinarity arises. This concept denotes a sublation of disciplinary boundaries. The term transdisciplinarity can therefore not be defined in organizational or institutional terms (as is the case with interdisciplinarity). Rather, transdisciplinarity must necessarily be conceptualized from an epistemological perspective. And the exponents of postacademic science indeed suggest a new kind of epistemology. If, however, transdisciplinarity—and postacademic science in general—requires an epistemology different from the one which holds true for academic science, the question is: what are the new methodological criteria and rules and the new social norms which shall replace the epistemology of academic science? The idea of transdisciplinarity, and of postacademic science in general, stands and falls with this new epistemology. Yet, the exponents of the concept of postacademic science do not elaborate this crucial point in any detail, for they do not treat it straightforward and systematically. But if one examines their unsystematic observations and recalls the characteristics of postacademic science, it becomes evident that the epistemology of the latter is somehow related to social accountability and reflexivity and perhaps also—though this is hard to imagine, unless one adheres to a boundless relativism, because then there would be no epistemology but only myriad arbitrary epistemologies—to context- and use-dependent quality control (see *Evaluation of Transdisciplinary Research*).

Science may be defined as that human enterprise which serves the production of new knowledge by following the regulative idea of "truth." Whether we conceive of truth in the emphatical sense of a normative-rationalistic philosophy of science and regard science as a kind of purely cognitive universe "outside" society (i.e., as a methodologically privileged realm of objective knowledge) or simply as a code for

communication and regard science as a field of social action "within" society (i.e., as a functionally differentiated social system which is distinguished from other fields of action by social rules, including the application of methodological criteria to determine what shall count as true)—the regulative idea of truth is fundamental and essential to scientific knowledge production: it constitutes science. Epistemology serves the evaluation of truth claims: epistemological standards determine whether a statement is granted the predicate "true". And whether a statement is granted this predicate (i.e., whether a piece or whole body of knowledge is evaluated as true) depends in no way on its social accountability. Social accountability and reflexivity is a (no doubt legitimate) normative and political demand on science (see *Evaluation of Transdisciplinary Research*). It is a political (in the broad sense of the term) criterion, but not an epistemological standard. Therefore, any attempt to blend truth and social accountability would mean a "de-differentiation" of science and politics. A shift in the evaluation of truth claims from epistemology to social accountability would even turn science into politics. Put provocatively: whatever postacademic science may be, it is not science.

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Biographical Sketch

Matthias Wingens is “wissenschaftlicher Oberassistent” with the Institut for Empirical and Applied Sociology (EMPAS), Faculty of Social Sciences, at the University of Bremen and member of the German Science Foundation’s “Special Research Center 186: Status Passages and Risks in the Life Course.” He studied sociology, philosophy, education, and German literature at the Gutenberg University in Mainz and at the University of Bremen. For his dissertation on the utilization of social-science knowledge in policy making he was awarded the Bremen Study Prize in 1988. He is member of the board of the German Sociological Association’s Section on Education. His main research interests include social theory and the sociology of knowledge, the transformations from industrial society to knowledge society, the sociology of science and technology, the sociology of education, life course research, and utilization research. In these fields, he has published numerous articles and seven books of which “Wissensgesellschaft und Industrialisierung der Wissenschaft” (1998) is the most important with regard to his EOLSS contribution. Most recently, he coedited a book on education and vocational training in the knowledge society (Wingens/Sackmann: Bildung und Beruf. Ausbildung und berufsstruktureller Wandel in der Wissensgesellschaft).