Best practice in research evaluation?

How to evaluate and select new scientific knowledge by introducing the social dimension in the evaluation of research quality[1].

by

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Introduction

Evaluation or assessment of scientific work in universities and other research organizations has traditionally been based on a procedure or a system of having equals from the same scientific field, peers, to value the quality of the output, the scientific paper. It is the peer review system with its almost jury–like functionality and a history of more than 200 years. The classic tradition looked at the output or the product of scientific work and ignored everything else and was for many years, and to some degree still is, acknowledged as a special procedure necessary to evaluate something as special or unique as scientific work. Such a system of organizing evaluation based on the economy of symbolic behavior constitutes a special marked for symbolic capital (Bourdieu 1981) .

A central issue in science studies and science policy today is the changing role and function of science in society. How do we understand these changes and not the least what are the consequences for our traditional understanding of science and its systems? One illustration of this change towards a growing social and political influence on science and research is the very diverse landscape of research evaluation, one can see today. The landscape of research evaluation can be understood as the outcome of attempts to open the traditionally very closed and conservative system of scientific quality control. But has it influenced the internal or micro-level quality control in the scientific knowledge production? Discussions of problems in the organization, construction and function of the classic peer review system have been going on for a number of years and the criticism has sometimes been harsh. Nevertheless, the peer review system is still integrated in and commonly accepted by the scientific communities, the university system as well as in the political and public field. How does various public or private research organizations evaluate science quality when the role of science in society is changing rapidly, as well as the social and economic

conditions for the researcher? What is new, creative or innovative knowledge? What type of authorized procedures recognizes and acknowledges it? How to govern the production and evaluation of scientific knowledge? The article will argue that a critical rethinking of concepts and ideas from newer sociological and organizational theory in relation to knowledge production is the most promising strategy in order to overcome the limitations in the ongoing discussion in the sociology of science as well as in science on how to evaluate and select the best quality of research, e.g. the high quality knowledge products?

Science in risk society

Anybody who follows the headlines in the daily news has experienced the contradictions in the recent picture of scientific results in the media. The seemingly endless debates on the uses of gene technology in food production (GMO) illustrate this complicated situation in relation to the use of expert knowledge and scientific results in the public and political world today. Both the pro and the con positions regarding GMO's present scientifically based arguments to support their position, arguments based on scientific results controlled by the traditional system, by peer reviews. In a situation, where rapid social, economically and ecological changes demand increasingly new trustworthy knowledge in order to be involved in solving problems (Beck 2000), the questions of both what is new scientific knowledge and how its trustworthiness is established demand more than ever a very critical look at the traditional system for quality control in science, the peer review system.

On a more general level the problem has been raised. The traditional peer review based evaluation system belongs to the 'legend of science' to use Ziman's (2000) expression, or can be paralleled to problems of Adam Smith's 'invisible hand' in the regulation of market economy (Fuller 2000, p.90). A growing number of case studies in various science fields have shown the growth of more fundamental changes in the traditional organization of the production of scientific knowledge. In the field of science policy, Gibbons et. al (1994) launched the concepts of mode 1 and mode 2 science, based on the development of the application of scientific knowledge and a close relation between production and the application of knowledge. The concepts of mode 1 and 2 science have been criticized for being based on too narrow and limited empirical evidence leading to a conceptual differentiation claiming transdisciplinary organization and close application as something completely novel in the history of science (Audétat 2001, Fuller 1995, 2001, Weingart 2000, Godin 1998). Even if the critics pointed at exaggeration and over-interpretation of various phenomena as part of the argumentation, the result was a much needed and necessary debate of the consequences of major changes in modern science and knowledge production. The arguments from The New Production of Knowledge have been developed further by Nowotny et. al. (2001) incorporating some of the major criticism. Through the introduction of perspectives from modern social theory on the contradictory function of risk, knowledge and expertise in modern societies[2], the concept of *social robust knowledge* is introduced in order to strengthen the social explanation of the changed relations between science and society and as a proposal on how to solve the problem of selecting the right knowledge, i.e. how to assess quality under these new and very changed conditions. The concept of the *Triple Helix* (Etzkowitz, H. & Leydesdorff, L. 2000) relates to the rather new and

[2] Theoretical arguments on knowledge, risk and expertise are taken from Beck 1992 [1986], 1999, Giddens 1990 and Beck, Lash and Giddens (1994).

dramatic changes in the relation between science, policy and society but it focuses much more on the growing co-operation between university-based knowledge production, government science policy and industrial application.

In the social sciences, the new focus on knowledge and especially the changed role of knowledge in the economy and social welfare is discussed as part of a more general discussion of the development of modern societies. Prominent social scientists like Giddens (1990, 1994), Beck (1992, 1994, 1999) (risk society), Habermas (1972, 1982) (dialogue and communication), Castells (1998, 2000) (information society) have showed how the development in late modernity in the Western World with major social changes has important implications for our understanding of the role of science and knowledge. The most central point is that the former unquestioned trust in scientific knowledge and expert advisory in the general public, the media and the political scene is changing. The public and political uses of scientific information and expert knowledge are today more and more experienced as partisan arguments or as only limited parts of the whole picture. The results are an erosion of the traditional trust in the neutrality and unquestionable truths of scientific knowledge (Giddens 1990, Beck 1992, 1999, Nowotny 2001) and hence a public and political focus on thrust and trust-creating procedures in relation to new knowledge. Indicators of the many changes in science and the relation to politics and the problem of creation of trust are the almost numerous new evaluation techniques in the field of science and research[3].

The implications of what traditionally has been regarded the central system for evaluation of research, the peer review system, are numerous, but in this article I will discuss two central problems. One problem is that the growth and constant changes in the former much more stable system of scientific disciplines implies a growing competition between knowledge paradigms in all science areas. It is no longer a situation of a dominating paradigm and a new upcoming one in the sense Kuhn (1970) argued, making it difficult to establish trust in a single peer review system. Today various paradigms exist side by side in almost any science field, the result being a growing number of local paradigms or 'communities of practice' based on time-limited boundary drawings (Gieryn 1994) between one specialty and another. Also the growing number of new scientific fields and transdisciplinary work or Mode 2 science with a different and more direct relation to application (Gibbons 1994, Nowotny 2001) is difficult to evaluate in the traditional systems based on a traditional Mode 1 disciplinary understanding of science. Related to this is the fact that new knowledge production more and more is a result of teamwork or group work where the contribution of the individual researcher is difficult to identify and measure. Furthermore, the accelerating speed

[3] Ranging from the level of individual to institutions, peer reviews appear in various variations: *Peer Review of Articles, Projects; Peer Advisory Board; Informed Peer Review; Rating/Expert-Statements; Visions, Forecasting.* Research evaluation by professional evaluators encompass the individual, the institutional and the disciplinary level techniques and procedures; *Research productivity, Personal Management; Benchmarking; Bibliometric measurement; Contract Steering; Advisory Boards; Cost-benefit Studies; Policy Formulation, Foresights*. On the level of political participation and lay participation/NGO another group of research evaluation techniques is relevant: *User Studies, Evaluation of application of knowledge, projects and of candidates; Public Hearings; Consensus Conferences*.
This is only a partial picture but it does show how differentiated the field of research evaluation has become in just a decade. (Hansson & Holst Jørgensen 2002, p. 72).

in the knowledge producing system conflicts with the rather slow and traditional system of peer reviews based on what has been produced and published.

The other problem has to do with the fact that scientific work now has to be understood as wage work organized in large research organizations or universities, leaving the picture of the lonely truth-seeking scientist as obsolete as the picture of the medieval alchemist. Scientific work as wage work in often very large institutional or organizational arrangements implies questions of employment, career, salary etc. for the individual scientist as well as questions about working conditions the research organization. Weber was early in his analysis of this problem in his famous lecture on 'Science as a Vocation' (1919), but for many years this dimension was more or less ignored. With headings like 'commodification of science', the discussion of the implementations of the modern market economy influencing the production of scientific knowledge has been a growing part of the science policy discussion the last ten years (Gibbons and Wittrock 1985).

The two problems in question in relation to production of scientific knowledge are the opening of the disciplinary borders (trans- or interdisciplinarity) and the growing influence from market economy. The radical and irreversible changes in scientific work and its organization created by this development will be the background for the discussion in the rest of this article. How can trustworthy evaluation systems be established or has the peer review systems potentials to survive these changes and still be a central quality control system in science?

First, I will briefly comment on some of the central literature on the traditional quality evaluation system in science, the peer review system or the classic inside view on science, followed by some critical points made from a sociological view and from the new public management approach to evaluations in organizations, the policy view on science. After this literature-based discussion, I will discuss how useful concepts from social and organizational theory on organizing knowledge production are in relation to the question of how to evaluate research.

The classic view: the 'product before person' approach to evaluation of scientific quality.

The classic picture of a community of science as a specific set of social norms that guaranteed the quality of the products continued for a number of years almost unquestioned in the sociology of science. It was Robert Merton (1968) who first opened the field of science studies to sociology with a coherent analysis of the social basis for this system in the form of a number of central social norms in the community of science (CUDOS). Merton analyzed the norms from a rather functional understanding of science in society and the few critical questions raised at the time were concerned with the specific substance of the norms or the existence of other norm systems (Mitroff 1973, Ziman 1994). The system of norms worked behind the back of the single scientist and for Merton they formed the functional background of the existence and further development of the dominant evaluation system, the peer review system (1973, 1968). The 'community of science' had according to Merton found its institutionalized form in the late 17th century in the peer review system. This system developed and institutionalized itself as science grew over the next centuries to become a major social and economic factor. But to the sociologist Merton, the questions of autonomy and

clear borderlines to the rest of society was essential in order to understand the uniqueness of scientific knowledge and to protect it from recent attempts to influence science.[4] The closed quality evaluation system based on peers played a central role for the community of science in order to establish and reproduce its authority with regard to knowledge creation and cumulating in the society. "It is in this sense that the structure of authority in science, in which the referee system occupies a central place, provides an institutional basis for the comparative reliability and cumulating of knowledge." (Merton and Zuckermann in Merton 1973, p. 495) But when public and political trust in science or maybe better, in the specific scientific knowledge, is eroding or changing as seems to be the case today, the system behind the production of certified, trustworthy scientific knowledge has to be scrutinized. Mertons analysis of the universal norms guiding scientists behavior with regard of production of recognized knowledge was an attempt to find ways to overcome threats to the autonomy of science 50-60 years ago (Merton 1968, p. 603). But this strategy to save the autonomy is clearly no longer tenable in a society, where the autonomy is questioned politically in public as well as economically through a growing commercial use. These changes must have substantial influence on the role of the quality control system based on a very idealized picture of the production of scientific knowledge. In the heritage of Merton, a number of attempts to strengthen the norm system has been tried out (Hagstrom 1965, Barber 1970, Ernø-Kjølhede 2001) in order to save the autonomy. The foundation put forward by Merton to separate science and the scientist from the rest of society has had the maybe unforeseen consequence that it produced a fixation of the ideal picture of the isolation of science from society. The scientific product could be regarded completely isolated from all personal, social, political and economic influence, and the price for autonomy was a totally unrealistic picture of complete isolation.

The sociological view:

With a formulation from Boath and Bodnarczyk (1995, p.340), it looks as if the "knowledge or "facts" contained in scientific works and publications *rise above* the organizational and human factors of laboratory life, once the experiment is completed." A large number of empirical studies of the social life in laboratories starting in the early 1980ties have very convincingly shown that it is not the case (Latour and Woolgar 1986, Latour 1987, Knorr-Cetina 1981). What scientists did in laboratories could not be explained with the help of the CUDOS norms, not even as a deviance from these norms, but only through the introduction of social and organizational factors. Social constructivist studies of the sociology of science showed in the 1970ties and 1980ties another reality addressing the influence of the social structure surrounding science like personal and organizational dimensions. "The needed only a few years to destroy effectively all the myths about the special character of scientific knowledge which the Mertonian/Popperian alliance had handled down." (Mayntz and Schimank 1998, p.749) The whole idea of a universal set of norms that governs the behavior of scientists based on a common understanding and acceptance of the social structure in

[4] To Merton, it was important to fight against any attempts to change the full autonomy of science, see f. i. his closing remarks in the article Science and the Social Order: "The main conclusions of this paper may be briefly summarized. There exist a latent and active hostility toward science in many societies,… This paper does not present a program for action in order to withstand threats to the development and autonomy of science. It may be suggested however, that as long as the locus of social power resides in any one institution other than science and as long as scientists themselves are uncertain of their prime loyalty, their position becomes tenuous and uncertain." (Merton 1968, p. 603 [1937])

science and its hierarchies independent of the surrounding society is increasingly difficult to defend today.

Starting from organizational sociology, Whitley (1984/2000) studied the internal organizational system in various science areas and found that modern science indeed is very differentiated when it comes to the organizational structure and reward systems of the various scientific disciplines. "The explanation of such differences and their continued reproduction is linked to variations in reward systems and in the structure of legitimate audiences for intellectual contributions, as well as in the conditions governing access to research funds and other key resources" (Whitley 2000, p. 2.) Others have criticized the idea of a reward system of science operating in an ideal world managed by scientists with no other personal interest than the search for 'truth' or that the removal of the role of social, personal, organizational and political factors in science as in Merton's norms in a modern society with huge investments in science and research rather strange (Fuller 2000, 2001). The opening of the field of scientific work to sociological analysis implies that a number of new problems emerges, one is that the core of the research quality system, the peer review, has to be discussed as a social system organized in order to select the quality in knowledge. Recent discussion has put focus on the operation of this quality system. Gieryn (1983) conceptualized boundary - work in order to illustrate how social processes always have been involved in the struggle between what is and what is not accepted or defined as scientific knowledge. Ziman argues in his recent book (2000) for the importance of the inclusion of the societal surroundings of science and for a social science approach in order to understand the development of science in society, but is not very explicit about the implications of a social science approach to the analysis of science.

The strengths of the peer review in evaluating research have always been its ability to deliver a quality brand or stamp on a piece of research, especially when published in a top journal. The problems are besides the influence of social and organizational factors that the demands for a 'perfect' peer review are very costly and time-consuming to meet. It is a system open to social and political pressure or influence, its reliability is by the nature of the knowledge-creation processes uncertain and difficult to estimate[5]. New knowledge is difficult to evaluate in a world of competing knowledge paradigms. But even if the recent development in the sociology of science has deconstructed the classic Mertonian understanding of research evaluation based on peer reviews, the problem still is to come up with new models or ideas of how to evaluate research and knowledge.

The policy view: the productivity-focus of the new public management evaluation of research

The first major challenge to the former so powerful self-governing system of science came as a part of the general reforms of the public sector starting in the early 1980es often under the label New Public Management. For public funded research organizations, it meant a new and powerful focus on modernization through concepts like 'value for money' or auditing of the public sponsored research. The development and organization of policy-based evaluation of research was quite different in the various countries, but even if the peer review system looked like it might have

[5] A number of studies have shown the many problems often associated with peer reviews, the old boys network, nepotism, the Matthew effect, lack of independent reviewers etc.. Cicchetti (1991) and Kostoff (1995/99) have summarized in detail most of the central discussion of peer reviews (for an overview see Hansson 2001).

survived or maybe even dominates the new evaluation systems, important changes have taken place. The public policy discussion on evaluation of science, science policy and scientific quality broke up the former internal and often very closed scientific community discussions. Suddenly, the peer review system was placed in a broad and open policy-influenced organizational context with a number of important consequences for the traditional autonomy view on science and research. Based on a large case study and the experience from evaluation systems in Danish universities Foss Hansen and Borum (1999, 2000) concluded about the new role or function of the peer review system: "In the field of research, existing standards are applied to new evaluation tasks. The standard, peer review, is a standard for organizing, and not for defining criteria. This makes it flexible in relation to possibilities for professional variations, maintains focus on the evaluation of professional quality, and sustains the power balance...."(1999, p. 324).

Peer review is then defined as a an open standard of how to organize the evaluation of quality, not in order to isolate the question of quality from various types of external influence, but on the contrary to set a standard for how to organize the various external relations in evaluations. Based on the experience from a case study of research evaluation on Copenhagen Business School, Foss Hansen and Borum (2000, p. 296) conclude: "The crucial consideration in relation to further development of standards for research evaluation seems to be the balance between exploration and exploitation. Routinization of research evaluation through strict standards reduces costs and facilitates comparisons and standard operating procedures. But routinization also drives out experimentation and risks transforming evaluations into reporting routines. These may provide useful data at reasonable cost, and attention-creating indicators. But they will provide input of only limited value to the actors' sense-making processes about research, research milieux, management systems and culture."

The are a number of very complex problems related to the development of such an open standardized evaluation system. How is this open standard used, how is it legitimized as a quality system, what are the relations to the classic peer review system?

The necessity of a more solid foundation to establish this open standard is based on the fact that it can be very difficult to secure the necessary openness in such a standard. "A fetish for quantification seems to be astir among our contemporaries. We worship the altar of statistics: the penchant for quantities is a salient characteristic of contemporary Western culture. Everything we touch turns into numbers" (Rescher 1995: 82)[6]. The quest for quantification and measurement is very real in the framework of new public management evaluation (Pollit 1996). New standards for evaluation of research can easily become the victim of the 'fetish for quantification' based on a combination of pressure for cost-reduction and routine as the natural result of a bureaucratically organized activity. The result will then be the introduction of a number of quantitative evaluation techniques, (from benchmarking to bibliometrics) in order to reduce the costs and establish administrative visibility, defining the criteria for evaluation and closing the attempts to open and contextualize the evaluation standard. Brunsson (2000) has shown that the implementation of a set of standardized procedures for professional organizations often results in unwanted and destructive consequences in relation to the professional norms and values in the organization. The attempts to de-couple the audit process in the organization into separate units or sub-parts of the universities

[6] "In our own time, measurement means nothing if not precision and objectivity. Our ideal exchange is an impersonal one. Consumers rarely lay eyes on the owner or maker of the items they purchase;...". Porter (1995: 23)

has according to Power rarely been successful, as the "external audit process rarely (is) sealed off from the rest of the audit organization, despite strategies with that intention" (Power 1997). A central goal of a very formalized auditing or evaluation of research is, like other NPM programs, an attempt to colonize the organization, to "challenge the organizational power and discretion of relatively autonomous groups, such as doctors and teachers, by making these groups more publicly accountable for their performance." (ibid. p. 97)

The first years of the UK system for evaluation of university-based research can illustrate how a formalized standardization often takes over the research evaluation processes and hinders the necessary development of new experience with evaluation. The 'side-effects' of the closed standard system were an undermining of the original accountability by certain types of behavior by reporting the results in a way that it "much more resembles the reports by a civil service in a defeated country to an occupying power, or by state-owned industrial plants or farms to central government in a command economy."(Trow 1996, p.314)

The problem of closing the standard for evaluation is always present. Even if the agenda of evaluation of research is organizational change and development and not just 'value for money' in research, the modified peer review, as an open standard, is still a new and unproven evaluation instrument. In the end it very easy, even for concepts or models for evaluation of research aiming at organizational development and the broader social setting around production of knowledge, to end up oriented towards the scientific product. The orientation towards organizational problems in research evaluation has become more commonly accepted in the last years, but has not yet resulted in new theoretical or empirical models for evaluation of research that include the social and organizational dimensions. The growing awareness of the importance of social and organizational dimensions in the evaluation of research cannot change the fact that the classic peer review model seems to be a very stable system and the only one widely accepted for assessment of science quality. A number of modifications of the 'peers' can be found, like the extension of the concept of peers to include general experts, managers and science policy officers.

These questions will be discussed in the following chapter on the background of a short excursion into recent discussions in social and organizational theory on how to understand the conditions of knowledge production. The idea is to try to establish a more coherent conceptually and theoretically foundation of the organization and operation of evaluation systems in relation to its prime function to select and brand trustworthy quality in scientific knowledge.

The problem of the social dimension in scientific and knowledge work

The problems and limits of the peer review system have often been discussed in the literature on research evaluation over the years. But the major part of the discussion has been based on reviews of empirical studies of the functionality of peer reviews, concluding that the system has certain weaknesses but can be made to function better and fulfill the demands through revisions of procedures and evaluation techniques (Cicchetti, 1991). A few studies (Kostoff 1995/99, Hemlin 1996) has gone further and introduced the organizational surroundings of the peer review system. According to Bozeman et. al. (2001), the suggested alternative to the peer review in research evaluation is very often the introduction of evaluation approaches from other fields based on

microeconomic theory; cost-benefit studies or benchmarking and other 'hard' or quantified evaluation procedures.[7] But the problem of how to evaluate scientific knowledge or just new knowledge is not restricted to the field of research evaluation. In relation to knowledge in organizations, the economic approach has not been convincing in relation to problems of knowledge selection in the new economy. Mainstream economics and business economics are not really equipped whether conceptually or theoretically to face the challenges of the knowledge economy. The knowledge economy has made the importance of knowledge for the continuation of economic welfare in the free market economy extremely empirically visible. This challenge to economics was raised by Hayek (1945) [8] and later by North (1994). The result in business economics was a slow shift in paradigms towards a growing interest in knowledge creation and its organization and application on the level of the firm. But neither transaction cost theory or institutional theory has yet been able fully to integrate the social dimensions in relation to production and assessment of knowledge and especially the complexity of knowledge production in the firm.

The problem can be restated as a part from a more general problem of embeddedness of the social dimensions in economic behavior originally formulated by Granovetter (1985) in his much cited article on the importance of acknowledging social relations like trust, confidence, distrust etc. in economic behavior. Granovetter's argument was a convincing and very explicit critique of the omission or negligence of the importance of social or personal relations in economic behavior by economic theory from the neo-classic economics to Williamsson's institutional theory. "The embeddedness argument stresses instead the role of concrete personal relations and structures (or "networks") of such relations in generating trust and discouraging malfeasance. The widespread preference for transacting with individuals of known reputation implies that few are actually content to rely on either generalized morality *or* institutional arrangements to guard against trouble." (Granovetter 1985, p.490) The general criticism of the ignorance of social relations in economics is just as relevant in relation to the traditional understanding of system of science and research.

The problem of the embedded but not recognized social relations in the systems of quality evaluation in science, the peer review system, is rooted in the functionalism of the Mertonian heritage with its attempts to formulate an objective social theory on the system and function of science. Even though Merton recognized the complex and fuzzy social world amongst scientists (the Matthew effect), he nevertheless disregarded its importance in his functionalist theory on the conditions for scientific knowledge production.

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[7] Breslau (1997) has in the field of labor market evaluation convincingly demonstrated how microeconomic evaluation methods are introduced in order to establish political credibility.

[8] In his article from 1945, Hayek puts forward some very important critical points toward mainstream economic theory for its ignorance of the role of knowledge for the production of welfare. In the article Hayek completely disregard that it was in fact Marx who much earlier, in his theory of labor value, formulated the overall importance of the active human knowledge and competence in the value creating processes through his extensive critique of Ricardo's concept of value. For Marx, the use (use value) of the living labor in the production was the central 'secret' of the capitalist production of surplus value and hence of economic growth.

New concepts or models for evaluation of research – contributions from organizational theory:

The question put forward earlier in the discussion of the organization of research evaluation and the peer review tradition was how to argue for a solid foundation for the open standard peer review evaluation. The standard should ideally make it possible to maintain and develop research evaluations in an open and broad framework focusing on development and change and not on control. It should include the traditional use of peer reviews of articles and proposals, an activity still very important in the production of scientific knowledge not only as a control but just as important as part of the critical discourse which produces solid new knowledge. And it should reflect the problem of the embeddedness of social relations, the personal relations, networks, and organization, in other words the social settings around the knowledge producing researcher in the evaluation.

On of the most obvious starting points is the discussion of social capital. The concept was originally a part of Bourdieus concepts to analyze power and dominance in different institutions but it was more or less appropriated into modern social science by Coleman (1990) in order to analyze common values and norms in a group or organization.[9] A central idea was to formulate a critical distance to the limits in the concept of human capital used by economists like Gary Becker, where the embeddedness problem was largely ignored.

In organizational theory, the concept has had a revival. In order to understand the social and organizational dimensions in relation to development of new knowledge in the firm, Nahapiel and Ghoshal (1998) argue for the use of the concept of social capital as a means to focus on the function of relations and especially network relations in the production of knowledge. Therefore, social capital is central for the understanding of the production of knowledge (intellectual capital) and market advantages of the firm. It is[10] "the sum of actual and potential resources embedded within, available trough, and derived from the network of relationships possessed by an individual or social unit. Social capital thus comprises both the network and the assets that may be mobilized trough that network" (ibid. 243). Social capital resources can be described by three dimensions, the structural, the relational and the cognitive dimensions and are in various ways embedded in the social and personal arrangements and interactions of persons in a social structure, a firm or an

[9] In the chapter on Social Capital in the new twentysix-volume large International encyclopedia of the social & behavioral sciences , the author R. W. Jackman credits Coleman for the recent popularity of the concept. In this new and large international work of reference, it is astonishing that there is not a single reference to the works of Pierre Bourdieu and his concepts of social and symbolic capital. Ben Fine (2001, p. 191) writes that "although Bourdieu is a (decreasingly) acknowledged initiator of the theory of social capital, the critical aspects of his contributions have been excised in deference to the tamer versions associated with the likes of Coleman and Putnam. In particular, Bourdieu has been emphasised with the social construction of the content of social capital….that it is irreducibly attached to class stratification which, in turn, is associated with the exercise of economic and other forms of exploitation, and the relation between them. Significantly, the functional approaches to social capital attached to the founding empirical studies of Coleman and Putnam have both been shown to be questionable..".

[10] Nahapiel and Ghoshal use the concept of social capital with references to both Coleman and Bourdieu. "In particular, for Bourdieu, systematic analysis of the volume and structure of social capital enables examination of the relationships between social and other forms of capital." (ibid p. 262) But as it will be shown later, their reading of Bourdieu is very traditional.

organization. Intellectual capital can be characterized as tacit[11] or explicit knowledge and social (organizational) or individual knowledge and "for a given firm, these four elements collectively constitute its intellectual capital". (247) Important dimensions of social capital for development of new intellectual capital are network ties, network configuration and appropriable organization. Following their idea of intellectual capital as a social artefact, e.g. it is always embedded in a social context, shared language and codes and shared narratives are constitutive to the creation of intellectual capital. Other important relational dimensions of social capital are trust, social norms (especially on openness and team-working), obligations and expectations. But the relation between social and intellectual capital is not one-sided.

The production and sharing of knowledge in an organization help or strengthen the social capital giving the organization an advantage. Turning the problem Nonaka (1994) extended the concept by arguing at the perspective of the organization minimizes the whole range of problems and dynamics located in the relations between individual persons and between persons and the organizational structure. The basic ideas or the theoretical foundations of organizational creation of knowledge should then be based on "the active, subjective nature of knowledge represented by such terms as "belief" and "commitment" that are deeply rooted in the value system of individuals" (Nonaka 1994, 16). Polanyi's (1983) concepts of tacit and explicit knowledge are introduced to open the relation between the individual and the organizational knowledge creation. The organizational knowledge creation is from this perspective depending on the handling of individuals and management ought according to Nonaka to be very oriented towards self-organization like teams. The specific demands for knowledge and solutions to selected problems and the standards to be evaluated by are determined by the management, but Nonaka emphasizes that management in a knowledge creating organization has to be very flexible in order to combine the individual 'commitment' with the organizational demands. Managing through "enabling conditions -creative chaos, redundancy of information and requisite variety" (ibid. p. 27) relies to a large degree on self-organization (teams) and an open and flexible organization. The efficiency and stability of the traditional organizational and managerial hierarchy have a role in order to guide the knowledge creation process by setting up standards for evaluation and other types of goals and guidelines, but it has to be very open to bottom-up processes in order not to destroy the individual creativity and commitment which are so important to the knowledge creation.

Both Nahapiel and Ghoshal and Nonaka have more or less discussed the problems from the point of view of the traditional organization. A classic problem in scientific knowledge creation is what Merton formulated as the norm of universalism or Gieryn as boundary-drawing, the necessary exchange of knowledge between unknown participants in the creation and correction of knowledge.

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[11] I think it could be useful to try to rethink the much-used conceptual subdivision of knowledge in tacit and explicit knowledge. Originally, Polanyi used tacit knowledge for types of knowledge, we cannot speak about or codify like "we know more than we can tell" or "Tacit knowing is shown to account (1) for a valid knowledge of a problem, (2) for the scientist's capacity to pursue it, guided by his sense of approaching its solution, and (3) for a valid anticipation of the yet indeterminate implications of the discovery arrived at in the end." Polanyi tried to argue for the role of some of the more unconscious dynamics in the creation of new knowledge. Explicit knowledge is everything else and this everything else is probably a very heterogeneous collection of types of knowledge. From the sociological analysis of group learning, the concepts of *formal* and *informal* knowledge might be a fruitful way to divide the concept of explicit knowledge in a way that relates to the social and organizational settings it is performed inside. One advantage of this distinction is that it allows us to look closer into some of the social processes of knowledge creation and the function of learning, formal as well as less formal.

Narrowing the focus to the organization is in this respect a serious problem. The concept of networks or what is the network and what is the organization or firm, where and what constitute the boundaries or borders between the organization or firm and the outside world, who are the gatekeepers etc. are problems only very briefly discussed by Nahapiel and Ghoshal and Nonaka. Cohen and Levinthal (1990) introduce the concept of absorptive capacity in order to understand how the internal organization of the firm has important influence on the knowledge production through its ability to exploit external knowledge. The central problem is then to establish a balance between existing specialization and the absorption of new knowledge in order to secure innovation. Kogut (2000) and Kogut and Zander (1992) address the problem directly by the help of the concept of boundary making between the firm and the environment. Kogut's (2000) discussion of the dynamics of the boundaries between the firm and the networks when looking at information assets focuses on the interaction and dynamics of the relations. "Networks are more than just relationships that govern the diffusion of innovations and norms, or explain the variability of access to information across competing firms. Because they are the outcome of generative rules of co-ordination, networks constitute capabilities that augment the value of the firm." (Kogut 2000, p. 423) Gant (1996) takes up another but related problem, the difficulties of knowledge integration in the organization. Knowledge integration puts focus on the organizational structure and it functions in relation to the integration and application of knowledge. The concept of 'organizational capability' is important as it focuses on organizational routines and procedures in the process of knowledge integration. "The task is to devise decision processes that permit integration of the specialized knowledge held throughout the organization – not just in the boardroom, but on the shop floor as well." (Gant p. 384) These problems discussed by Gant point to discussions in the field of sociology of work on how to organize and motivate the workforce and are clearly related to the discussion of tacit and explicit knowledge and teams. This discussion of the organizational knowledge creation process shows that when it comes to real knowledge production much has to be left to the dynamics of the individual and the group in a loose or flat organizational structure. The team evolves as a central organizing principle in the knowledge creating organization.

In order to understand, manage and evaluate knowledge creation in an organization as dynamic and complex, relational processes, focus on the product, knowledge in the form of a product, patent, article are important but clearly not sufficient. A number of contributions from organizational theory have taken up the challenge. Nahapiel and Ghoshal's definition of social capital, the role of tacit and explicit knowledge in the knowledge creation process (Nonaka 1994, Nonaka and Takeuchi 1995), network relations in- and outside the organization (Kogut), absorptive capacities for new knowledge (Cohen and Levinthal 1990), boundaries and gate-keepers, organizational principles for project work, teams etc. (Gant 1996) - all argue for a much broader understanding of the role of the organization in the knowledge production. The direct focus on the organizational and social processes surrounding the knowledge creation has, of course, much to do with the market driven necessity to produce a competitive advantage for the firm, but it has its strengths in the close connection between the organization and knowledge creation. The market competition, on the other hand, calls for secrecy in order to protect profitability and therefore implies serious restrictions for the public peer review processes.

A model for evaluation of social capital in organizations:

But one problem remains after this convincing break with the traditional approach to studies of science and knowledge; how to combine or integrate these contributions into something that can be

empirical studied and evaluated. Bozeman, Dietz and Gaughan (2001) confront the problem of how to evaluate research realizing that the traditional evaluation methods are too narrow and restricted. Much in line with the above-mentioned attempts to analyze knowledge production in organizations, they discuss human capital theory, tacit knowledge and social networks in order to develop a model for a more organizational-based approach to the evaluation as an alternative to peer based methods. Combined with the idea of a "knowledge value collective (as) a set of individuals connected by their uses of a particular body of information" (ibid. p. 719, Rodgers and Bozeman, 2001), Bozeman, Dietz and Gaughan too end up with the concept of social capital from Bourdieu and Coleman and Coleman's concept of human capital as the central core of a Science and Technology human capital model. "The evaluation of science requires an approach in touch with knowledge of the social context of scientific work. An S&T human capital model is first a model of scientific work and its social qualities (eg., Rodgers and Bozeman 2001); the evaluation methodology flows from this more fundamental conceptualization. Much of this capital, especially that aspect that is interpersonal and social, is embedded in social and professional networks, technological communities or knowledge or knowledge value collectives. …. none of these discounts the more traditional aspects of individual scientist's talent, … Our concept simply recognizes that in modern science being brilliant is only necessary, not sufficient. "(Bozeman, Dietz and Gaughan 2001 p. 724) Their model can be summarized into a model for research evaluation with four advantages (ibid. p.733) :

"1. It deals with the life cycle dynamics and the evolution of scientific and technological fields,

2. It conforms closely to scientists' own conception of their work and exploits knowledge developed in the social study of science

3. It can act as a counterweight against policy makers' needs to 'rush to judgment'

4. It can provide an alternative based on something other than the monetized value of science."

The dynamic, contextual and time sensitive approach to evaluation has to be reviewed with regard to the theoretical concepts used to argue for the model. Bozeman, Dietz and Gaughan use a rather free combination of the concepts of social and human capital from Coleman with his background in rational choice theory and a rather traditional conception of theory and social capital from Bourdieu, who despite his critical distance towards French Marxism uses the concept of capital much in line with Marx, works with a concept of capital that only exists and functions in relation to a field (Bourdieu 1987, 1998, Bourdieu and Wacquant 1992). The concept of social capital presupposes the recognition of a special field or arena, a micro-cosmos, with autonomy and clearly differentiated from its surroundings. The attempts by Bozeman, Dietz and Gaughan (2001), Burt (1997) and by Nahapiel and Ghospal (1998) to use the concept of social capital in order to emphasize the dependency of the knowledge production on a broad range of personal qualifications as well as the organization leave out the discussion of the field or the specific context in which the social capital operates.

A digression to Bourdieu and the field of science:

In relation to studies of science or knowledge producing organizations, Bourdieu (1981) assigns the field a central role: "It is the scientific field which, as the locus of a political struggle for scientific

domination, assigns each researcher, as a function of his position within it, his indissociably political and scientific problems and his methods – scientific strategies which, being expressly or objectively defined by reference to the political and scientific positions constituting the scientific field, are at the same time political strategies." (Bourdieu 1981, p. 33) Later, he refined his theory in a study of INRA (1998).[12] In this study, he introduces the concept of scientific capital as a special form of social capital in this field and goes on to develop the relation between his key concepts. Following Bourdieu (1987, 1998), the social or symbolic capital cannot be discussed without a specification of the field, a dependency quite often is ignored, leading to a partial or misleading use of the concept of social capital in empirical studies[13]. In order to speak of social or symbolic capital, it is necessary to define a specific field, e.g. a field or an arena with a certain level of autonomy in relation to its surroundings. The field of science is characterized by its ability to design, mediate and reformulate external demands and forces. The field is composed of various representations in the form of constructions, norms and rules and in relation to the field of science. Bourdieu emphasizes that the degree of autonomy is varying (basic and applied research and natural and social science have very different degrees of autonomy and hence, constitutes different fields). To Bourdieu, the concept of scientific capital is as a special type of symbolic capital existing in a scientific field. "The amount of capital designates the weight or strength of actors in the field in relation to other actors. Scientific capital is a special type of symbolic capital based on credits or recognition in the field." (Bourdieu 1998, p. 21)

Bordieu operates with two types of scientific capital; one based on political or institutional power in relation to institutions and economic funding and one based on personal power from the recognition by the invisible college. Central for the constitution of the field is the power and struggle between actors and between actors in the field and with the surroundings (other fields). The concept of habitus refers to prescriptions and attitudes among the actors, very often in the form of scientific interests presented as altruistic or above everyday politics. From the standpoint of the field, it is constituted by various representations, e.g. various social constructions of reality by the actors in a never-ending internal struggle.

What is the outcome of this short presentation of Bourdieu's theory of scientific knowledge production? Most importantly, the discussion by Bourdieu has established a solid foundation for a critical review of studies based on the concept of social capital. Quite often the concept is used on empirical material without taking the problem of the field into account, e.g. the specific context (Fine 2001, p. 65-96). But it is possible to see an outline of another research strategy with much

[12] INRA – Institut National de la Recherche Agronomique, an agricultural research institution in France established in 1946.

[13] To Marx, capital is the process of producing a surplus, a process forced to constant reproduction and extension and not a steady state. It would clarify the use and development of the concept of 'social capital' if it is substituted by 'social value'. Value indicates the quality and potentials in 'something', only realizable in the process as capital. The problem is much more than semantic, because value indicates something to be measured empirically while capital is value in the processing mode, creating surplus value. "Value therefore now becomes value in process, money in process, and, as such, capital. It comes out of circulation, enters into it again, preserves and multiplies itself within its circuit, comes back out of it with expanded bulk, and begins the same round ever afresh. …. "M-C-M' is therefore in reality the general formula of capital as it appears prima facie within the sphere of circulation." Karl Marx, Capital Volume One ch. 4: The General Formula for Capital.

more far-reaching perspectives for research evaluation, through insisting on a social or sociological frame of reference for the understanding of how knowledge is produced and logically, what has to be the main focus on any evaluation of science and knowledge production in general. The short presentation of Bourdieu's theoretical apparatus strengthen the argument that the concept of the field or the arena is very central and unavoidable if the concept of social or symbolic (scientific) capital is used. The field has to be specified in order to differentiate between types of scientific capital, the concrete types of habitus (norms and attitudes) and most importantly, how the actors in the field constantly are parts of the process of its constitution (representation). The way the actors (scientists) perceive themselves, their attitudes towards the field in question is a dynamic part of what constitutes the field and therefore an integral and necessary part of any study of scientific knowledge production processes and evaluations thereof. Insisting on the combination of the concepts of capital and field makes it possible to integrate more technical studies of the output of scientific knowledge production in order to measure parts of the scientific capital in a field. First of all, it strengthens the argument for the open peer review standard as the organizational frame of reference for research evaluation.

Conclusion:

The interrelation between scientific knowledge and the social environment in both production and in use has been the subject for a number of studies in sociology of science recently. Reaching from how personal trust-relations have decisive importance in high-energy physics in the selection of experimental data (Knorr-Cetina 1999) to the growing importance of the social acceptance of scientific knowledge in society (Nowotny 2001), the problem of the social or the social dimensions in science and research has received growing attention. But neither the micro-studies of the interaction of single researchers nor the macro-studies of scientific knowledge in society have focused explicitly on the knowledge production processes in its organizational settings. Recent developments in organizational theory on knowledge in organizations have focused the discussion of the function of the social dimensions on the knowledge creation process placing the organization in a central role in the knowledge creation process. Concepts and ideas from the discussion of knowledge creation in organizations and networks have found their way into the discussion of scientific knowledge production (Bozeman, Dietz and Gaughan 2001). The dynamic concepts of social, symbolic and scientific capital have already influenced the discussion but as it have been shown a much more systematic use of Bourdieu' s theory will take the discussion much farther and open for empirical studies of 'the social' in science. The interrelated concepts of capital and field open for bridging the gap between the studies of the organizational framework for knowledge production and the problems of the changing social frames for knowledge production as discussed by Nowotny (2001) and others[14].

The problem posed in the beginning of the article on restrictions and limits in the traditional approaches to evaluation of research can be reformulated in the light of a social and organizational understanding of knowledge production. The main critique raised was that the traditional evaluation system in research, the classic peer review, is insufficient as the only instrument to evaluate the

[14] Nowotny (2001) uses the concept of Agora, Etzkowitz and Leydesdorff (2000) the concept of triple helix and Ziman (2000) post-academic knowledge in order to capture dimensions of the social influence on science.

quality of research in the process of knowledge production. The argument is supported by the empirical fact that in the last twenty years a very broad arena of evaluation and assessment systems for quality in research has come up, but most of them do not explicitly take up the organizational dimensions. The modified peer review as an open standard (Foss Hansen and Borum 1999, 2000) has been suggested as the framework for contextualize research evaluations. Through the discussion of contributions from social and organizational theory on knowledge production, the argument for an open standard for research evaluation has been strengthened. As the context for knowledge production becomes more and more important, the research evaluation methods have to be related very closely to the specific knowledge producing environment or context. The definition of a field and its scientific capital, the active participation of the actors in defining the field, the role of both traditional and new forms of knowledge in a field, all seem to point in one direction; it is necessary to develop research evaluation or assessment systems in context, e.g. with focus on the social and organizational processes surrounding the knowledge production.

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