Life in the Triple Helix:
the Contract Researcher, the University and the Knowledge Society

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Recently, a number of observers have argued that the academic world is undergoing a process of transformation in the production and organisation of scientific knowledge. This process has been variously described as trans-science (Weinberg, 1971), post-normal science (Funtowicz and Ravetz, 1993), Mode 2 (Gibbons *et al.*1994) and post-academic science (Ziman,1994). At the organisational level, the formation of a new tripartite alliance among the university, industry and the bureaucracy (the so called Triple Helix) has meant that the organisational contexts for the production of knowledge have become more diverse. These developments have been attributed by some commentators to herald a structural shift in the economies of industrialised countries to the post industrial (Bell, 1973) or knowledge society phase of development (Drucker, 1993) in which knowledge is the *primus motor* of economic growth.

The above mentioned changes in the relations between science and society have been occurring within a context of increasing cutbacks in government spending on science and changes in the criteria for research funding on the part of research foundations. The prevalence of these developments in Europe, North America and to a lesser extent Latin America has precipated a debate about their impact on the nature of scientific knowledge and on the role of the university in society (Shils, 1992; Tight, 1994; Gibbons *et al.* 1994; Weingart, 1997).

In the light of the above, this paper has two objectives. One is to provide a critical discussion of one of the more controversial theses in the ongoing debate about the transformation of the university, i.e. the Mode 2 thesis. According to this argument, the evidence from the frontier of knowledge production suggests that we are witnessing a shift in the context of generation of knowledge production from a disciplinary, primarily cognitive context (Mode 1) to a broader, transdiciplinary social and economic context (Mode 2). The latter thesis has

given new vigour to the already heated debate about the role of the university in society. The second objective is to give voice to an as yet unarticulated position in this debate, that of the junior researchers working in the context of transformation.

The discussion is divided into three sections. The first provides the context for the Mode 2 thesis by painting in broad strokes the state of the science-society contract at the present. This is followed by a critical discussion of the main features of Mode 2 science. The third part of the paper focuses on the impact of Mode 2 science from the perspective of the contract researcher.

The State of the Science-Society Contract

Crisis rhetoric has been in some respects as common to the university as the charge that the university *qua* institution has a weak grasp on the reality outside of its walls. A review of the literature on higher education and the university reveals that at least since World War II, there has been a steady stream of publications reporting crises in academe (Moberly, 1949; Brubacher, 1972; Coombs, 1985; Readings, 1996). In response to a number of important developments that have occurred in the last two to three decades, the crisis rhetoric has intensified within industrialised countries. Among such developments, three may be considered to be significant.

1. The higher education sector is undergoing a period of transformation spearheaded by smaller and smaller government contributions (see Eicher, 1990; Jalling and Carlsson, 1995; Schmidtlein and Taylor, 1996).
2. The emergence of a new demand for accountability in the public sector of industrialised countries (Woolgar, 1997; Peters, 1992). When applied to higher education in Europe, this emphasis on the public accountability of the university issued into the introduction of national systems of external evaluation of universities and in countries such as Britain, a consequent ranking and funding of institutions in terms of research performance.
3. A change in the research funding system. This change may be seen as part of a science policy initiative that began in the 1980s when governments in both Europe and North America intensified efforts to forge linkages between industry, the public sector and the university. Students of science and research policy will recall that attempts to pursue such a union took several forms from science and research parks to small university based firms especially set up to market and exploit micro electronics and advances in molecular biology (Reams, 1986). In keeping with this trend, there is now an increased demand for user/stakeholder/beneficiary involvement from research councils and other funding agencies.

Along with these structural phenomena came a realisation that the science-society contract was undergoing a process of change. The previous arrangement inspired by Vannevar Bush for the United States and the OECD for Europe was that scientists would be more or less left alone to determine the internal content of science. Society would fund this enterprise with the understanding that the

resulting knowledge products would be public goods.

Beginning in the 1980s, commentators began to observe a change of behaviour on the part of both parties to the science-society contract. Public funding of science began to take on increasingly strategic dimensions. The popular image of the scientist as the disinterested communitarian producer of knowledge began to be attenuated by media reports of fraud, exploitation of junior colleagues and appropriation of research funds for private purposes. Away from the limelight of the social debate about the difference between the romanticised image and the media construction of the scientist, the administrators and researchers at universities were grappling with the impact of decreasing budgets for education and changing demands from research councils.

Academic discourse about the science-society contract (science policy studies) began to use new descriptive concepts such as the Triple Helix to discuss the changing science-society relation (Etzkowitz, 1992). This new terminology heralded a qualitative shift in the discussion from the fundamentalist tones of the science-society contract and the basic vs. strategic research discussion to one that argued for a closer linkage between universities and the users of knowledge in industry and public institutions. The need for this linkage is said to be a logical outcome of structural developments such as the shift towards more knowledge intensive technology and recognition of the importance of new technologies in promoting economic growth.

Other important contributing factors include a change in the pattern of corporate investment in research and development. Corporations such as IBM and Astra Hässle, that traditionally maintained large in house R&D concerns have been supplementing, and in some instances replacing in house R&D with short term contractual arrangements for research with some universities. This new arrangement between the university and industry may be attributed to several factors. The most important of these include: the policy initiatives mentioned earlier, efforts by scientists themselves to commercialise their own knowledge products, thus making it more difficult for firms to access this knowledge, and an economic recession that forced the university and to a lesser extent the industry to seek new partners.

The net result of these developments has been an increased emphasis on the role of knowledge in economic development and a growing recognition of the diversity of sites in which knowledge is being produced. At this point one may quite reasonably assert that none of these developments is new in itself, perhaps the only difference is an increase in the intensity of the activity. While it is incontestable that university scientists have always done some commissioned research, the developments that are now being reported as Triple Helix alliances and university-industry partnerships do indeed differ qualitatively from earlier university-industry or university-public sector interaction.

This difference may be seen to operate on two levels. One is the changed funding situation alluded to above that has heightened the sense of vulnerability of the university. The other is that there is now an ideological climate that favours and promotes Triple Helix part-

nerships as imperatives for future economic development. This ideological climate further manifests itself in the favourable attitude displayed by funding agencies and governments to the new partnering relations and in a rhetoric that is fuelled by academic discourse itself. Here I refer specifically to the discussions about the passage of industrial society to a post industrial/knowledge society phase. More recently, the postulation of notions such as post normal science and Mode 2 knowledge by Funtowicz and Ravetz (1993)[1] and Gibbons *et al.* (1994) respectively have led to speculations and counter speculations (Weingart, 1997) about the uniqueness of the knowledge production system spawned by the Triple Helix and other phenomena in the knowledge society.

Mode 2 Knowledge Production

Mode 2 describes the knowledge produced by the institutional alliance forged within the Triple Helix. This knowledge is distinguished from traditional or Mode 1 knowledge (see Box 1 for features of Mode 1). In the following paragraphs, the critical features of Mode 2 will be outlined.

Knowledge Produced in the Context of Application

This first attribute of Mode 2 refers to a situation in which knowledge is being produced through a process of continuous negotiation of the needs, interests and specifications of all the involved actors. This particular feature is one of those that distinguishes knowledge production in the Triple Helix or Mode 2 from previous consultancy or commissioned research arrangements that existed between the university and industry or the bureaucracy. Gibbons *et al.* did not specify the details of this part of the process. However, it is the contention of this paper that the negotiated character of the process of knowledge production is one of the most important qualitative differences between Mode 1 and Mode 2 knowledge and to a lesser extent of post normal science.

In order to illustrate this, some critical differentiating aspects of knowledge

Box1: Features of Mode 1 Knowledge Production

- Problems set and solved in a context governed by academic community
- Disciplinary
- Homogeneity of producers
- Hierarchical and continuing
- Quality control through peer review
- Emphasis on individual creativity

Source: Gibbons *et al.* (1994: 3)

produced in the context of application will be examined in the following paragraphs. The focus will be on the integration of users/beneficiaries/stakeholders in Mode 2 knowledge production. There are two established methods of achieving this objective. The first is that the project is developed along the lines indicated by the user. This would typically involve working with specifications outlined by the users/beneficiaries/stakeholders as well as ongoing consultation throughout the life of the research project in order to recalibrate specifications, etc. Applied research in Mode 1 also involves this type of co-operation both for social science as well as engineering and medicine.

The second and more radical approach is to have the users/beneficiaries/stakeholders integrated into the project. Some strategic research councils in Sweden are presently trying this approach and this discussion will draw on this example to provide insight into the nature of the negotiatedness of knowledge produced in the context of application. In order to demonstrate this, I shall use an example of a composite project. The features of this composite are taken from a number of different projects funded by the new strategic research foundations in Sweden.

The project of interest aims to study the possible impact of the introduction of a marine protected area in a small coastal fishing community. The research team is comprised of social science and natural science researchers from the university, scientists from a government laboratory and public servants from regulatory bodies. The scientists from the government laboratory and the public servants have direct stakes in the outcome of the project. A research council that supports strategic environmental research funds the project.

The project will be implemented through a participatory research method in which other stakeholders are identified and consulted about the proposed policy intervention. This project may be regarded as a typical Mode 2 set-up in that the knowledge is being produced in the context of application; the team is transdisciplinary and includes stakeholders/users/beneficiaries in the research process. This type of arrangement is on the surface, the ideal one for doing research of this kind. Closer examination reveals two important problems that are not transparent from the more abstract discussions by Gibbons *et al.* These are the differential nature of stakeholder involvement and the nature of the negotiatedness of knowledge production.

There are two broad categories of stakeholder involvement in the project. Category A is the *empowered stakeholders.* These are the stakeholders or their employees that are actually members of the research team and thus have control and input in every stage of the research process. Category B refers to the *stakeholders to be empowered.* These are those stakeholders that have a traditional relationship to the research team, i.e. as research objects. This group of stakeholders have no formal access to the research project itself and have to depend on the researchers to recognise their claims and when necessary take their perspective in negotiating with the stakeholders that are within the project. The issue of whether science conducted in this particular nexus would be able to deliver a product that *can* be of use to those *to be* empowered is one that will

be determined through the process of negotiation.

The diversity of the project team is an important source of the changed character of negotiation in knowledge production. The co-operation between natural and human scientists brings with it the clash of the two cultures. The addition of bureaucrats and government scientists to this mix leads to a further clash between the scientific culture on one hand and that of policy on the other. A further problem in this regard is the expectations of the funding agency with respect to the ability of this team to function as a cohesive unit almost as soon as the project begins. Last but not least, project members have to be prepared for the fact that stakeholders will try to use the participative nature of the project to promote their interests vis-a-vis those of other stakeholders.

Such problems have also been observed in Mode 1 knowledge, the only difference here is that in these types of projects, there is less room for scientists to operationalise the traditional boundary demarcating devices to limit the influence of these factors on the final knowledge product. Without such devices, the character of the politics of the research process is changed.

It may be argued that since the political implications of the research are obvious to participants and stakeholders alike, the ability to deploy science as a neutral legitimating force is reduced in this mode of interaction between science and policy. One could however counter this with the argument that it may be that research done within this type of framework has a more powerful legitimation value from the political perspective. The inclusion of stakeholders within the research project and the action-oriented nature of the research give it an aura of representativeness that is not present in other modes of scientific production. When taken into the political arena, the policy intervention proposed on the basis of knowledge so produced has the force of the democratic mandate as well as that of science. Through the above discussion, it is possible to get a more detailed insight into what Gibbons and his colleagues refer to as negotiatedness. In the following paragraphs we will as far as possible use the hypothetical project outlined above to further illustrate other features in the Mode 2 thesis.

Transdisciplinarity

Whereas in Mode 1, transdisciplinarity often means the gathering together of a diverse team of specialists to work on a problem, Mode 2 approaches the ideal specifications for transdisciplinarity. Enquiry is guided by specifiable consensus as to appropriate cognitive and social practice and research projects develop a framework to guide problem-solving efforts in each context. This consensus involves the usual politics of science that is part of the construction of a research problem as well as the *real politik* of stakeholder/researcher negotiation.

According to Gibbons *et al.* transdisciplinary knowledge in Mode 2 generates its own distinct theoretical structures, research methods and modes of practice. The final distinguishing feature of Mode 2 transdisciplinarity is the way in which results are communicated. Rather than through institutional channels such as publication and conferences,

diffusion of results is accomplished through the process of production and through the migration of practitioners from one context of application to another. This constitutes a departure from Mode 1 knowledge production both in its dynamism as well as in the way results are communicated.

Since users/beneficiaries/stakeholders are integrated in the project, the results are necessarily communicated to them during their interaction in the project. Gibbons *et al.* stress the tacit nature of the knowledge products in this mode of production. This particular aspect may be worrying to those who still believe that one of the essential hallmarks of science is that it strives to create and communicate knowledge in as broad a fashion as possible (Fuller, 1997a; 1997b). The shift to Mode 2 seems to involve a re-embodiment of the knowledge products of science on the scale one associates with artisan work. This particular Mode 2 claim is in agreement with findings on the cultural and social embeddedness of science (Lewenstein, 1995; Bijker *et al.* 1987) as well as knowledge gained from efforts to effect the transfer of science and technology to developing countries (Salomon, 1996; Henderson, 1994).

The Mode 2 claim that its brand of transdisciplinarity generates its own distinct theoretical structures, research methods and modes of practice is in my view an exaggerated one. Transdisciplinary projects do produce innovations at the level of method and theoretical structures but these innovations are often the result of tinkering and reverse engineering of established methods and theories from disciplinary science. Whether the result of this process is a radical enough departure from the original model is an open question. In the final analysis however, transdisciplinarity is still dependent on a corpus of knowledge developed within the disciplinary sciences for their theoretical and methodological needs. In fact, Gibbons *et al.* argue that Mode 1 and Mode 2 science are not independent of each other and that many scientists often migrate back and forth between the two Modes. The ability of scientists to impart the tacit knowledge generated in Mode 2 from one site to another will therefore determine whether Mode 2 will be able to feed the internalist demands of scientific research and education.

Heterogeneity and Organisational Diversity

Mode 2 knowledge production is characterised by heterogeneity and diversity at the organisational level. An important indicator of this is that the university is no longer the centre of knowledge production. A range of different organisations including private consultancy firms, non-governmental organisations, etc. are recognised as sources of knowledge. Gibbons and his colleagues (1994: 6-7) point to a range of structural criteria such as linking of sites through electronic and other means in order to create networks of communication. These networks of communication are more important in Mode 2 because institutional structures of a stable kind are more the exception than the rule. The institutional reference point is the research team and this unit is constructed and reconstructed in response to demand and problem solving. Networks then function as the means

through which a matrix of communication from which further groups and networks may be constituted. Put differently, the research team is configured on the model of the Just in Time inventory method introduced in management in the 1980s.

Social Accountability and Reflexivity

Mode 2 knowledge production is characterised by a higher demand for social accountability and reflexivity. This demand is reflected at all stages of the research process (interpretation, diffusion of results, problem definition and the setting of research priorities). Scientists, it is claimed are more responsive or sensitive to the impact of their research within Mode 2 because the problems which motivate research in Mode 2 cannot be specified in scientific and technical terms alone (Gibbons *et al.* 1994: 7). The resulting research has therefore to incorporate options for the implementation of the solutions and these necessarily entail values and preferences of the different actors. Scientists involved in this type of research have therefore to try to reflect on the problem at hand from the standpoints of the different actors. This inherent demand for reflection on values and aspirations creates a demand according to Gibbons for knowledge from the humanities.

Social accountability is undoubtedly an issue that is more evident in Mode 2 than in Mode 1 but the social in the context of Mode 2 is also limited to the group of stakeholders involved in the defined inner and outer circles of the specific project. The demand for humanist reflection on values and aspirations as argued by Gibbons *et al.* has to be restricted to the values and aspirations of the concerned public defined by the project. The risk is that since this knowledge is produced in the context of its application, there will be inflated expectation about its inherent social accountability and reflexivity. To the extent that these projects demand humanist reflection on a broader understanding of the social milieu of the project, this task depends on the willingness of the project members to engage in such reflection on their own time.

Quality Control

Finally, Mode 2 knowledge involves multidimensional criteria of evaluation. In addition to the peer review process, criteria such as market competitiveness, cost effectiveness and social acceptability play an important role in determining the quality of Mode 2 knowledge (Gibbons *et al.* 1994: 8). This shift in the criteria of quality control is not an unproblematic one since as long as the Mode 2 researcher remains formally linked to the university, the traditional criteria of evaluation will also apply. Thus, in addition to the maintenance of networks and contacts with users, the production of peer reviewed scientific papers and monographs will be an important capital investment for the Mode 2 researcher.

The above is a brief description of the epistemological aspects of the Mode 2 thesis. However, the Mode 2 argument has implications for the university as an institution and for the individual careers of the researchers working in this context.

The Implications of Mode 2 for the University

The new relationship between the university and industry has aroused strong reactions within the university. In the following, I will provide a brief overview of some of the main positions in the debate.

Like all debates in which the stakes are high, it is the voices that represent the positions that lend themselves most easily to stereotyping that appear to be the loudest. The debate about the transformation of the university is no different. On one hand there are the contributions of Etzkowitz and Gibbons as well as the copious number of research articles on the subject of how to manage university-industry alliances (Cyert and Goodman, 1997; Killoren, 1994; Cukor, 1992). This body of work may be said to represent the pro transformation forces. On the other, there has been a renewed discussion about the role of the university in society. This debate (Shils, 1992; Soley, 1995, Readings, 1992) centres on concerns about the implications of the impact of Mode 2 and knowledge society rhetoric on:

- the Humboldtian idea that education and research should be treated as interdependent in the university;
- the importance of the traditional university as the most favourable environment for stimulating basic research;
- the view that the university ought to exist as an institutional force independent from direct influence of politics and economics.

These arguments and variations thereof have always informed the basis of the science-society contract. Many of the knowledge claims in Mode 2 represent a fundamental challenge to this position. In order to illustrate this let us return to Gibbons *et al.* argument that transdisciplinary Mode 2 research generates its own theoretical structures and research methods. This claim challenges the prevailing wisdom that it is research that is driven by the internalist demands of science that is most likely to yield new theoretical methods. There is a fear that if policymakers are encouraged to believe that science as an enterprise can progress on transdisciplinarity alone, the present structure of education and research will have to be drastically revised.

Whether this is a rational fear is beside the point. If we regard this argument from a strictly politico-economic point, the following becomes apparent. On one hand, we have an institution with a considerable amount of resources invested in a specific structure as well as careers built along disciplinary lines. The majority of the academic staff at this institution has been trained to solve problems from the perspective of a single discipline. On the other, we have a cross section of policy and business interests that are now convinced that sustained economic growth requires that the production of knowledge should be explicitly oriented to promoting technical innovation and solving social problems. In the midst of all this a sector of the research community has posited that: (a) the future economic growth of society will be dependent on the production of knowledge and (b) that what is good for the public sector and business is also good for science. The unexplicated problem is what is to become of the capital investments that the university has already made in disciplinary research?

With respect to the content of the university-industry alliance, there is a host of information in the literature and consultancy support for universities that want to adapt to the new circumstances. The latter may be found in private consultancy services as well as within the management faculties of universities themselves. The burden of the adjustment needed to make the university-industry alliance work seems to fall for the most part on the university. Universities are encouraged to be realistic about their demands for a share of the proceedings from patents, etc. Killoren (1994) views on the subject were particularly enlightening:

> Many universities are unrealistic in patent rights negotiations when dealing with industry. I believe that the primary mission of technology transfer should not be making money but should be the successful commercialisation of a university's research findings to the benefit of our country (sic) and its citizens. Reaping the rewards of our intellectual property is very important, both as a stimulus to faculty involvement and as a means of making tax-supported research help generate funds to pay for more research. This effort must remain secondary to a desire to serve the best public interest.

Killorens arguments while focused on the US situation are valid for other contexts. The interest of universities in accruing money from patents has provoked responses such as that outlined by Killoren. Such responses reflect a central problem with university-industry relations. This is that while corporations are seen to exist for the express purpose of making profit for a well defined group of beneficiaries, the university is still perceived to be a public institution and the products of universities are still perceived as public goods even in the societies where tertiary education has virtually been privatised. My suspicion is that much of the benefit of the university-industry alliance is based on exploiting this public-private distinction for the benefit of the private partner. The situatedness of the university in the public sphere has a deflationary impact on the costs of the highly skilled labour it provides relative to the costs of that labour when it is located in the corporate sector. From the point of view of the corporate and public sectors, direct contracting of research from universities is nothing more than the extension of outsourcing practices from low skill tasks to higher skill tasks.

The university-industry alliance will not change academic salaries, the profits accrued by the university will vanish into a common property resource which is supposedly equally accessible to all academics not just the ones who participated in generating this profit. The rationale for this approach to distributing the university's share of the take is obvious if one considers the extent of the investment that universities will have to make to adapt and create support structures to service the university-industry alliance. From the perspective of the university this arrangement is similar to that which existed between multinational companies and developing countries in areas such as mining, etc. Just as some developing countries learnt how to adapt and extract long term benefits from these arrangements, some universities will fare similarly. If the analogy holds however, there will be a large number of universities that will merely be

exploited or ignored in this arrangement. The situation is not better from the point of view of the individual research groups that go out to seek such contracts because a communal division of the profits is not a fair solution. The risk of not getting a contract is only spread within the research group not throughout the entire community.

The Contract Researcher and Mode 2

How do the increasing numbers of PhDs who work in Mode 2, i.e. conduct academic work within the limited time frame of contracts that run from a few months to a couple years view Mode 2 and the crisis debate. The experience of this group as gleaned from informal interviews suggests that their position is one that is neither widely exuberant about Mode 2 nor is it longing for the comfort of tenure.

Prior to the advent of contract research, the newly graduated PhD could count on a brief period of job insecurity. During this period, one survived on postdoctoral stipends and research grants (the latter often achieved either through teaming up with a senior researcher or in rare cases through individual effort). This time is used to develop a resume that would typically contain a teaching portfolio and a number of publications. It is expected that after this period one would either get tenure or a tenure track position. The *status quo* in many countries with Britain being the most advanced in this respect is that a newly graduated PhD can look forward to a future in which a series of short-term research positions is the rule. If one is fortunate, a significant number of these contracts will be to implement research that one designed oneself. A more common situation is that of working on research projects designed by others. In both cases, ability to successfully hire oneself out is a condition for getting access to the university's resources to do research as well as for ones personal economy.

The notion of academic freedom – a central concern for some in the debate – takes on a different dimension in this context since the contract researcher has to keep one eye on the changes taking place in the research councils and another on the usual tasks of academic accreditation such as publishing. The phenomenon that some science policy commentators (Elzinga, 1995) refer to as curiosity driven research is not a part of this scenario.

The impact of short term contract employment on the ability to do even Mode 2 research is seldom taken up in any meaningful way. One reads Gibbons *et al.* discussion about networks of communication and wonders what it means from the standpoint of a head of a small research group who is rely on being able to get the same research team for the next contract.

The university as an institution is still organised on the assumption that the main task of its staff is education. The ability of the administrative structure to cater to the needs of the growing numbers of short term research staff is limited. This shortcoming is not only a function of the lack of resources or an administrative inertia but also a reflection of the prevailing ambiguity within the university to contract researchers. These academics do not fit the model on which the university prides itself, i.e. distanced

critical reflection and dedicated education. The contract researcher very rarely enters a classroom. If the university were to make any major adjustments to accommodate such a worker, it would be admitting that the Humboldtian ideal is far from alive and well. This is evidenced by the way in which the situatedness of academics tends to determine the stance they take towards the Mode 2 claims. The most enthusiastic supporters of Mode 2 are the senior academics who are already practising this type of research. These academics are often marginal to the university. Those who argue that Mode 2 is either marginal or that if it is as dominant as reported will undermine the virtues of academe are generally tenured staff.[2] Finally, let us focus on the structure of the relations between the contract researcher and the new unit of reference, i.e. the research group. The latter is in many cases a multidisciplinary, transnational group. This is the ideal of the knowledge society enthusiasts and it is this constellation taken together with a high profile research topic that usually gets funding. However, working in this nexus does have some drawbacks for the academic. If we return to the composite project team outlined previously. The tensions between the different cultures, science/policy, natural/social science, bureaucrat/scientist have to be negotiated constantly during the process of work. The ability to do this successfully is not part of the pedagogy of academe so most academics have to learn it by doing. One might contend here that this is not unique to Mode 2 since even in Mode 1, it has long been observed that research education only prepares the student for a small fraction of his/her potential duties after graduation (Merton, 1973). The mismatch is however, more keenly felt in Mode 2 because the contract researcher will actually be depending on such skills to market him/herself successfully.

The fact that science is not universal and national cultures do have scientific styles (Jamison, 1983; 1993) is a second lesson that the contract researcher who is part of a transnational team has to learn. While much of the literature prepares one for a cultural difference between the natural and social sciences, few researchers are prepared for the cultural differences that exist within their own disciplines as a result of national styles. This particular problem is observed most frequently in European Union projects where research teams from different nations have to get together to implement a particular project.

In the final analysis, one should pose the question is Mode 2 research worth it from the individual researchers point of view?

Conclusion

In summary, this paper has focused on the Mode 2 discussion as a part of the ongoing debate about crisis in the university system. The aim was to deepen the understanding of certain aspects of Mode 2 through an elucidation of some of its key features. A second objective has been to provide a view into the lived reality of Mode 2 both from the standpoint of the university *qua* institution and that of the contract researcher.

The paper has found that the new relations of knowledge production are quite similar to those that obtain in other parts of the industrial economy. This

converges on commentaries by authors such as Fuller and others who maintain that what is being witnessed is not post-industrialism but the industrialisation of scientific knowledge production.

By pitting the different features of Mode 2 against the way projects in Mode 2 work in reality, the discussion was able to bring forward a number of points concerning issues such as the negotiatedness of knowledge produced in the context of application. In this respect, one issue that emerged is that knowledge produced in Mode 2 may be preferred by policymakers because of the added legitimacy that science in conjunction with the prospective users/beneficiaries/stakeholders can lend to the final product.

In examining Mode 2 and its implications for the so-called crisis in the university system, most discussions including the present overlook the possibility that Mode 2 could also be conducted with partners other than industry. Here I refer to working with disadvantaged regions, non governmental organisations or what Peter Drucker refers to as the social economy. The problem however is that such partners are often unable to afford the overhead costs that come with university research. This may account for the fact that it is the university-industry alliance that takes centre stage.

With respect to the contract researcher, the impact of Mode 2 is to create an official space within the scientific hierarchy for the industrial worker. This is the researcher whose labour is dedicated to the fulfilment of a prototype developed by another. It is up to the ingenuity and sheer energy level of such a worker, whether s/he manages to accrue from this arrangement any capital that may be reinvested in an individual research programme.

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Notes

1 Taking their point of departure from problems areas such as environmental risk and climate change, Funtowicz and Ravetz posited that there is a growing class of problem situations in which scientific expertise is sought that are characterised by uncertain facts, values in dispute, high stakes and urgent decisions.

2 All the projects used as the basis for the composite project share the same structural features as the composite in terms of aims, relations to users/beneficiaries, funders, dissemination of knowledge etc.

3 The information in this section of the paper is based on a series (10) of unstructured interviews conducted with researchers in Britain and Sweden. All of the researchers were social scientists or humanists. Further information for the paper came from a meeting of heads of research groups for the ESRC sponsored Centre on Research on Innovation and Competition Workshop on Uses of Social Research, September, 3, 1997.

4 Similarly, when a pre-print of this paper was circulated among a group of colleagues, tenured colleagues read the paper as a critique of Mode 2, there was a universal lack of interest among this group for the plight of the junior researchers who faced a future of contract re-

search. Contract workers for the most part cared little for abstract debate about the future of the university *per se* and were more interested in how to find a solution given the reality of contract research to allow for individual research programmes, job security, etc.

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