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## Epistemic communities in universities

Tim Gore<sup>a\*</sup>

<sup>a</sup> *The University of Greenwich, Park Row, London SE10 9LS, UK*

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### Abstract

The creation of new knowledge, as evidenced by trends in research publications is increasingly a collaborative affair. However, the epistemological assumptions underlying how we see knowledge are predominantly based on a view of knowledge as created and owned by individuals who may then ‘trade’ this ‘commodity’. These assumptions permeate the way we try to manage knowledge creation and dissemination – an issue of increasing centrality for universities. This paper examines the concept of epistemic communities from the strategic view of universities wishing to augment their role as knowledge producers and disseminators. It shines a light on underlying assumptions about the nature of knowledge and offers some alternative more socially oriented views to the prevailing individualist orthodoxy. The paper draws on a range of current studies and quotes expert witnesses to inform how universities could better widen their capacity for novel research, reaching out to a geographically dispersed network of experts and across national and organisational frontiers.

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Groups have become a vital unit of knowledge creation in modern science with the average number of authors of an article showing substantial increases and an increasing importance of diversification of sources of knowledge through collaboration in cutting-edge and multidisciplinary research fields such as nanoscience and bioscience. (OECD 2007). There may be various causes for this, Loffler (2005) claims that biotechnology had had a disruptive affect on the knowledge creation process having been a linear process up to the 1980s. He claims that since then, biotechnology has transformed the process by integrating academia, government, industry and the public (Loffler 2005: xii). Prusack and Weiss (2007) identify two main trends in knowledge management. First, greater emphasis on social networks, new search techniques and better expertise location and second, greater attention to adding context to content and the role of the group (Prusack & Weiss 2007). In other words recognising the social basis for knowledge creation and sharing and an increasing move away from cognitivist underpinnings for knowledge generation.

Bearing in mind these trends towards more collaboration and more open and diverse knowledge networks, how can industry better work with universities in partnerships that aim to develop new knowledge? The expert witnesses that I have talked to have great respect for universities and a strong interest in working with them and also have

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\* Corresponding author. Tel.: +0044-02-8331-7852.

*E-mail address:* T.Gore@gre.ac.uk.

useful insights in how to get the best out of their relationships with universities. I am particularly interested in the nature of knowledge and particularly of socially owned and created knowledge. Work such as Karin Knorr Cetina's (1999) monograph have helped develop our sense of the glue that keeps tightly knit groups of researchers together as 'epistemic communities' or communities that are defined by their shared tacit knowledge of process, context, history and culture but then the issue becomes one of porosity. How open are these coherent groups to cooperation and partnership with others? This question has two dimensions which reflect the trends in knowledge management identified by Prusack and Weiss (2007): how is a particular epistemic community to keep in touch with a far-flung and diverse range of contributors to their area of interest? And how once contact is made with another epistemic culture is the relationship that leads to true co-creation of knowledge to develop?

This paper helps clarify these questions and suggests some ways both these questions may be taken forward. It uses interviews with two experts in industry–university interfaces, the first from an imaging company and the second from a multinational energy company.

IT industry today we are talking of embedded systems, we are talking of silicon based devices but the technology of the future may not be that it may be carbon nano-tubes we are talking of which are more sturdy, less utilisation of energy, low cost-intensive. If the shift happens ... a sudden fundamental shift, the way we manufacture IT devices, or the cost may drastically come down that will change the dynamics the key players in the industry would have to look for radically different solutions and a radically different business model – that may come more from the academic side rather than any commercial or current IT player taking that because change is always disruptive (Regional Representative of an Imaging Company 2008)

This quote illustrates the deep respect industry has for the role of universities. The expert witnesses that spoke to me stressed that for them the value of universities is in their longer term viewpoints and broader horizons than commercial research organisations. The energy company pointed out that to contract out a straightforward research task is relatively simple and can be done equally with a university or commercial organisation. She pointed out that universities are of great value when their full creativity and freedom to operate is respected. Another strength universities bring is the scope for multi-disciplinary or interdisciplinary approaches.

Even if we are talking of design elements you know as an industry so you need four different perspectives – a person with a capability of IT design, another person maybe from a purely from a design element, thirdly from a cognitive science and maybe from a consumer view , behavioural management perspective so you need a multi-dimensional team, you need an interdisciplinary skill based team or a person who can amalgamate all these four options which is hard to find. So better option is to have an interdisciplinary team in place. So commercial institutions always take a more narrow more focussed approach which is more near term realisation of things while a university has a more holistic and can bring a blend of skills which is helpful. (Regional Representative of an Imaging Company 2008).

However, this contact also stressed the need to take a long term approach to the relationship with universities. She stressed the role of trust building:

In China some of the folks we worked with in China at a couple of the universities had been burnt by petrochemicals player Were hugely suspicious and thought we wanted to take them for a ride – I think it just took time and people spending time together and we had people who actually went and lived at the university and when you really interact with people day to day you see them putting in time, teaching, I think it really changes the relationship so I think it broke ... my sense was that the initial concerns were allayed and it got to the point where they were bringing research to us which was never part of the original scheme saying here's some great research would you be interested in it. (External Relations Manager for a Multinational Energy Company 2008)

There are many studies that point to the closeness of epistemic communities. A study of Chinese software engineers exemplifies the nuanced approach knowledge workers adopt to expanding their knowledge and solving knowledge problems. Assimakopoulous and Yan (2006) claim that the development of software is heavily dependent on people. The sources of knowledge used are both codified – in for example existing code, databanks, books, journals and tacit in human brains and communities of practice. The codified knowledge can easily be easily communicated at a distance but the tacit knowledge is not so easily accessed. The software engineers were observed to follow distinct knowledge acquisition strategies. The first recourse is technical books, online searches or other codified sources. However, as the problems are often difficult to define, this approach is often unsatisfactory. Then, the engineers tend to rely on collective discussions and advice seeking most commonly with colleagues within the company and local communities of practice. Many times this will involve walking over to a colleague's cubicle and discussing directly, often other colleagues get involved and typically the discussion is short. Then, if this does not yield a solution they may tap into wider communities of practice such as an online forum where problems are posted and answers can come from anywhere in the online community.

In other words, the engineers most frequently consult their own team and especially the local team before consulting more distant experts. The engineers state that this is because their own team as they know each others' work better. Team colleagues share similar tacit knowledge whereas additional effort to explain the context is necessary with more distant experts making this less time efficient. Members of a community of practice, according to Assimakopoulous, develop a shared mental model, a common language and behaviour for specific practices and this lowers the cost of communication and results in explicit and tacit rules of behaviour that develop with the community.(Assimakopoulous and Yan 2006).

Polanyi introduced the notion of tacit versus explicit knowledge putting forward the construct that “we can know more than we can tell” (Polanyi 1983 p4). Ichijo and Nonaka stress that tacit knowledge involves human processes in knowledge management – creativity, conversation, judgement, learning and teaching and is difficult to quantify and manage. It was a ground breaking 1991 article by Nonaka that popularised the concept of tacit knowledge in which he stressed the competitive advantage that Japanese companies were accessing by tapping the ‘tacit and often highly subjective insights, intuition and hunches of individuals and making those insights available for testing and use by the company as a whole’ (Nonaka 1991 p164). These insights into the nature of knowledge have helped organisations have a better understanding of how knowledge can be better shared and therefore how the organisation as a whole can access the knowledge.

The widespread recognition of the value of knowledge has come only recently. Prusak and Weiss (2007) claim that it was between 1992-8 that a number of companies came to recognise knowledge (rather than information and data) as a crucial source of competitive advantage. Leonard (2007) uses the term ‘stickiness of knowledge’ to illustrate the barriers to communication and sharing of knowledge. She claims that this stickiness is a result of the tacit dimension present in all knowledge. The knowledge can be very context or culturally specific. The recognition of the value of knowledge was closely followed by the realisation of how difficult it is to access this value.

The concept of distinct epistemic cultures with their own internal tacit understandings helps us see the difficulties in bridging such epistemic communities. It is not just a question of shared knowledge but also a shared working practice, coded language use, social organisation and even a distinct and identifiable stance on epistemology in general. Karin Knorr Cetina (1999) has been enormously influential in demonstrating just how unique such epistemic cultures as she calls them can be. Her work is a very detailed ethnographic study on the different cultures of high energy physics and molecular biology.

Much writing on epistemology centres on the individual and her relationship with external knowledge through direct sensory experience or through testimony of others. However, there is work available on more socially oriented epistemologies where knowledge is seen as possessed and even created by groups rather than individuals for example Kusch (2007) and Fuller (2007). One approach to epistemology that seems to me particularly relevant for the issue of crossing epistemic boundaries is the concept of autopoiesis.

Autopoietic epistemology is different in that it moves away from representationalism. Here systems are seen as open to data but closed to higher levels of knowledge such as information. This is because in this epistemology systems are seen as unique in their approach to interpretation of data and that in any case it is not possible to represent reality. As soon as data enters the system it is absorbed according to the self-defined rules of that system. Krogh, Roose and Kleine (1998) cite Nonaka and Takeuchi (1995) as being closest to this approach and explains that there are deep Japanese cultural antecedents for this approach to knowledge whereby reality is a fragile and

transitory flux seen in concrete and visible matter rather than being in itself an unchangeable truth. Knowledge is thus seen as a personal or social construction not as a more or less close representation of truth. In other words autopoiesis assumes a constructivist ontology (Krogh Roos & Kleine 1998). As well as being alternative ways of viewing knowledge production and sharing, these epistemologies can be seen as an increasingly sophisticated understanding of the nature of knowledge and reality and have no doubt been affected by new paradigms of thought in the Kuhnsian sense. The imagery most commonly used for autopoietic epistemology is a biological and self-referring system such as a cell which is a collection of sealed processes which follows its inexorable approach to growth and development sealed from the world by a membrane which selectively allows in the resources to sustain life. The growth of our understanding of genetics has no doubt helped in the conceptualisation of this epistemology.

Vicari et al stress that in autopoietic systems, signals are received by the system as a perturbation which can trigger knowledge development processes in the receiving autopoietic system. There are various implications to this. First, that these perturbations released through cooperations become a source of new knowledge throughout any collaboration but that knowledge is sealed within the participating network and cannot be transferred out. Second that as the systems are self-referential the organisations need to be aware of the knowledge processing structure to ensure it is appropriate and to ensure that the organisation is open to new signals.

The other is the relative closure of knowledge communities – take Karin Knorr Cetina’s work on high energy physics and molecular biology. Each community is distinct and operates within a distinct and to a large extent mutually exclusive culture. Indeed Keiser and Leiner, invoking autopoietic thought, argue that it is almost impossible for such communities to communicate.

My discussions with experts from industry showed that some organisations are keenly aware of these closed epistemic communities and have developed strategies to allow their researchers to work closely with the community. If we take autopoietic epistemology seriously, we need to be aware that knowledge can only be shared within such communities. Therefore if industry wishes to work with a university research team they need to spend time becoming a part of that community and this will clearly involve trust building and physical proximity. The energy company paid particular attention to this in the design of the clean energy research centre they developed in partnership with a university.

We helped set up this centre for clean energy research, we tried to physically design the centre to support that ... the physical layout was done with open planning so researchers were all in the same room together like in the classic modern office and not in .. cubicles, there was a sort of break out area with bar stools and coffee deliberately to try and say .. how do we encourage an atmosphere where people talk and exchange ideas and between the company and the researchers at the centre how do we create events where people share things the usual format was poster sessions etc... (External Relations Manager for a Multinational Energy Company 2008)

The other dimension that needs attention is the horizon scanning mode for knowledge producing communities:

Keeping your channels of communication open with experts in the area with the drivers and leaders of change in technology be at the fore frontiers of what is happening in different domains, also working very closely with universities that’s why these joint projects in ..... Innovation research .... is a demonstration of the same. Like in a house it needs to breath you need to have sunshine and fresh air come in, similarly an organisations has to find ways so that ideas flow in and flow out , you need to meet with people have exchange of ideas and not just sit with closed doors and windows. (Regional Representative of an Imaging Company 2008)

There has been much emphasis on open innovation in recent years. Other companies such as Procter and Gamble are using more open innovation models to cut costs and shorten innovation time (Huston 2006) and recognising where knowledge lies and collaborating with that source of knowledge is behind an approach used by 3M to develop breakthrough products for the medical industry. 3M targeted specific industry problems and then carefully sought out experts in that technology or a closely related one recognising that lead users in industry may already have got further ahead in tackling these problems than researchers in the labs. One area of research was aimed at the identification of smaller and smaller tumours in medical imaging. Their search for lead users took them to pattern

recognition experts in the military who had already experimented with image enhancement by adapting pattern recognition software (von Hippel 2006). Gibbons (1994) reinforces this connection between competitiveness and more open innovation models maintaining that to be internationally competitive firms must keep up to date in knowledge and have instant access to it (Gibbons 1994).

Tata Consultancy Services (TCS), has a substantial in-house research and development capability. However, they believe that this is not enough and are pursuing a strategy of open and collaborative innovation - a 'Co-Innovation Network (COIN)™'. COIN involves a network centred on their own TCS Innovation Labs but involving 'Global Academic Institutions, Strategic Alliances, Start-up Companies and Venture Funds apart from key customers'. They claim to work with international and national academic institutions and cite Stanford University, Georgia Tech, MIT Sloan School, University of Wisconsin, University of Massachusetts, and a number of Indian Institutes of Technology (Tata Consultancy Services 2007).

As a university you have to be quite smart about thinking how you organically build up the connection points in order to build that relationship that some of the big stuff can come out of. (External Relations Manager for a Multinational Energy Company 2008)

Many organisations fail to understand the importance of informal knowledge networks in the social construction of knowledge. There is considerable evidence of mismanagement of knowledge production. A social network study of formal versus informal knowledge networks at ICI found considerable disparities between what management aimed to create through conscious knowledge management practices and what was actually happening through informal networks. Allen, James et al noted that formal processes tended to limit and restrain knowledge transfer rather than encouraging it. They noted that 'experts' nominated by ICI to fulfil bridging functions were actually themselves marginal to the actual knowledge transfer processes. They also found that both business unit and geography are important and both limit knowledge exchange. Technical communications on R&D issues remain predominantly within business units (islands of knowledge) despite formal efforts to bridge different units and technical collaboration is mainly with colleagues located near rather than distant research centres (Allen, James et al. 2007). Similarly, a study of the European IT collaboration Esprit found that personal networks tended to conflict with organisational ones. Macdonald and Piekkari point out that information cannot be bought and sold and an organisation's information systems cannot stretch beyond their organisational boundaries so collaborations are an attempt to enlarge these boundaries to include the necessary information for innovation. This brings us back to an autopoietic interpretation of open and closed systems. They go on to state that organisations contract explicit information from collaborations but their informal networks can work at a deeper tacit level as they are more aware of each others' language and culture. Membership of these personal networks is, according to the authors, personal and non-transferable. The rules of membership are implicit but strict, trust being the main factor which can be rapidly lost if an individual abuses the network by selfish or intrusive behaviour (Macdonald & Piekkari 2005).

For universities, the messages seem to be quite clear. There is a strong and valued role that universities can play as partners in knowledge production with industry. The challenges for university research communities are to ensure membership of wide enough social networks with industry that may need access to the particular areas of expertise the university has to offer and to think about how to help industry access and work with the relatively closed epistemic communities in the university.

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