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on

Managing university/industry relationships: The role of knowledge management

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Gakujutsu-Sougou Centre, Tokyo

This paper highlights some of the important issues that arise when universities and private enterprises are co-operating. Its aim is to raise a number of questions that can stimulate the discussions at the High-level Forum on " Managing university/industry relationships: the role of knowledge management" on the 15th October 2001 in Tokyo. The basic idea in the paper is that knowledge management can be seen as a key mechanism in the management of university/industry relationships without endangering the basic objectives and missions of each partner. The Forum will thus focus on the role of knowledge management in facilitating university/industry relationships and not university/industry relationships in general[1].

University/industry relationships are raising a challenging **quid pro quo** issue. The focus of this seminar can be summed up roughly in the following way: if decision makers (public and private) are nowadays all agreeing that industry and university **should** co-operate, it appears that the **"why questions"** (why university and industry should co-operate and work together?) are more documented than the **"how questions"** (how university and industry can come up with organisational devices and incentives in order to make the relationships workable and beneficial for both partners?; and how to build up co-ordination mechanisms, trust and learning loops between the two partners?).

As mentioned, the "Why" questions are already well documented. The Centre of Educational Research and Innovation (CERI) at the OECD has mainly contributed to explore this domain by organising several high-level experts meetings (Stanford, Ottawa, Copenhagen) about the restructuring of knowledge production systems. In these seminars, several experts have provided convincing answers to the changes that are taking place in the production, mediation and application of knowledge in both private and public sectors. New and intensified interaction of R&D activities between universities and companies play an important role in these changes. The percentage of R&D funding at American universities sponsored by the American industry has tripled over the last 30 years from 2.1 per cent in 1970 to 6.2 per cent in 1999. Michael Gibbon's distinction between two modes for producing knowledge - mode 1 versus mode 2 - is useful for understanding the shift from disciplined-based research to application-based research. These two modes of knowledge production - which have to be again considered as stereotypes - are shaping different relationships between university and industry which implies new ways of co-ordination and co-operation.

Mode 1 is characterised by university-based disciplines and the scientific agenda is managed by disciplinary elites heading public laboratories (Richard Whitley 2000[2])**.** Mode 1 provides an organisational answer, which consists in transferring knowledge from science to technology with specialists in charge of the mediation such as university technology transfer office.

[1] For more information on general policy issues in university/industry relationships see report on «Benchmarking Industy-Science Relationships», Berlin, 16-17 October 2000 prepared by The Directorate of Science, Technology and Industry (DSTI) at the OECD together with the German government.

[2] Presidential address by Richard Withley; The restructuring of knowledge production: the end of science as we know it or increment diversification? Society for Advancement of Socio-economics, 9th July 2000.

Mode 2 provides a different *picture*. The frontiers between science (basic research) and technology (applied research) are less and less visible and relevant, especially within specific domains such as biotechnology and information and communication technologies. Knowledge production in Mode 2 is not organised according to university-based disciplines but is focused on problems which are coming up from a variety of channels both private or public. There is now a serie of convincing research results about the blurring frontiers between basic sciences and applied research which strongly revisits the dilemma between the "republic of science" and the "kingdom of technology" to use Professor Paul David's wording. Increasingly, industries are focusing on “time to market" constraints and pressures coming from users (Professor Eric Von Hippel's work on end users[3]) are entering public laboratories, which are less and less considered as "ivory towers". "To link or not to link" university and industry is not an issue to be raised anymore. There are however "what" questions that remain to be addressed:

- What are universities expecting from industry in developing such links with industry and reciprocally?
- What are the benefits and costs of such links?
- What are the asymmetry risks each side is taking in building up such relationships?

These questions can be further refined:

What are universities looking for?:
- Are academics interested in capturing or sharing tacit knowledge embedded in research engineers working in the private sector?
- Are firms viewed as a fieldwork or study object for scientific purposes?
- Are firms viewed as a way to get access to sophisticated equipment not available in public laboratories facing a budget crisis?
- Is collaboration seen as an opportunity to explore the nature of questions raised by users?; Or an opportunity for academics to join specific training programmes and to learn from it?; Or an opportunity to participate in joint alliances with other laboratories? Or an opportunity to commercialise results and provide extra money for their laboratories?

What are private companies looking for?:
- Are firms interested in capturing knowledge for free in avoiding paying the fixed costs?
- Is collaboration seen as an opportunity to share tacit knowledge about the way academic researchers are tackling new questions?; Or an opportunity to extract tacit knowledge from the academics? Or a means for improving the knowledge basis of the firm in its capacity to dialogue permanently with academics and programme research managers?

How best to work together?

All these "what" questions must not to be taken for granted during the Tokyo seminar and will be addressed through case studies or testimonies coming from academics and research managers from industry but the **how questions** are still pending: ***How to make the relationship workable***. The focus of the seminar will be on : how a knowledge management approach can enlighten and possibly improve these working relationships.

In analysing the relationship between industry and university, there is a need for a clear understanding of what is the nature of knowledge involved within the relationships which links *individuals* and also *organisations*[4]. Extensive and strong linkages between university and industry are not easy to built up.

[3] Hippel E Von.,1988, «The sources of innovation», Oxford University Press, New York; Hippel E von and Tyre, M.J. «How learning by doing is done:problem identification in novel process equipment» Research Policy vol 24.

[4] Lam A., Lundvall B.A., «Innovation policy and knowledge management in the learning economy; the interplay between firm strategies and national systems of competence building and innovation» unpublished

In some OECD countries, university-industry relationships can be bureaucratic and difficult. In others, co-operation depends on how research and education are institutionaly arranged (e.g. the separation of biological research from medical schools and hospitals in France).

Several examples show that the problem of establishing good collaboration between university and industry is often related more to one of mutual disinterest in what the other is doing than a strictly economic or ethical one. Academic researchers love to work on «hyper-innovative» solutions but lose interest once the work entails building reliability into the selected solution and overseeing its industrial development. In comparison, the industrial partner does not share the same interest for the «elegance» of an innovative solution, as it can be a source of unforeseeable problems and failures. Instead, focus is put on effectiveness in terms of time frames and well-controlled costs. Knowledge management must facilitate convergence of interests in specific projects in areas where interests diverge spontaneously.

University-industry relationship can be characterised as linkages between two different **worlds**. Referring to sociologist Howard Becker's work[5], a "world" is an original **combination of different elements**: first element: the definition of its main activity (what is scientific activity about for the academic world and for the industrial world?); second element: the nature of knowledge involved for undertaking an activity; third element: the judgement principle involved which defines parameters for evaluating the quality of the performance; and fourth element: a cultural style which is embedded within each organisation.

Each world has its own structure, its own organisation, its own hierarchy, its own evaluation process using its own parameters, and its own strategic manoeuvres. The Tokyo High-level Forum has therefore to address ***the connection between these two worlds*** in order to identify best practices about how to create such connections or linkages.

Our main hypothesis is that management of these relationships has to be supported by the management of knowledge both at universities and in enterprises. As Professor Hiroyuki Yoshikawa put it[6], "*if we know how to manage knowledge, then we know how to manage people"*. The paper will now address four important issues in managing university/industry relationships that policy-makers have to take into account when they are seeking to promote these relationships. The analysis of these four issues mentioned below is inspired by the knowledge management approach of Professor Nonaka[7] in his knowledge spiral work.

1. How to socialise Ph.D. students to the corporate world?

Professional orientation of Ph.D. students comes up during a time when they are young and often unfamiliar with the nature of firms. The corporate world is mainly viewed through "clichés". Therefore, promoting university/industry relationships faces a problem which crosses the explicit knowledge and the individual level, and could be labelled as students' **embrained knowledge**. This embrained knowledge is relying on cognitive competences "located" in each individual and often detected by severe academic filters built mainly on one academic discipline. Ph.D. students are thus not yet comfortable with bridging disciplines and will often tend to stick to one discipline.

However, the bridging of academic disciplines has become a strategic move, which increasingly can be observed within the corporate world: chemistry with computer, optic with electronics, etc.

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[5] Becker S H.,1986 "Doing things together", Northwestern University.

[6] French report edited by JM Saussois on the role played by corporate researchers in japan Société franco-japonaise des techniques industrielles 1993, Paris «La place de l 'ingénieur de recherche au Japon» 265 p.

Individual choices of students are in fact taken very early in their carrier. Most students will not follow an academic carrier. The few, who continue their Ph.D. studies, will continue to work inside the university perimeter as post-docs or research assistants. To socialise these Ph.D. researchers to the corporate world or to make them well aware of the corporate world can be seen as a key step for setting up future fruitful relationships between university and industry.

All involved, including policy-makers, in promoting such a socialisation phase have to be aware that this socialisation is not a straightforward process. The ***socialisation phase*** is an exchange of tacit knowledge both at the individual and the collective level, sharing know-how with young and senior colleagues. The involved persons have to sympathise; it is a trial-and-error process through emotions, feelings, habits, and behaviours. It is a kind of observation round where the clichés about the industrial world can vanish.

This socialisation phase can be developed and improved through different policy measures. Many of these measures are known to policy makers and have been implemented in OECD countries. Some of the measures are, among others: organised partnerships, internships, doctoral programs run jointly by corporations and academia, organised mobility between the two "worlds", sabbatical periods for academic researchers within firms and vice versa . Although many of these initiatives are already in place in several OECD countries, they are too often taken for granted. The partnerships are too often institutionalised and not managed carefully enough. It is important to manage this socialisation phase by setting up organised feedbacks, to set up breathing time in both "worlds" in order to listen to the Ph.D. students and understand their questions and their "fresh" reactions about the corporate world.

Questions:

How can the socialisation process of Ph.D. students to the corporate world be strengthened and improved through knowledge management in the "two worlds"?

What is the importance of the *physical setting* for learning? How to organise attractive physical shifts from the academic laboratory to the industrial plant and vice versa? What kinds of new incentives are necessary to make that mobility possible?

2. How to establish trust between university and industry?

This trust question is not a trivial one. Sociologists and economists have carried out important work on that question **(Granovetter[8], Gambetta[9], Zucker[10])**. Establishing linkages between two partners go through a management of mainly **embodied knowledge**, which crosses the implicit knowledge and the individual dimension. Embodied knowledge is acquired through daily organisational practices: central authority versus decentralises authority, loosely couple organisations versus tightly couple organisations, small teams versus large group. There are several examples that illustrate different embodied knowledge between academic and industrial researchers or more generally people working within a firm. The way of writing a paper for an academic congress or for a scientific journal with a peer review is done not the same as writing a memo for a superior within an industrial hierarchy. The notion of time is also different: time for research is not the same time for industry driven by time-to-market pressure.

Individual behaviours during meetings at university are not the same than during business meetings within a firm. The manners of talking and behaving are also different; these manners are embodied to

[8] Granovetter M., 1985, "Economic action and social structure: the problem of embeddedness" American journal of sociology vol 91, n° 3.
[9] Gambetta N.,1988, " Trust:making and breaking cooperative basic relations " Blackwell, Oxford.
[10] Zucker L.G., 1986, "Production of trust:institutional sources of economic structures , 1840-1920" Research in organizational behavior ,vol 8.

the person and not visible at first sight but will be vital for making the linkage workable between the two parties.

All these points which could appear "obvious" are essential to be aware of it in order to establish a climate of trust and to get a **win-win situation** between the two parties. Complementarity between the requirements coming from the corporate world and requirements coming from the academic world are made possible only within a trust climate, which allow good practices. The origin of the relationship, the nature and the size of the firms involved will have implications for the type of relationship that can be created.

For example, within a European project on enzymes[11], a compromise has been set up between industrial partners and academic partners (22 participants) on which knowledge would be kept within the firms and which knowledge could be circulated openly between university researchers. Six firms competing on the same subject were involved in the research project. In order to guarantee the confidentiality, the project has been divided into five pieces and rules were set up concerning the circulation of the biological substances and the research results. Three types of data were distinguished: 1) *team data* reserved only to the members of the team working on one piece of the project; 2) *pooled data* accessible to the all participants of the project; and 3) *public data* which can be published within scientific journals.

The shift from one type of data to another was also closely managed; a retention time of three months for each category of data was clearly defined from one circle to an other. This management through setting up good practices "between gentlemen", allowed the production of, 1) *private knowledge* protected through patents, 2) *collective knowledge* available among the participants of the project and, 3) *flying knowledge* available through scientific publications. These private arrangements had in fact no legal value but allowed the exchange process between competing firms and academic people belonging to different European countries because the trust between partners allowed for it.

Question:

How can knowledge management support trust and realising the convergence of interest in university/industry relationships?

3. How to solve the intellectual property issue?

The intellectual property issue raises the question of the appropriation and circulation of research results, which increasingly have a direct impact on the marketplace. This question is not new and has received various regulatory frameworks among OECD countries. In the US, the Bayh-Dole Act has been an answer, which is now evaluated in its effectiveness (OECD)[12]. But confidentiality rules, disclosures, patents management are only the visible part of the “iceberg”. The hidden part faces **encoded knowledge and embedded knowledge problems,** which cannot be ignored by policy makers.

Encoded knowledge crosses the explicit level and the collective level; explicit social codes are different within academic organisations and firms. Several examples of such differences can be mentioned. Codes with regard to money, authority or careers are different. A scientific career has not the same pattern than a corporate career. Merits are evaluated differently; expected rewards are also

[11] Cassier M., 1997, "Compromis institutionels et hybridations entre recherche publique et recherche privée" Revue d'économie industrielle n° 79, pp. 191-212. Cassier M., Foray D., 1999, "La régulation de la propriété intellectuelle dans les consortiums de recherche:les types de solutions élaborés par les chercheurs" Economie appliquée tome LII, n° 2, pp. 155-182.

[12] Presentation of experts' reports on the management of knowledge JM Sausois pp. 107-114 in Knowledge management in the learning society, OECD 2000.

different. "The publish or perish law" within universities does not make sense within a corporate laboratory or within a business unit of a large industrial group. In contrast, "in or out law" which structures international business consultant firms does not make any sense for university professors having a permanent tenure. Exchange of free scientific information or samples are common practices for academic communities, which can be difficult to understand by researchers encoded in a culture of secrecy. Personal recognition as an author among a peer group is antinomy to team work within a firm working on a management of project basis.

Embedded knowledge crosses the tacit level of knowledge and the collective level. Academic researchers are part of a professional community, which is structured through different university disciplines, associations, journals, forums, web sites, etc. Some researchers are local researchers others are cosmopolite, belonging to an international invisible college where the knowledge is flying. Within the firms, there are also communities of practice but built on a different mode. Embedded knowledge is encapsulated in organisational routines. Envy and jealousy issues cannot be ignored in a relationship between university and industry. On each side, embedded knowledge may hamper the quality of the relationship. Communities of practice are different and shape the individuals' behaviours. These communities of practice are an important part of the management of the relationship between university and industries.

Behaviours coming from each "world" are changing and converging within some specific domains such as biological sciences, where public and private funds are financing health care research. Academic researchers are increasingly familiar with legal aspects of immaterial property, using different sources of funding.

Academic laboratories are becoming familiar with corporate practices (Cassier**,** Foray 1999[13]). In general, they are not frightened anymore to work **with** and **for** a firm. Among OECD countries, there are still important differences. This familiarity still depends on the nature of the research area involved and also the size of the firms (small firms versus large firms); for example, researchers can divide their research project into pieces dedicated to specific industrial requirements in using the same generic technology. These researchers accept the confidentiality rules and refrain from publishing during a time, which is more or less easily negotiated with the firm. Within specific areas such as enzymatic technology, new materials which are discovered within public laboratories which may have a double value **both** on the market place and among the scientific community. Academic researchers can patenting their results and sell them to the firms, but they can also publish their results in prestigious scientific review such as *Nature* and make their students work on thesis. This "killing two birds with one stone" example is not unusual nowadays and provides both another approach of innovation and another vision of a firm which is more and more considered as a portfolio of competences instead of a porfolio of products**;** it means that knowledge on how to mobilize key resources is becoming a strong competitive advantage among the firms; how to use and produce knowledge through networking is becoming nowadays a distinctive competence.

Questions:

To what extent can knowledge management design intellectual property solutions providing a good balance between the twin goals of appropriating and diffusing knowledge?

How can mutual learning on the needs of the other partner lead to acceptable solutions for the two "worlds"?

4. How to set up mediation devices?

The restructuring of knowledge production from mode 1 to mode 2 has profound impacts on the mediation structures between university and industry. A linear model requires a transfer approach of

[13] op.cit

knowledge which means that upstream are producing downstream; from scientific knowledge to applied knowledge there is a line to draw. The role of liaison bureau (University Technology Transfer Offices) often located inside the university is to serve as a kind of go-between. New actors are then emerging as experts in scientific valorisation. They should be able to speak **both** the language of corporations and the language of researchers working within public laboratories. These new actors (mediators) may convert tacit knowledge into explicit knowledge to the researchers and also to the firms they work with. They also valorise the researcher's work in selling their findings or in advising them for patenting their inventions. It appears, moreover, that staffing practices in University Technology Transfer Offices matter a lot. They usually hire either a mix of scientists and lawyers, or a mix of scientists and entrepreneurs/businessmen. Who is working in these offices is a big issue for selecting a mode of knowledge management practices which can be either more oriented towards issues of intellectual property and royalty agreements negotiations, or rather focussing on the phase of start up and marketing of academic discoveries.

OECD countries have set up a variety of arrangements for mediating the production of knowledge. The trend [14] is to observe a reduction of block grants "blindly" allocated to public laboratories. Research funded on an application basis is changing the role devoted to the mediators who turn out to be more entrepreneurial and more aware of legal constraints.

Mode 2 focuses on interactivity between theory-oriented goals in research and technology. It does not mean that the autonomy of the different previous actors is vanishing but that linkages have to be managed differently. The shift towards Mode 2 knowledge production implies that new research funding tends to favour research hybrid structures with mixed public and private money through consortiums. Academic researchers can be also attracted by the marketplace rationale in setting up their own firms, sometimes within university perimeters or in selling themselves their own research results without the help of any liaison officers. Within OECD countries, this entrepreneurial move and an increasing mobility between public and corporate laboratories is favoured by policy-makers, which shows that the legitimacy of intellectual prestige and success can come from different sources.

Questions:

What are the important knowledge management issues in University Technology Transfer Offices? What are the implications for staffing practices?

Professor Jean Michel Saussois, Ecole Supérieure de Commerce de Paris and consultant at the OECD in collaboration with the OECD/CERI Secretariat have prepared this paper.

[14] Richard Withley op.cit