

Is there such a thing as Tech Trans? Or learning from Pasteur

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This short paper is an attempt to start a discussion on some basic issues within the concept of Tech Trans especially the relationship between flow and structure within the concept. The background to this paper is first of all an academic interest in the relationship between flow and structure in innovation. Secondly it will illustrate my experience from Knowledge Lab, which was established seven years ago at the University of Southern Denmark with the aim to enable and develop the relationship between research and business. Thirdly our part in the development project "BONITA" plays a role. The paper explores the concept of Tech Trans, show rooms and innovation systems, and it suggests that the notion of Tech Trans should be defined in the fix point of vertical and horizontal innovation. Finally this paper suggests a mathematical formula for evaluating Tech Trans.

The rationality of the BONITA Project

The rationality of the BONITA project is stated as:

Research cooperation, as well as knowledge transfer between public research organisations and industry, is insufficiently developed within the European innovation system. In order to develop the Baltic Sea Region into a high-tech region the available scientific knowledge needs to be successfully transferred into practice. Even though universities are important developers of new technologies and products their innovations are rarely transferred for commercialization. This can be explained by lack of facilitating structures and it may also be due to the fact that academic staff may lack a commercial mindset. At the same time vast innovation potential of SME's is not exploited due to missing resources¹.

This rationality raises various important discussions. First of all: Is there such a European System of Innovation? The very idea of a national system of innovation goes back to Friedrich List who criticised Adam Smith for being too focused on competition and resource allocation, thus neglecting structures, systems and technology (List). Some twenty years ago the modern revival of this concept gave rise to different more or less broad definitions of innovation systems. A main influence was the USA with its ability to combine big business and university systems within a national technology policy, a spin-off benefit from World War 2. This has influenced both research and policy making in other major regions (Japan and the EU) (Lundvall & Christensen).

Still, if one accepted that such a system existed, the first and foremost question would be: What is the European innovation system?²

Innovation takes place in different ways, depending on traditions, resources and economic structures. In Germany there is a strong tradition of research within big companies and clusters of companies. In Denmark we have very few big

¹ See: <http://www.bonita-project.eu/>

companies and the industrial infrastructure consist with a very few exceptions of small and medium size companies.

There are different innovation systems in Europe and different practices of innovation. A most interesting aspect of the BONITA project is the opportunity to compare these different ways in order to learn from each other and establish networks between different modes of innovation and structures to scaffold innovation. Then there is the elusive concept of transfer – and I will discuss this further below; however I do think that a generic and comprehensive understanding of the relations between academic research practises (note this is in plural), the practises of SME's and their innovative potentials and the development of facilitating structures would probably increase the chances of success not only within our project but also in general.

Different domains – different rationalities

Tech Trans is indeed on the agenda, not only in this project. It is part the modern world's thrive to establish a more effective and efficient relation between research within the scientific system and the application of this research in enterprises. It is an expression of the drive to increase utilization of universities and to mobilize research with the aim to make societies more competitive and innovative³ thus shortening the pipeline between research and commercialisation or as it is stated in the BONITA project: *"Interregional development by turning university research into business value"*.

This is considered to be a European problem, and on several occasions the European Commission has emphasised the need to overcome structural weaknesses in converting or transforming research into economic outcome⁴. In these policy statements the agenda is a more general concern about knowledge transfer which is broadly defined as:

"Knowledge Transfer involves the processes for capturing, collecting and sharing explicit and tacit knowledge, including skills and competence. It includes both commercial and non-commercial activities such as research collaborations, consultancy, licensing, spin-off creation, researcher mobility, publication, etc. While the emphasis is on scientific and technological knowledge other forms such as technology-enabled business processes are also concerned."

When we talk about specific technology transfer we should define what we talk about when we talk about technology. To make this discussion short I suggest that we define technology as designs that are developed to satisfy human needs. This

³ See: COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT
DELIVERING ON THE MODERNISATION AGENDA FOR UNIVERSITIES:
EDUCATION, RESEARCH AND INNOVATION
(<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/213&format=HTML&aged=0&language=EN&guiLanguage=en>)

⁴ See: COMMUNICATION FROM THE COMMISSION TO THE COUNCIL, THE EUROPEAN PARLIAMENT, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS
Improving knowledge transfer between research institutions and industry across Europe: embracing open innovation – Implementing the Lisbon agenda –
(http://ec.europa.eu/invest-in-research/news_en.htm)

means that technology is not merely artefacts but also processes. But it also means that we are able to understand technology as something different than science, which is basically about understanding or interpreting the world, depending on what faculty you come from. Thus technology is generally about constructing and designing. This process of construction is also part of the scientific mode when it is designed to develop understanding. This is the case when we work with experiments in a laboratory at the university, or it may be research and development projects where we try to understand and interpret in collaborative research projects. But the expected outcome is not economic it is scientific.

The scientific world or domain is different from business or any other domain. The scientific world is codified towards scientific validity or scientific truth. Therefore other domains look towards this domain to find solutions which are valid, which are true. Truth should not be understood as ontological truth, but as epistemological truth. This means that results are made in an accepted way which enables others within this domain to evaluate the outcomes. The whole system of science of academia is structured towards this codification, and work is done in accordance with it. Therefore the representatives from academia do not produce economic outcome, they produce papers, books, research results and so on.

Especially since World War 2 a different modus of science has been developed. This is often labelled Modus II Science (Gibbons) and science is here an applied science where the important issue is change and development. Research policies have been orientated towards supporting a move in this direction. Research programmes emphasise usefulness, an orientation towards results. Different national and European programmes have been established to lead universities and researchers in the right direction. One could of course with Leydesdorff argue that the so-called Modus 1 type of research is a temporal event developed in the 19th century when universities went through the 1st Academic revolution and started to see themselves as domains of both teaching and research. In this period of fragile structuring there was a need for protection, and it was clear to the surrounding world that in this period of enlightenment research did produce understanding and i.e. enlightenment, therefore the autonomy was based on reciprocal trust where dissemination of knowledge should happen through research-based teaching in the tradition of Humboldt.

In a modern world of speed waiting for the dissemination of knowledge through the production of graduates is not seen as acceptable. This model of vertical knowledge transfer is considered limited without taking full advantage of society's investment in research. Therefore new models have been developed.

And researchers such as Leydesdorff argues for Triple Helix models, where structures, or rather structural couplings, are established between government, business and research, but at the same time accepting that we are talking about different domains or systems with specific codification and competences (Etzkowitz & Leydesdorff). Therefore the DNA model (triple helix) is suggested where systems interact and are interdependent, but not brought together because it would lead to convergence and loss of the full potential of their different competences. Meaning that if universities turn into businesses they will be codified towards surplus instead of producing science and vice versa (if one can imagine that).

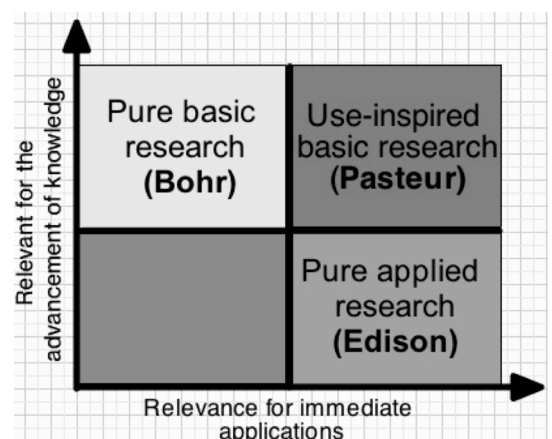
These structural couplings are materialized in initiatives such as laboratories, Tech Trans set-ups and different liaison offices. The laboratory model is adopted from the US with initiatives such as the Media Lab at MIT and Rank Xerox Lab. In Denmark we have tried to develop such laboratory settings as a kind of translation zone between universities and the rest of the society. They share an archetypical

story moving from great reciprocal expectation between business and research, where both parties involved are able to realize the great mutual benefits. This might be on a rather superficial level: Where research communities brand themselves by collaboration with business, or the business partner includes this in the annual report to shareholders or seeks to secure validity through statements such as: “developed together with this or that university”. After a period disillusion arises and at a given time (after 2-4 years) a peak of inflated expectations is reached. Business enterprises experience that researchers are in fact researchers and therefore more interested in peer-reviewed papers than in sustainable business solutions. The developed systems and artefacts are often raw prototypes which are valid for research, but seldom solid or workable enough for marketing. Researchers realize that business partners are more interested in the market than in insight. And the funding earmarked for the initial phase will disappear when governmental (or other) programmes move on to new policy issues. The translation zone disappears or becomes part of the university routine, according to the codification described above, or they become semi-autonomous set-ups spending their time on applying for new kinds of funding. Whether this development is avoidable or not is a key question. One could argue that it is bound to happen, but things change a little every time such initiatives take place. On the other hand it seems that a lot of learning and generated knowledge about such processes disappear and new set-ups seem to repeat the story. I will argue that this is avoidable, but that further development depends on a more generic understanding of the phenomenology of Tech Trans and the relationship between innovation regimes and Tech Trans.

The very expression Tech Trans is reductionist

First of all we have to understand that the very expression Tech Trans is reductionist. It is not a mail service designed to transport technology from one domain to another we are talking about. The process of Tech Trans is often not about transportation – it is about translation and transformation, and in order to increase the likelihood of this to happen we have to look into practices of research and development. Boundary crossing between different domains means that change will happen. We know from theories on learning that the notion of transfer from education to practice is more about developing language and optics for understanding than just applying the learning that takes place in school to another domain. Inspired by that insight we can move a little closer to the different practices of research.

We will use the model known as Pasteur’s Quadrants as our initial framework. This model is developed by Stokes (Stokes 1997). His model suggests a separation of different research practices depending on whether the researchers strive for and are concerned with “pure” understanding or applied research with focus on use. But at the same time Stokes emphasises that if we want to understand scientific development we have to understand that the linear model of the relationship between research and application is too simplistic. Moving from pure research to



applied research to deployment work to production and operation is simplified and single-dimensional. Empirically we can use Pasteur and his work to show that a case such as the development of organic chemistry in the 19th century was a result of pre-college applied research, practical experiments and “pure” research. That is not our actual agenda. Instead we try to highlight that the relationship between research and industry is different when we talk about pure research where application very often will be depending on co-operation and relationship to environments for applied research within a company. This means that pure research is an important component in development of business, but that transfer is depending on more than translation or transfer. Here we are talking about transformation and translation. When we deal with the kind of research, which we embrace, in Pasteur’s part, with both inspiration from use and pure research consideration, we have a process of translation. And in relation to the development lab of Edison we might talk about a simple transfer, but in his case with an attached price tag.

This means that when we talk about Tech Trans as a process we do need to distinguish between different research practices and different partners. In short:

Bohr	Transformation and translation
Pasteur	Translation and transformation
Edison	Transfer

And when we talk about structure

Bohr	Research partners
Pasteur	Collaborative Laboratories
Edison	Sales office

This means that we can talk about a process where the developed knowledge, which in our case is embodied as different technological artefacts, is manifested in different ways. In the case of Bohr we do not have embodied knowledge. The scientific results call for a strong research-based interface among industries. The statement from research could be something like: “We have learned this and it adds to our understanding, but whether it can be used for something practical or not we do not know and we do not care!” In the case of Pasteur we have something on its way to embody an assemblage, an episteme, which in collaboration can embody knowledge – but we are still talking about not yet embodied knowledge. Therefore we are not talking about statements, but rather invitations to collaborative dialogues. “We have found out this or developed this, and we would like to move further, but we need your collaboration to do so!” In the case of Edison we have the embodied knowledge and we might need a skin like a practical and market-orientated branding. “Hey this is a great invention couldn’t you market and produce it? Then we can split the profit!”

These illustrations do not mean that Tech Trans always moves from the university to private or public enterprises. Quite often, when industry has developed or invented something, they move the opposite way. Then they might need a technical knowledge injection to solve this or that problem or they need a more phenomenological interpretation: “We have invented this – but what is it and what does it mean?”

When the BONITA projects should be developed further we need to have a clear understanding of how Tech Trans *takes place*. Note the expression since Tech Trans both is temporal and spatial - takes place. We have a relationship between process and structure or, in more academic terms, between the ontology and the epistemology of Tech Trans. The obvious spatial component is the showrooms,

and the temporal is the Tech Trans process. The actual artefacts being exhibited could then be seen as the reification of research, which might mediate the relationship between flow and structure. The innovation researcher Lundvall states "Learning by interacting is fundamental since it transforms the outcomes of learning by doing and learning by using from being local to becoming non-local. Embodying knowledge in new services and products may be seen as an alternative to codification as mechanism of generalizing local knowledge"(Lundvall). Experience from different Tech Trans set-ups suggests that the reification of knowledge in the form of prototypes or demos is very beneficial to this process. Here we might add that the very technology seen as the artefacts (which of course is only part of technology – more on that later). What we could call the ontic status of the artefact is here explored through different ontologies depending on whether we are talking about actors from one domain (business) or another (research). But the very reification will enable, or at least could enable these different sense makings and also bridge the sense making between different domains.

Different Innovation Systems

This takes us back to the so-called innovation system. The above-mentioned researcher Lundvall suggests a differentiation between two or rather three basic models of innovation system. On one hand we can identify the innovation system as rooted in the R&D-system, the second is the innovation system rooted in the production system and the third innovation system is rooted in the production and human resource development system. The first one is the classic idea that new insights are produced at universities and could be distributed and translated to business through different mechanisms: He calls this STI 'Science-Technology-Innovation', but I would prefer to call this vertical innovation. The second model highlights the more horizontal process of innovation between industries: He labels this DUI for 'Doing-Using-Interacting'. Again I would re-label this horizontal innovation. Lundvall also introduces a third one that puts special emphasis on the HR-dimension, especially the access to a workforce, which may be low skilled in formal ways, but might have a high degree of more generic competence such as flexibility, problem solving and self management (Lundvall 2005). If we demark our discussion to the first two models I would suggest that the development of Tech Trans should be done through combining the vertical STI process and structure with the DUI approach. This means that research-based innovation should be enabled and supported through the scaffolding of networks, reciprocal learning and collaboration. A basic factor in the development of such generic and at the same time specific models would be development of processes and structures where selling, translating and transforming could take place. The showrooms could be the fix point for this: the structure which reifies these processes and the actual Tech Trans would then be the process.

The usefulness of BONITA

A European system of innovation or a Baltic system of innovation should be characterized by agility and the capability to mobilize different sub regional competences. The overall purpose is to develop our economies to secure a good life for our citizens. The economic development would in more traditional economic approaches be seen as a function of labour and capital. This could be formulated as production (Q) is produced by two inputs capital (C) and labour (L):

$$Q=f(C, L)$$

This rather simple two-factor model could be expanded to include other factors such as Knowledge (K) and Tech Trans (TT) in our case:

$$Q=f(C, L, K, TT)$$

But I would rather suggest that we use a different formula and look at the usefulness of the BONITA project through the following: The usefulness of the Bonita Projects should be seen as the function of combining Horizontal Innovation (H) with Vertical Innovation (V) and generating both academic output (AO) and economic output (EO), securing investment (I), sustainability (S) and ensuring societal change (SC).

$$U=f(H*V*AO*EO*I*S*SC)$$

If the project is unable to secure the combining of horizontal innovation and vertical innovation it will not move beyond a number of other set-ups established to secure either cooperation between universities and business or to boost business innovation. If we do not secure both economic and academic output we will not be able to mobilize neither communities (business and academia), if we do not have sufficient funds we will face a steep tour up hill and if we don't secure sustainability and societal change we will not have the necessary impact to legalize neither present external funding nor future internal or external focus.

And last but not least: Please note that the factors should be multiplied, which means that if one is 0, then the whole equation will end up with a big round 0!

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