

# TECH TRANSFER IN DANISH UNIVERSITIES

- what have we learned from ten years of trying to make money on research?



# INTRODUCTION

During the last decade, Denmark and other OECD countries have become increasingly interested in strengthening the extent to which academic research results are exploited commercially. The underlying driver for this interest is a belief among policymakers that publicly financed research ought to contribute more directly to innovation and economic growth. The key mechanisms for this contribution are closer collaboration with industry, development of new technologies that can be licensed or sold to firms, and spin-out companies founded to pursue the commercial exploitation of research results.

In Denmark, the focus on how to profit from academic research is closely tied to the mantra “From re-search to invoice” that became normative for Danish research policy in the 2000’s and suggested that public investments in research should lead more directly and more rapidly than before to a pay-off, i.e. an “invoice”. Universities’ focus on the commercialization of research findings during the 2000’s was also heavily influenced by the Act on Inventions at public research institutions, which was passed by the Danish government in 1999 with the aim of strengthening the commercial utilization of publicly funded research. This Act abolished the “professor’s privilege”, transferring rights to inventions developed through publicly funded research from researchers to the university. The Act also obligated universities to actively pursue the commercial exploitation of those inventions, which they decided to take ownership of. The political ambitions behind the Act on Inventions and the government strategy “From research to invoice” are still very much alive, as illustrated for example by the government’s new national innovation strategy, which was an-

nounced in December 2012. In 2013, DEA undertook a qualitative study of lessons learned from 13 years of professional technology transfer in Danish universities. The results of the study indicate that politicians’ and policymakers’ continued beliefs in the short-term economic potential of increased commercialization of university re-search might be in need of some adjustment.

The analysis points out that the universities’ tech transfer efforts by and large have not managed to yield a direct and measurable financial profit. The Act, which was supposed to improve knowledge sharing between academia and industry, has in some ways increased barriers for effective collaboration. Moreover, the kind of one-way, IP-based technology transfer that policymakers have emphasized represents but one of many mechanisms for effective knowledge transfer; other forms, such as collaboration on R&D, collaboration on education and training, and informal knowledge transfer are generally rated as much more important than IP-based technology transfer by university researchers and industry alike. However, they are more difficult to measure and therefore often overlooked.

## DATA AND METHODS

As mentioned in the introduction, in this study, DEA has taken stock of the universities’ technology transfer efforts since the Act on Inventions came into force on January 1, 2000. The law was passed as part of a political effort to strengthen the commercialization of academic research and eventually led to the establishment of “technology transfer offices” or “TTO’s” at all the major Danish universities. The qualitative study was based on:

- Extensive desk research (of Danish policy documents and evaluations, and of international re-search on technology transfer and the commercialization of publicly funded research results)
- On-site visits to and case studies of TTO’s at University of Aalborg, University of Aarhus, Technical University of Denmark, University of Copenhagen and Southern Danish University.
- Interviews with almost seventy resource people from the university sector, the business sector and the authorities, carried out during the period from November 2012 till June 2013.

## KEY FINDINGS

A key motivation for the study was widespread criticism of the technology transfer offices and efforts of the universities among policymakers, university researchers and industry alike.

DEA’s analysis shows that there has been a considerable and positive development in the technology transfer effort over the past ten years or so. The efforts at the Danish universities have been continually adjusted, as the universities and the political system have developed a more nuanced understanding of how to best support technology transfer. However, the study also points to significant, continued challenges, which politicians, universities and business have to address in order to effectively support the translation and application of academic research.

Moreover, DEA’s study stresses that the political framework for the technology transfer effort in

Danish universities has largely been based on unrealistic expectations of the direct economic value of university inventions. It has not been informed by an in-depth understanding of how universities and businesses collaborate most effectively on the development, transfer and commercialization of research-based knowledge and technology.

Key results of the study are summarized on the following pages.

# WHAT HAVE WE LEARNED SINCE 2000?

## TECHNOLOGY TRANSFER IS AN INVESTMENT – AND PROBABLY AN UNPROFITABLE ONE

- Technology transfer, understood as the selling and licensing of IP owned by universities, accounts for a very small part of the universities' total knowledge exchange with the business sector. This exchange primarily takes place through research-based education of the workforce of the future, research collaborations, contract research, consultancy work and informal knowledge sharing.
- The original technology transfer effort was based on an unrealistic idea that the universities' expenditures on technology transfer would sooner or later be covered by revenues from the selling and licensing of IP. Today, no Danish universities expect to earn money on technology transfer. Rather, they describe it as an investment in the dissemination and utilization of their research.
- If technology transfer is recognized as a loss-making venture rather as a profit-making venture, it is important to support the universities' continued efforts to use TTO-resources more efficiently, for instance by letting the universities concentrate their resources on fewer inventions with considerable market or societal potential, where serious potential buyers and other private investors are involved in the further maturation and transfer.

## NOT AN “OFF THE SHELF”-GOOD; SUCCESSFUL TRANSFER REQUIRES MATURATION AND KNOWLEDGE SHARING

- DEA argues that policymakers and universities have underestimated the scope and importance of the maturation process that is necessary in order to make research results commercially useful. There is a long way from the validation of inventions that takes place in the research environment to the type of validation that is necessary for private investors to be able to make an informed assessment of the business potential of these inventions. This requires a lengthy and costly maturation process guided by insight from research and from industry. The key to the transfer and commercialization of research is therefore often a close and prolonged collaboration between researchers with a promising technology and possible users from the business sector.
- The Act on Inventions overestimated the importance of patents in the transfer of research-based technology to the business sector. Patents are not the main pillar of most collaborations between universities and businesses, but rather a crowbar that facilitates collaboration by establishing a clear framework for the distribution of rights to inventions and the potential earnings from the commercialization of those inventions. Thus, it is not in the amount of patents, but in the collaboration between researchers and businesses that real, effective commercialization takes place.
- This suggests that the political goals for technology transfer – including the continued focus on transfer of IP and establishment of spin-out companies – are not effective instruments in supporting complex, long-term collaboration between researchers and businesses.

## THE ACT ON INVENTIONS HAS UNIVERSITY-INDUSTRY NEGOTIATIONS MORE DIFFICULT

- One of the consequences of the Act on Inventions is that all collaborations between academic researchers and industry must be preceded by a contract that establishes the distribution of rights and profits from the potential inventions that might spring from the collaboration. Universities and businesses are still working on establishing more efficient ways of negotiating the terms of such agreements, but in spite of improvements, the parties still spend an overwhelming amount of resources on negotiating the rights to potential future inventions, even though most projects will never result in commercially valuable inventions that would justify such negotiations.
- There is no easy way to make the negotiation of collaboration contracts more malleable, but part of the solution appears to be to (a) build on good principles and models from previous contracts, (b) draw up standard framework agreements with frequent collaborators, (c) ensure that negotiations are handled by experienced legal advisors, (d) establish a sound framework for legal negotiations by ensuring that initial expectations are clearly communicated among the parties, and (e) ensuring that researchers as well as representatives from the company's management participate actively in the negotiations so that the legal perspectives do not eclipse the strategic ones.
- In addition, companies and universities often disagree on the value of research-based inventions. This is largely due to the fact that the current (Danish and EU) legislation forces universities to sell their inventions at so-called market prices without clearly stating how market prices can be determined for a product for which there is currently no

market. Universities therefore often seek to obtain the highest possible price, in order to avoid subsequent scrutiny or criticism. Meanwhile, businesses regard the market value of university inventions as largely nonexistent because of the significant uncertainty and the need for further investments in R&D in order to (potentially) translate the research results into a viable product.

- If the primary aim of technology transfer is not to generate earnings for the university but to get promising inventions out into the business sector, we need to discuss how universities should determine a fair “market price” for their IP. There are a number of approaches that might help bring research institutions and businesses closer – including the use of windfall clauses and option agreements, as well as research collaborations aimed at joint further developing and testing of a certain technology before the rights are handed over to a company. Last but not least, it would be interesting to work with models where the university, in exchange for a lump sum at the outset of a joint venture, renounces all rights to potential inventions that might spring from the collaboration.

# WHAT ARE THE KEY CHALLENGES TODAY?

## TECHNOLOGY TRANSFER DOES NOT PAY (ENOUGH) FOR THE INDIVIDUAL ACADEMIC

- The universities are already working to create better incentives for collaboration with industry and for technology transfer. Among the most promising initiatives are the development of more flexible career paths, highlighting good role models, and creating better opportunities for mobility between the public and the private sector (for instance via part-time positions and employee exchanges).
- Collaboration with industry and technology transfer should not be seen as a “third mission” but rather, at least ideally, as a natural and rewarding extension of the two main missions of research and education. As such, the decision on the part of the individual researcher to engage in closer interaction with the non-academic world should be voluntary, not mandatory. The aim is not to get all researchers “on board”, but to ensure that there will be at least one person in all research units that collaborates with businesses; this will ensure a regular two-way flow of information and help bridge the gap between the university and the business sector.
- There is very little documentation of actual changes in the behaviour of researchers and their attitudes towards technology transfer, which is why much of the discussion of incentives is based on anecdotes. As such, DEA suggests carrying out a recurring survey among researchers, e.g. every two or three years, in order to gauge whether scepticism and lack of incentives constitute a real challenge, and if so, for whom. This would provide valuable inputs to politicians and university administrators alike.

## DOES TECHNOLOGY TRANSFER PAY (ENOUGH) FOR THE UNIVERSITY?

- Today, technology transfer is primarily financed through the base funding that is meant to support the universities’ professional development, not technology transfer or the commercial exploitation of research results. Thus, there is a need for politicians and university management to discuss how universities are to finance a growing technology transfer effort (or risk that these efforts are either prioritized lower or that draw too much funding away from other vital activities).
- As per January 1, 2013, there are no public programs that specifically support the early maturation that is needed if university inventions are to become attractive to investors. This type of funding is often referred to as “bridge funding”, “bridge the gap”-funding or “proof of concept”-funding. Effective maturation is vital, if public research results are to become commercially useful. This means that we need to ensure the availability of “proof of concept”-funding. Ideally, these funds should be distributed by experienced industry people and be invested in the maturation of research projects carried out in collaboration with potential buyers. Most of the Danish universities have since established their own, internal “proof of concept”-funds, but it remains to be seen whether this model will be as effective as the national, state-funded “proof of concept”-funding that was dissolved in 2012.

## WE MEASURE TTO'S – BUT NOT ON THE EFFECTS THAT WE TRULY WISH TO FURTHER

- Today, the Technology Transfer Offices cover a wide range of functions, which means that there is a risk that their resources are spread too thin. Also, there are some implicit contradictions between their various assignments. For example, TTO's are responsible for “protecting” university inventions from being exploited by private business and ensure adherence to a large number of laws and requirements; at the same time, they are also expected to facilitate collaboration with the business sector. These tasks do not always go hand in hand. In another example, TTO's are measured by their ability to generate revenue and are therefore under pressure to push up the prices of their IP, even though it is by now widely recognized in the universities that technology transfer cannot be expected to turn a profit. Last but not least, universities are measured by their ability to sell or license IP trade and their contribution to the establishment of research-based spin-out companies, even though the best route to commercialization does not always include patents or spin-outs but may instead take the form of a research collaboration. Thus, in order to ensure better working conditions for the TTO's and a more efficient use of their resources, it is important to clarify which aims we most wish to further, to help the TTO's to prioritize their efforts.
- Today, we measure technology transfer by something else than what we actually wish to further. To some extent, “you get what you measure”. It therefore does not make sense to measure universities based on the number of patents applied for or the number

of spin-outs they help establish, if the lion's part of value creation stems from complex, long-term collaborations, supported by flexible IP arrangements and a broad variety of formal and informal mechanisms for collaboration. Moreover, mere quantitative indicators do not always provide useful insight into developments in a TTO. For example, a decrease in the number of invention disclosures may occur if the TTO invests significant resources in upfront dialogue with interested investors, which will often lead to fewer disclosures but of a higher average quality. Such positive developments are not apparent from a superficial analysis of indicators.

- At the same time, university managers indicate that some form of measurement is often necessary, as it helps them to legitimize why they have to prioritize certain activities. DEA suggests that indicators of technology transfer ought to be used more as monitoring and management tools at the universities, rather than as a tool for policymakers with which to control the universities, in order to reduce the risk that less-than-optimal indicators skew the incentives of TTOs or university researchers, drawing them away from the most effective, long-term route to knowledge exchange. Moreover, DEAs suggests supplementing quantitative indicators with some form of qualitative insight into the policies and strategies behind those indicators (e.g. through self-assessment reports from the universities or on-site visits by a panel of peers, i.e. qualified international experts).

## HOW SHOULD TECHNOLOGY TRANSFER AT DANISH UNIVERSITIES BE ORGANIZED IN THE FUTURE?

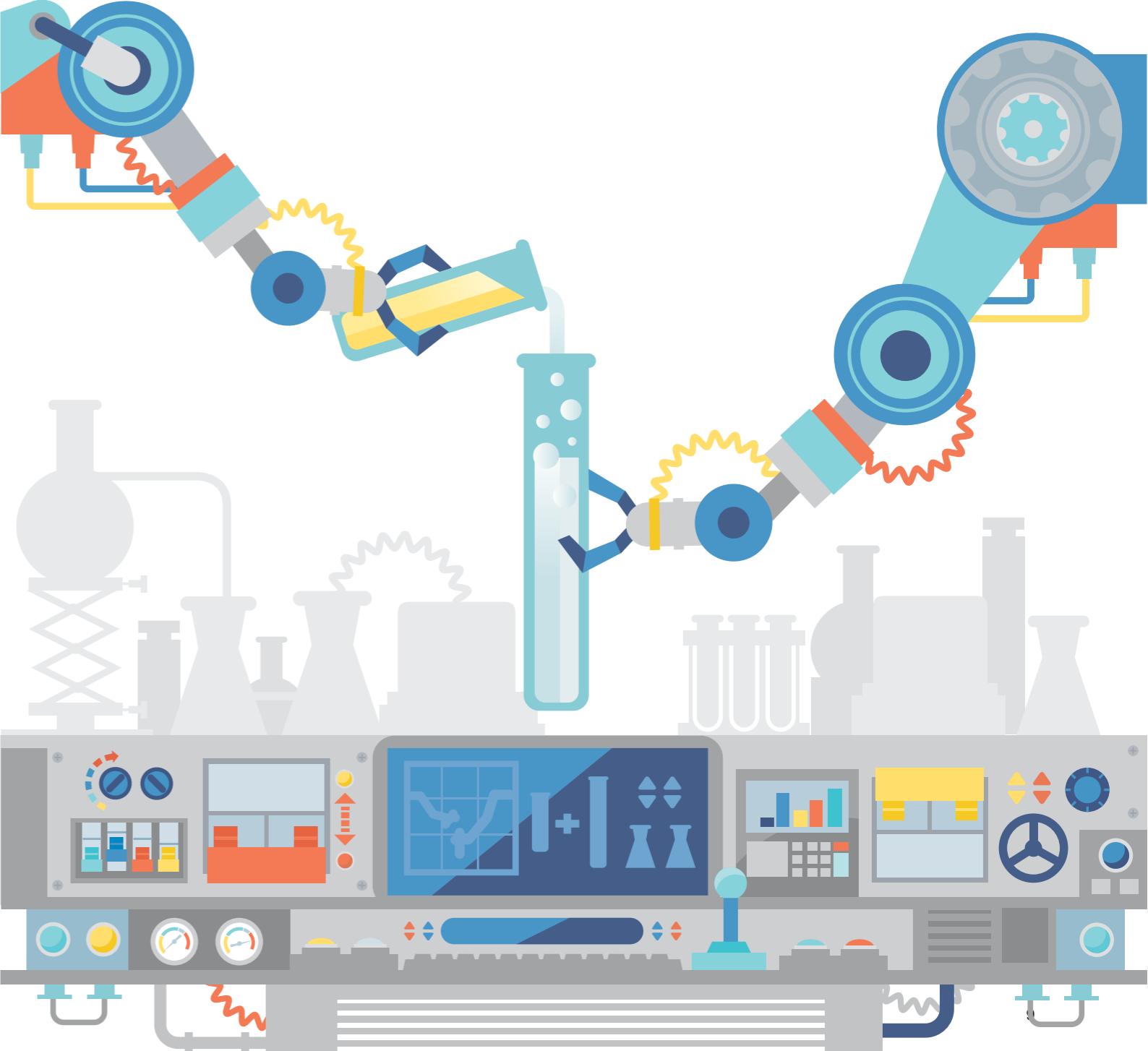
- There is no “one answer” to how technology transfer ought to be structured in the future. The individual university should be free to choose a technology transfer approach that matches the particular strategy of that institution, its interaction with the business sector, its academic profile etc.
- The suggestion of establishing one or more national TTO’s to replace the existing university-anchored TTO’s might contribute to increased professionalization and critical mass. However, DEA argues that there are strong arguments in favour of keeping the technology transfer effort at the universities in order to support the early identification and maturation of inventions and to stimulate greater focus on technology transfer as one of many dimensions in successful, two-way knowledge exchanges between universities and industry.
- That being said, it might be interesting to consider whether one or more national units might be able to lift more projects out of universities once the projects are matured and have clearly demonstrated a commercial potential. But such a national unit should complement rather than replace the existing TTO’s.
- Finally, if technology transfer is to be seen as a natural extension of research rather than a distinct, “third mission”, it has to become an integral part of the research environments. There are promising initiatives to promote “embedded technology transfer”, which should be studied in the future. These initiatives supplement the central

TTO (which often has difficulties establishing close links to the research environments) with staff hired by individual departments or research groups. These dedicated staff members can, given the right profile and expertise, become part of the research environment, providing early-stage sparing for researchers and helping to minimize bureaucratic barriers associated with the commercialization of research. However, embedded technology transfer must not come at the cost of decreased transparency or increased fragmentation of the technology transfer effort. Industry calls for greater standardization in TTO-practices, not more variation and fragmentation. Last but not least, there should be a clear division of labour and ongoing coordination between the embedded technology transfer staff and the central TTO’s.

- Finally, the analysis points to a significant potential for strengthening the inclusion of students in the universities’ collaboration with the business sector on research and innovation.

*This document presented a brief summary of a report undertaken by The Think Tank DEA and published in August 2013 under the title “Fra forskning til faktura” (“From research to invoice”). The original report and the background report (both in Danish) are available for download from DEAs webpage: <http://dea.nu/publikation/fra-forskning-til-faktura>.*

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