Financing University Research

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Abstract

While the detailed mechanisms of the interplay of knowledge creation and economic growth have been discussed in great detail by endogenous growth theory, this paper is interested in assessing the role that universities play in the knowledge based economy. It does so at the example of best practice scenarios, as currently being undertaken by the University of Oxford, U.C. Berkeley, the M.I.T. and Chalmers School of Technology. It argues that key to successful research commercialization is the leverage of clusters and networks that assure knowledge flows between universities and business. We call this the 'Third Way' of university research commercialization, which focuses on systemic change, rather than on single stakeholder intervention. It reflects a novel generation of knowledge policies that focuses on training, awareness raising and the leverage of cluster effects, rather than the development of physical infrastructure (i.e. science parks). This is a unique approach that outperforms existing best practice in many ways; i.e. it focuses on the leverage of networks among the various academic institutions, rather than repeating the traditional 'one university – one technology transfer office' approach. The 'Third Way' also outperforms existing best practices by adopting latest trends in intellectual property management , such as online trading, perceiving intellectual property as a financial asset and leveraging open innovation for improving patent quality. Organizational values, structures & procedures of various actors (business, academia, government) are recognized and different institutional cultures are sought to be overcome through boundary spanning. The competing demands and interests of business and academia are reflected through the introduction of 'social responsible university research commercialization', as currently undertaken by U.C. Berkeley.

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Knowledge Transfer – not Technology Transfer

Economic history illustrates that a lack of adequate leverage and transfer of any type of knowledge, be it explicit, tacit and organizational knowledge, leads to stagnation. In Europe, growth rates remained constant for nearly one thousand five hundred years, 'the 18th century elites of Great Britain earned about the same as the elites of Rome in the 3rd century AD.'[1] It was only during the industrial revolution that economic growth drastically increased. The practical application of various knowledge systems and inventions in business, transport and machinery that became possible during the industrial revolution meant that economic processes could be optimized and both producer and consumer surplus be achieved. These important macroeconomic shifts again were strongly driven by adequate knowledge transfer processes between academics and inventors on the one hand side and business on the other side. This is an important take away from history as it illustrates the crucial role that knowledge transfer plays in economic performance and underlines the dire need to ensure the adequate transfer of knowledge from universities to business and vice versa.

While the detailed mechanisms of the interplay of knowledge creation and economic growth have been discussed in great detail by endogenous growth theory,[2] this paper is interested in assessing the role that universities play in the knowledge based economy. It does so at the example of best practice scenarios, as currently being undertaken by the University of Oxford, U.C. Berkeley, the M.I.T. and Chalmers School of Technology. It argues that key to successful research commercialization is the leverage of clusters and networks that assure knowledge flows between universities and business. We call this the 'Third Way' of university research commercialization, which focuses on systemic change, rather than on single stakeholder intervention. It reflects a novel generation of knowledge policies that focuses on training, awareness raising and the leverage of cluster effects, rather than the development of physical infrastructure (i.e. science parks). This is a unique approach that outperforms existing best practice in many ways; i.e. it focuses on the leverage of networks among the various academic institutions, rather than repeating the traditional 'one university – one technology transfer office' approach. The 'Third Way' also outperforms existing best practices by adopting latest

trends in intellectual property management , such as online trading, perceiving intellectual property as a financial asset and leveraging open innovation for improving patent quality. Organizational values, structures & procedures of various actors (business, academia, government) are recognized and different institutional cultures are sought to be overcome through boundary spanning. The competing demands and interests of business and academia are reflected through the introduction of 'social responsible university research commercialization', as currently undertaken by U.C. Berkeley.

It stands in strong contrast to an early generation of 'technology transfer' efforts, which primarily sought to assure spill over effects from universities to business through the creation of science parks and the provision of other physical infrastructure. The very term 'technology transfer' disposes of some outdated features as it incites that commercially valuable knowledge is primarily found in the 'hard sciences' (natural sciences) and its transfer is best assured through the provision of expensive physical infrastructure. The social sciences and humanities are very much spared from any forms of 'technology transfer' efforts. This preliminary approach towards knowledge generation and exchange not only reflects an inadequate approach towards knowledge management, but also a very one sided view on universities.

We argue that the 'Third Way' of university commercialization reflects best the essence of knowledge. Knowledge is an intangible good. Its worth does not decrease, the more it is in use. To the contrary; the more it is being used, the more it becomes valuable. Thus, Knowledge displays of increasing returns to adoption. The more it is adopted, the more experience is gained and the more it is improved. It is known that allocation problems with increasing returns tend to exhibit multiple equilibria points and so it is not surprising that multiple outcomes should appear. Static analysis can typically locate these multiple equilibria.[3] Knowledge generation is associated with non-predictability and potential inefficiencies. Knowledge generation is a complex process created to solve complex problems and the component-based nature of its production means that the modular division of labour can be easily aggregated into a final structure. This modular division makes individual contributions highly effective and beneficial to a given project. The cost of collaboration in these various endeavours decrease, the more exchange takes place. That is why it is so important to emphasize on networks and the establishment of functioning clusters. The management of intangible capital functions best through the establishment of a functioning intangible infrastructure. This requires to slightly alter commonly established notions of a university.

The University's economic contribution has for a long time come to be seen through the lens of training the next generation of labour force. Universities have also been seen as contributing to new perspectives on established views. In some ways universities have come to be stylized as cultural artefacts that serve primarily the greater public good. Universities are much more than that. Say Ryan and Ghafele: 'Universities are much more than the depositories of various knowledge islands. They are neither dictionaries nor databases; they are the 'know how' and 'know why' institutions in any healthy knowledge economy. Universities dispose of the organizational capabilities to turn information and know-how into commercially valuable products and services. The collective knowledge, know-how, and learning maintained by the university, its so-called 'core competency' is difficult for a competing business to replicate.'[4] The knowledge that is embedded in universities and managed through deliberate knowledge transfer, is the ultimate source of competitive advantage in the marketplace, whether of economy, polity, or society.[5]

Universities play an important role in the knowledge eco-system and can contribute to 'creative destruction' in a classical Schumpeterian sense. It is important to underline that the primary function of universities is not 'to turn science into business,'[6] but to advance the existing knowledge foundations of humanity. In this sense it is important to optimize the

interplay between universities and business if and where it is appropriate. In order to do so it is however important to understand that knowledge within universities experiences a different type of institutionalization from knowledge that exists within business.

This paper is structured as follows. We first discuss the different institutional structures of universities and business, then explain the important role that intellectual property plays in mediating between the different institutional realities of business and academia and proceed to presenting a series of case studies that illustrate the argument. We conclude by offering five key recommendations that we deem essential for the successful transfer of knowledge from universities to business.

Because a University is not a Business?

Within the academic literature a 'business model' has come to be seen as the creation of value and the implementation of strategy to capture revenue from this value. A successful business model relies on two key elements: value creation and value appropriation.[7] Say Ghafele and Gibert:' The business model establishes the organizational, procedural and operational means by which a firm creates and appropriates value in its target market. Value creation involves all of the resources and processes deployed towards product strategy and logistical strategy. Value appropriation describes the revenue logic of the firm's operations.'[8]

This understanding of a business model is underlined by Henry Chesbrough's definition of a business model as the provision of some sort of value to third parties, from which the business derives profits, which is a result of the firm's cost structure and its turnover.[9] This definition is not fundamentally different from what constitutes a university, only, that the type of value that may be offered to third parties is somewhat different. But, then again, businesses are characterized by heterogeneity in services and products they provide. Like in companies, the knowledge generated within universities belongs to the university (Bayh Dole Act and its European variations). We thus argue that from a mere academic point of view no clear distinction can be made between a firm and a university.

The main difference is however political in nature. As the access to education is in most countries considered a civil right and university education is either provided through the state or with the support of state subsidies. In *economic* terms, it is the public provision of a private good. This artificial intervention of the regulator is probably the most important feature that distinguishes a university from a company. The public or semi public structure of most universities triggers substantially different incentive structures for universities and business. This is an important take away as essentially any business that would be turned into a public or semi public institution would experience the same type of shift in incentive structures. While it is beyond the scope of the paper to discuss in greater depth the economic rationale of public or semi public institutions, we do need to elaborate the different organizational mechanisms of knowledge generation and transfer in various settings. Last, but not least because these help to understand the challenges of knowledge transfer from universities to business and provide a baseline for improving the present situation.

The entire academic system is based on knowledge sharing and putting knowledge subsequently into the public domain. In fact, academic success is measured by how much knowledge academics succeed in putting into the public domain, be it through journal articles or through lectures and talks in public. The more an academic is quoted by peers, the better the career prospects. The academic model of knowledge generation and knowledge sharing is thus in many ways similar to the open source movement. Like in open source, many different

scientists contribute to the deliberate reflection on a scientific problem and it is the joint effort that may lead to a possible solution. Similar to open source, academics have an incentive to put their knowledge in the public domain, as they gain an indirect benefit from doing so. Putting knowledge in the public domain, increases the academic's reputational capital, which in turn may lead to better career prospects. Again, there are some striking similarities to the open source business model. While knowledge is being put in the public domain, revenues are generated through the provision of complementary services. In the case of open source, this may be a range of supplementary services that are offered in addition to the free software, in the case of academia, the knowledge that is given away for free, helps the academic in return to apply for research funding, scholarships and better paid teaching positions. Owning various forms of intellectual property, such as patents, has so far hardly been considered a prestigious asset and leads to far less reputational capital than an extensive publication track record. Also, the IP generated by academics, belongs to the University and not the individual researcher, which brings along a classical 'principal-agent' situation, where the interests of the agent (the academic) and the principal (the university) are not aligned and the agent will seek to act her own personal benefits, which do not necessarily coincide with those of the principal. The academic model of knowledge generation is thus fundamentally different from the intellectual property system and the ownership of patents or other forms of IP is in most instances seen as an additional burden, rather than a winning opportunity. Many academics also simply don't know what intellectual property is and how they could use IP ownership for their own advantage. It seems that most technology transfer offices of universities tend to not fully realize that they encounter a century old tradition of knowledge management that is fundamentally at odds with the intellectual property system.

While the 'open source' business model of academic research has succeeded in advancing our understanding of the most various phenomena, it does not lend itself necessarily as the best means to structure the interaction between universities and companies. As universities leave knowledge in the public domain, companies are free to pick and choose from existing stocks of knowledge as they please. As academics took the deliberate choice to put knowledge in the public domain, they have also given up the right to ownership of this knowledge. This means they have no say over what is to happen with this knowledge and under what conditions firms may use the university's knowledge capital. It also bears the risk that market participants are deprived of the incentive to take the knowledge further and bring it to the market in the form of commercially viable products and services. From a societal point of view the mere reliance on indirect benefits from publicly available knowledge is that knowledge is insufficiently transferred and that costs associated with knowledge generation increase, which in turn may lead to slowing economic growth. [10] Assuring the adequate protection of university knowledge through intellectual property is ultimately a matter of degree. Protecting knowledge through intellectual property is associated with costs, which in turn may mean that research becomes more expensive and academics may focus on easily attainable research outputs so to remain competitive in the search for research funding.[11]

It is not the primary purpose of the university to generate commercially relevant knowledge, but to provide novel perspectives on established views. Academia does not exist to make a profit, but to generate knowledge, nor does it dispose of the mechanisms to commercialize knowledge as widely and broadly as possible. But business does. Thus, there is a need to establish collaborative structures that enable a functioning value chain from knowledge generation to final product/service.

Knowledge Transfer as Social Interaction

Knowledge transfer may be seen as a 'process through which ideas and techniques generated at one place find their application at another place.... Thanks though this process innovation reaches out to members of a social system through various means of communication.' [12] Thus it may be seen as a as a process, a continuous interaction.[13]

As the transfer of knowledge is essentially a social interaction, it is important to assure that this social interaction functions as smoothly as possible. The transfer of knowledge contains various processes that foster the flow of know-how, experiences, knowledge and tools and aims at offering an optimized and cheaper solution.[14] The transfer of knowledge can however be expensive and not necessarily lead to desired results. Opportunity costs, such as the shift from fundamental research to applied research can be substantial. It has been observed that international knowledge transfer may be more successful than national knowledge transfer.[15]

If we perceive knowledge transfer as a social process, then it becomes evident why it is important to understand in the first instance the different incentive structures of the various players. Any type of successful knowledge transfer needs to assure that the partners involved in the knowledge transfer process have a motivation to do so and that they find themselves in a situational context that allows them to exchange their knowledge freely and without constraint.

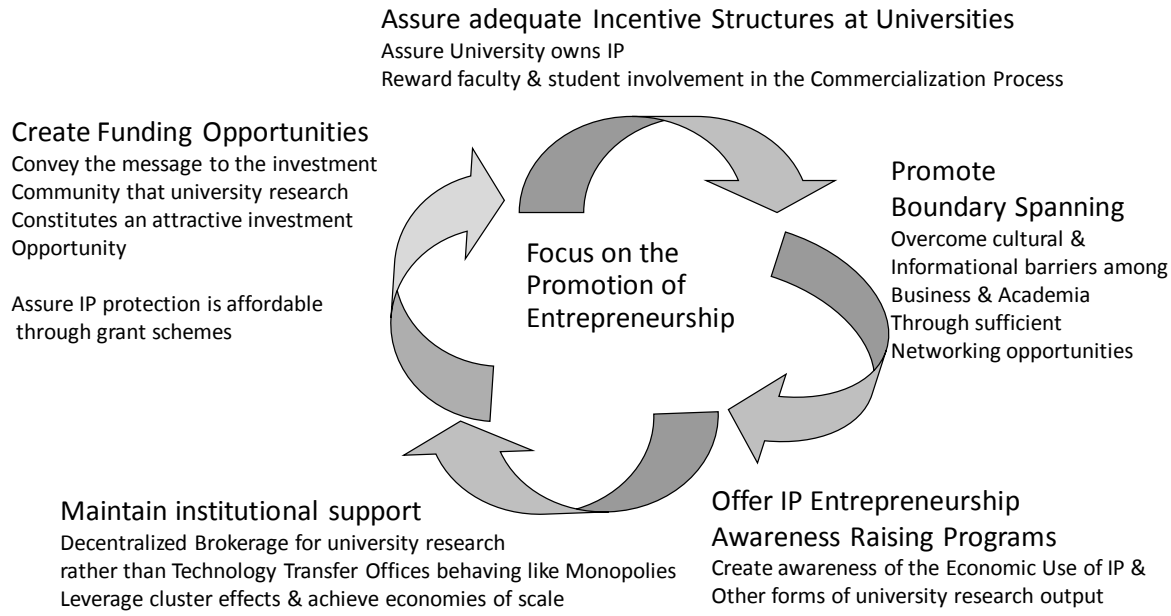
In the chart below we sought to illustrate the various elements that are needed in a virtuous knowledge transfer system.[16] In order to provide adequate incentives for academics and students, faculty and student involvement in the knowledge commercialization process must be rewarded. It needs to be considered in the annual performance review of academics and help students find jobs once they graduate. Furthermore, boundary spanning needs to be promoted. The existing cultural and informational barriers among business and academia need to be overcome through the provision of adequate fora of exchange and information channels. Networking opportunities need to be provided to guarantee an informal exchange and natural knowledge spill over effects.

This is why the creation of adequate social linkages and clusters is more important than the provision of physical infrastructure.

Knowledge transfer can take various forms. In most of these forms intellectual property plays an important role and acts as a channel for the transfer of knowledge. Yet, many academics do not know a lot about intellectual property and its economic relevance. That is why there is a need for IP entrepreneurship and awareness raising programs. The adequate institutional support needs to assured through de-centralized brokerage. Rather than have one single technology transfer office that acts like a monopoly better results can be achieved in de-centralizing technology transfer and make everyone in the university feel that 'technology transfer is their cause.' This approach reflects an open innovation approach, where every single stakeholder in the university is involved, rather than just a few people working in the technology transfer office.

While knowledge transfer can be embedded in research collaborations, contractual research or the licensing of research output, transaction costs associated with the transfer of knowledge can be controlled by using IP online exchanges, fostering IP brokerage and IP fairs. The university may also consider attracting investors who help promote the virtuous cycle of university knowledge transfer by providing the necessary funding and can in exchange have an option on future returns.

Developing a Knowledge Transfer System: Creating Leverage for Cooperation and Clusters



Source: Roya Ghafele

The Mediating Function of Intellectual Property Rights

"Intangible assets can be the source of competitive advantage only if they are supported by a regime of strong appropriability or are non-tradeable or 'sticky'.[17]

The introduction of intellectual property rights establishes property rights over knowledge. This is in my view the most important economic function of IP. The privatization of clearly codified knowledge that has been made fully explicit constitutes an important element for the establishment of a market based economy. De Soto for example observes that developing countries remain poor in spite of a wealth of natural resources because of a lack of respect for property rights. The inadequate guarantee of private property prevents the development of prospering markets.[18] A parallel may be drawn here to 'intellectual' property. The existing judicial system gives way to the creation of markets for knowledge and the transfer of knowledge in a clear and transparent form. In this way, intellectual property may be seen as the currency of the knowledge based economy. The architecture provided through IP allows to not only leverage the 'use value' of intellectual property, but also its 'exchange value'.[19] This means that knowledge may serve various purposes and that the existence of IP may give lead to secondary markets for knowledge, decoupled from primary knowledge markets.

The introduction of private property over knowledge allows the creation of surplus value. To offer a simplistic comparison: One is able to extract value from land even without owning it. One can go for example in the woods and collect bears. However if one owns land, then one can create value that may be decoupled from the land's primary function. One can start trading

the land and that trade may have really nothing to do anymore with the primary function of the land. Precisely these mechanisms are made possible through IP and for this very reason the existence of IP plays an important role in knowledge transfer. It gives way to a new paradigm of what constitutes property rights. Like other forms of property rights, intellectual property rights are artefacts. To what extent knowledge should be turned into a private property is ultimately a political decision. Access conditions remain an important element that does need careful deliberation and policy action. It is important to assure that the public interest is being maintained and that besides commercial considerations, the freedom of research is assured. This is even more so important as knowledge transfer between universities and business constitute a transfer between (semi) public and private institutions.

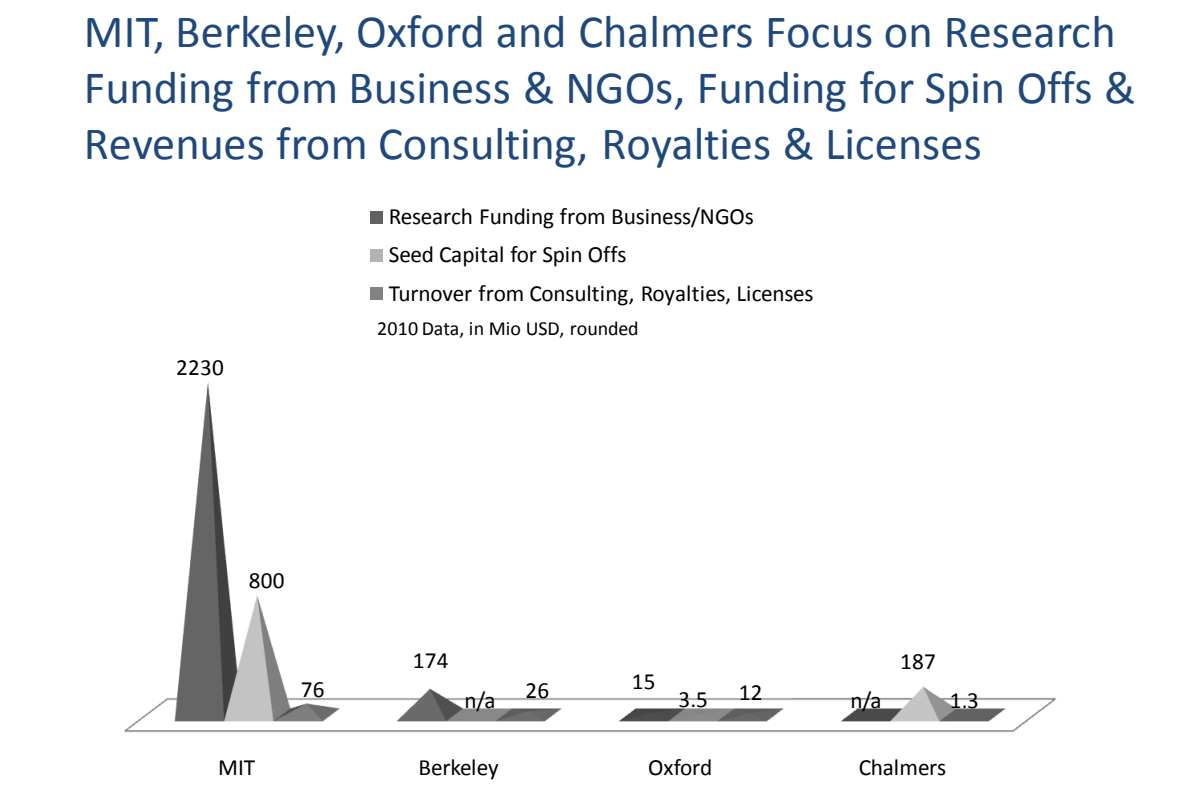
If intellectual property is being perceived as an option that gives way to economic interaction, then it becomes obvious that intellectual property rights allows the owner to create value. Buying, selling, trading, licensing or donating IP for free becomes possible through the establishment of property rights over knowledge. Intellectual property makes knowledge explicit and in this sense separates the knowledge creator from the knowledge. The dilemma associated with tacit knowledge is overcome. IP also allows to hedge against various risks associated with the creation of new knowledge. Knowledge generation can be sometimes a search for the metaphorical needle in the hay. While IP cannot minimize the risk associated with the search for new knowledge, it provides a compensation scheme for the research efforts that were associated with this search. This being said, Scherer and Harhoff document that only 10% of an average patent portfolio dispose of commercially relevant value.[20]

Finally, it is misleading to associate intellectual property primarily with patents. Intellectual property comprises the most various forms of creative expression. Copyrights and related rights, trademarks, trade secrets, design rights, protection against unfair competition allow academics across all disciplines to protect their intellectual property. Yet, there is an overarching lack of awareness of other forms of intellectual property. Paradoxically, this has helped mitigate the principal agent dilemma that universities face in their knowledge management. As most universities very closely watch their patents, but tend to ignore other forms of academic proprietary expressions, academics remain by and large unconstraint to use these forms of IP as they see fit.

Case Studies

In order to assess the practical implications of the arguments made above, we chose a couple of case studies. We selected the M.I.T., the University of California at Berkeley, the University of Oxford and Chalmers School of Technology in Sweden. We chose these cases as they reflect in our view current best practice in university knowledge transfer. Also, the author is personally familiar with U.C. Berkeley and Oxford, having worked in both institutions. Chalmers School of Technology again is interesting as it is not a very famous university and operates in a country with high taxes that is strongly oriented towards social welfare goals. Thus the institutional context in which Chalmer's find itself is completely different from that of the U.S. and the U.K. universities. Yet, the way Chalmer's chose to commercialize its knowledge replicates very much the decentralized knowledge transfer system we propose. U.C. Berkeley again is interesting as it is one of the few schools that assures that knowledge transfer is undertaken in a socially responsible way. Successful knowledge transfer is not only expressed in monetary terms, but also through the provision of public welfare. With respect to IP, Berkeley promotes open innovation clauses and issues on a broad scale non-exclusive licensing arrangements.

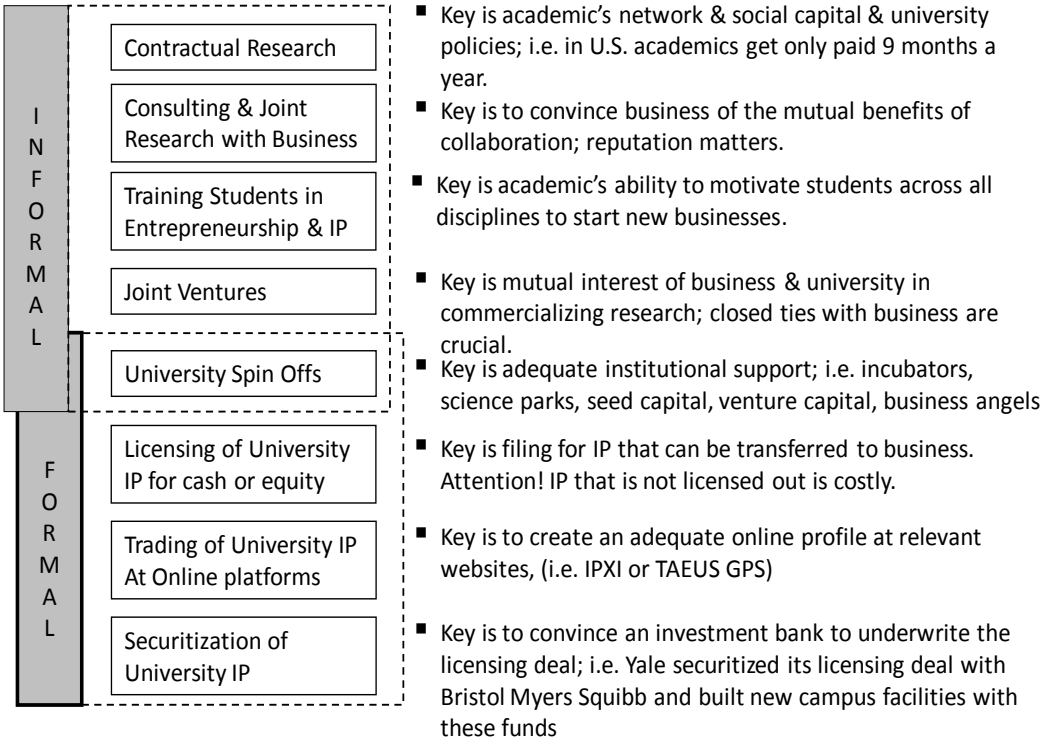
We assessed the case study sample according to common features and applied strategies in research funding. The analysis was based on publicly available secondary information and no interviews were conducted with staff members. We believe that a further in-depth study of these case studies could be a valuable area for future research. The significant gaps that exist between U.S. universities and European universities may be explained by a different political economy in which European and U.S. universities find themselves. Thus, there is a certain lack of comparability of data. When studying these four cases, we were interested in trying to understand where major sources of funding come from; what knowledge commercialization strategies were employed; and what initiatives had been launched to realize superior value from knowledge.



Source:
Roya Ghafele, Websites,
Oxford: Revenues from consulting not fully monitored, Chalmers: Reseearch Funding from Business/NGOs not monitored, Berkeley: Seed Capital for Spin Offs not monitored

When looking at the major sources of funding, one common feature emerges. All universities generate funding from the same type of sources; namely research funding from business and NGOs, seed capital for spin offs and spin outs and income from consulting and royalties and licenses from intellectual property. Certainly, the M.I.T. is unrivalled in its overarching income streams, but this can be explained by the different institutional context the M.I.T. is operating in, the strong reputation the school has as well as the solid alumni network of the university. Chalmer's university again attracts a lot of seed capital for its spin outs, which reflects the entrepreneurial spirit of the school and the strong orientation towards knowledge entrepreneurship in most areas that the school is providing training in. From a structural point of view this analysis suggests that successful knowledge transfer is multifaceted and needs to reflect a solid mix of revenues from IP, consulting, VC /Angel and other institutional funding for spin offs and research funding from the wider community. This is illustrated in the Chart above.[21]

All Case Study Universities Leverage Many Channels to Commercialize University Research



Source:
Roya Ghafele

All universities we studied leverage a variety of channels to commercialize their knowledge. Both formal and informal channels serve to assure to reach out to the widest audience. Channels of commercialization can range from contractual research, to consulting and joint ventures with business to training students in entrepreneurship and particularly in intellectual property. Among the more formal channels of university research commercialization we find the licensing of university research in exchange for cash or equity, the trading of IP at online platforms, such as the Chicago based Intellectual Property Exchange International or the securitization of intellectual property. The various channels require different skill sets and different approaches to assure that mutual interests are aligned.

In order to promote consulting and other informal means of knowledge exchange it is important that university policy enables such an exchange. In many universities in continental Europe, academics are not even allowed to consult for business. On the other extreme are U.S universities which only pay a salary for nine months in a year and expect academics to earn an income from another source during the other three months of the year. The University of Oxford is somewhat in between as it allows academics to consult for 30 days in any given calendar year.

Formal means of exchange require adequate institutional support. Incubators, good contacts with venture capital firms and business angels are crucial to spin off companies from the university. Other formal channels, such as the online trading or securitization of IP are quite new and have mainly been used in U.S. contexts. These certainly constitute arising opportunities for universities. All of this is summarized in the chart above.[22]

University Research Commercialization Initiatives

Initiative	MIT	Berkeley	Oxford	Chalmers
University owns IP	√	√	√	
IP Awareness Training on Campus				√
Government grants/public support for IP protection	√	√	√	√
Social Responsible IP transfer & Open Source		√		
Entrepreneurship Education	√	√	√	√
Business Plan Development Programs	√	√		√
Advisory Services, External Consulting Firms	√	√	√	√
Student Entrepreneurship Organizations	√	√	√	√
Commercialization Services on Campus	√	√	√	√
External Service Provider for Commercialization	√	√	√	√
University on Campus Incubator	√	√		√
Outside Incubators Situated in Town	√	√	√	√
Seed Capital	√	√	√	√
University Shares in Spin Offs & Licenses	√	√	√	√
Official Incentives for Commercialization				√

Source:
Roya Ghafele, Rasmussen et al. Technovation 26 (2006) 518-533, University Websites

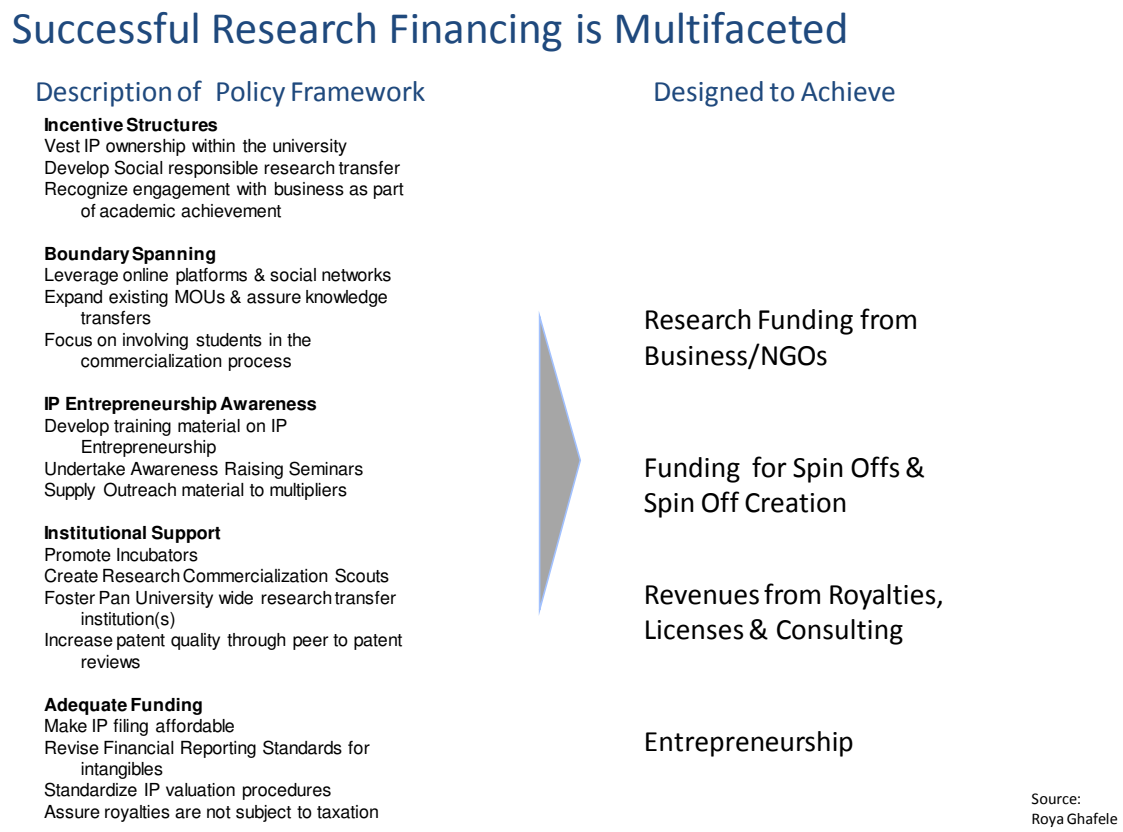
Structural similarities can also be observed when looking at the various initiatives universities took to assure the successful commercialization of research. All Universities have spin off and licenses programs, incubators, external service providers situated within proximity of the university, commercialization services on campus. All are surrounded by consulting firms (i.e. Oxfirst Limited or Oxford Analytica in Oxford) that seek to transfer university knowledge to business. Emphasis on public support for IP protection and government grants is also assured in the universities we studied. At Chalmer's the individual researcher and not the university owns the IP. This may be the reason why knowledge transfer in Sweden is so decentralized. Official incentives for university research commercialization exist also only in Sweden. Chalmer's School of Technology is also the only university to offer extensive training on intellectual property across various faculties. Thus, it is not only taught in the law school. This is summarized in the chart above.[23]

Conclusion

Knowledge transfer between university and business is conventionally justified via the university's ability to train the next generation of labour force and to assure spill over from the Engineering and Natural Sciences Departments, which has genuinely been viewed to be best achieved through the development of physical infrastructure. The rationale we propose for the transfer of knowledge is entirely different: Knowledge transfer is understood as a social process that is best achieved through the provision of an adequate intangible infrastructure. This comprises the development of networks, clusters and adequate incentive structures within the universities. Knowledge is intangible in nature and it can best be transferred through a

systemic approach that adequately grasps its intangible nature. Within that context it is important to understand IP as an enabling mechanism. IP can be an instrument that empowers universities because it increases the economic advantages derived from research and precipitates a governance structure owned and operated by the university. The potential benefits of this governance structure are supported by cluster research emphasizing social cohesion, good management, trust and collaboration, community culture, ethics and university leadership.[24]

Successful knowledge transfer is neither black nor white; it is a matter of degree. This paper sought to sketch out knowledge transfer as a social process that is driven by economic actors with various incentive structures. It has been argued that knowledge transfer is not primarily driven by the provision of physical infrastructure, but the adequate provision of an intangible infrastructure that enables economic actors to come together, exchange knowledge in an informal way and trade it for their mutually beneficial interest. In order to make this happen, it is important that the university's policies reward such activities, which is an important element to change the widely established custom of putting knowledge only in the public domain. The cases we presented are at the forefront of university knowledge commercialization and may serves as best practice example for a range of continental European Universities. Many of them still lag behind in adopting initiatives that enable and promote boundary spanning between universities and business. This essay sought to explain at the example of practical cases how successful university research transfer can look like and what elements need to be considered. The universities we studied generate funding from three major areas; research funding from business and NGOs, spin offs and revenues from intellectual property and consulting assignments.



In the chart above we have summarized the five areas that are most needed to continuously grow revenues from existing income channels. In order to provide adequate incentive

structures it is important to recognize engagement with business as part of the academic achievement. To assure boundary spanning the necessary social platforms need to be maintained and further developed. Online platforms, such as LinkedIn, can be very helpful to maintain relations with potential partners. University alumni networks form an equally important network that helps commercialize university research. Lack of awareness of both intellectual property and entrepreneurship can be overcome through training and awareness raising programs. Rather than have centralized courses, decentralized training through 'awareness raising scouts' may be preferable. Further institutional support may be promoted through decentralized university research transfer institutions and by assuring that intellectual property protection remains affordable. All of this is summarized in the chart above. [i]

Recommendations

Based on our analysis we recommend therefore the following steps for successful knowledge transfer (26):

- **Provide Incentive Structures for Knowledge Transfer**

Assure that the Performance review of faculty members includes off-campus activities in addition to research & teaching;

Reward faculty members for conducting research in partnership with non-academic-professionals

Assure faculty members have the freedom to choose if they want to engage in applied research and business projects

Assure that university policies allow the knowledge transfer and that academics do not act outside the law when collaborating with business

Develop Social responsible knowledge transfer strategies and ask academics to comply with these norms

- **Promote Boundary Spanning**

Develop performance plans that measure to what extent cooperation with organizations outside the university improves research activities

Seek to develop at the departmental level relationships with private or public sector institutions, as well as seed capital

Develop a reputation for collaborating with business & seek to be highly regarded by business/investors

Get recognized by business & society for flexibility & innovativeness

Leverage online platforms & social networks

Expand existing Memoranda of Understanding (MOUs) & assure knowledge transfers

Focus on involving students in the commercialization process

- **Develop IP Awareness Raising Programs**

Teach Entrepreneurial skill sets & business aspects of IP across the university

Assure faculty members are aware of IP & recognize the potential commercial applicability of research

Assure that the University is very responsive to new ideas & innovative practices

Help Students to secure high quality industry positions

Develop training material on IP Entrepreneurship

Undertake Awareness Raising Seminars

Supply Outreach material to multipliers

- **Guarantee a high Level of Institutional Support**

Develop university wide departments/groups/individuals dedicated to business/university liaison activities

Seek to benefit from the proximity of Science Parks and Incubators

Use feedback to improve institutional support for commercial activity

Create positions for Research Commercialization Scouts

Foster Pan University wide research transfer institution(s)

- **Be Creative in Identifying New Funding Opportunities**

Seek significant funding from sources other than the Government

Generate off campus benefits from research projects

Generate income from university spin offs, licensing out IP, consulting & contractual research

Inspire students to use their education to scope new business opportunities and start new firms

Make IP filing affordable & assure royalties are not subject to taxation

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