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Finnish university technology transfer in a whirl of changes: A brief summary

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Antti-Jussi Tahvanainen

FINNISH UNIVERSITY TECHNOLOGY TRANSFER IN A WHIRL OF CHANGES

– A Brief Summary –

Etlatieto OY / Elinkeinoelämän Tutkimuslaitos

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TIIVISTELMÄ:

Tämän tiivistelmän pohjana olevassa selvityksessä arvioidaan innovaatiojärjestelmässämme hiljattain tapahtuneiden ja tapahtuvien merkittävien aloitteiden ja uudistusten vaikutusta teknologiansiirtotoimintaan suomalaisissa yliopistoissa. Keskeisimpiin yliopistoja koskeviin uudistuksiin lukeutuvat Strategisen Huippuosaamisen Keskittymien (SHOK) perustaminen, korkeakoulukeksintölain voimaan astuminen vuoden 2007 alussa, ja yliopistolain tulevat massiiviset muutokset. Analyysissä pyritään peilaamaan yliopistojen alustavia kokemuksia yllä mainittujen uudistusten aiheuttamista muutoksista uudistusten alkuperäisiin tavoitteisiin. Tässä yhteydessä tunnistetaan myös keskeisimmät haasteet ja hyödyt yliopistojen näkökulmasta.

Tulosten mukaan SHOKien tuomien hyötyjen odotetaan muodostuvan pitkäjänteisemmistä tutkimushankkeista ja rahoitusyhteisistä, kunnianhimoisemmista tutkimustavoitteista, näiden mahdollistamien radikaalien innovaatioiden synnyttämisestä, tutkimuksen monipuolistumisesta, tutkimusyhteistyön lisääntymisestä ja tehostumisesta, eri yliopistojen roolin profiloitumisesta innovaatiojärjestelmässä, resurssien lisääntymisestä valikoiduilla aloilla, ja huippuosaajien rekrytoinnin helpottumisesta. Haasteiden nähdään liittyvän erityisesti SHOK:ssa syntyvien immateriaalioikeuksien laajoihin ja korvauksettomiin hyödyntämisoikeuksiin, jotka saattavat uhata yliopistotutkimuksen vapautta. SHOK -haasteiksi luetaan myös huippututkijoiden heikot kannustimet osallistua SHOK-hankkeisiin, vahvan yritysvetoisuuden vaarat akateemisen tutkimuksen laadulle ja kansainväliselle kilpailukyvyllä, laajan osallistujapohjan tehottomuus, ja sekavien valmistelukäytäntöjen aiheuttama tiedonpuute.

Korkeakoulukeksintölain tuomat hyödyt puolestaan muodostuvat tieteen ”norsunluutornin” vaiheittaisesta purusta, keksintöilmoitusmäärien lievästä noususta ja hallinnollisten käytäntöjen ja rutiinien virtaviivaistumisesta. Lakimuutoksen tuomat haasteet nähdään liittyvän erityisesti lain immateriaalioikeuksien kohdentamista säätelevien ratkaisujen tulkinvaraisuuteen, hallinnon uudelleenjärjestelystä koituvaan taakkaan, yliopistojen hallinnon sitoutumattomuuteen, ja tutkija-, hallinto, sekä yritysmaailmojen välisiin kulttuurieroihin.

Lopuksi tulevan yliopistolakiuudistuksen hyödyt nähdään uudistuksen tuomassa taloudellisessa joustavuudessa, jonka odotetaan ilmenevän vapautuneen sijoitustoiminnan ja vapaamman budjetoinnin muodossa. Erityisesti yliopistolähtöisten uusien yritysten perustaminen ja näiden tukeminen tullee helpottumaan. Yliopistojen taloudellisen itsenäisyyden myötä toivotaan myös, että teknologiansiirtotoiminnan rooli yliopistollisessa kokonaisstrategiassa tulisi vahvistumaan, jolloin myös resursointi paranisi. Haasteiden nähtiin liittyvän sekä hallinnollisen että liiketaloudellisen osaamisen puutteeseen yliopistoissa ja teknologiansiirtotoiminnassa. Nähtiin, että osaamisen hankinta on keskeinen menestystekijä siirryttäessä uuteen hallintomuotoon, jossa myös teknologiansiirtotoiminnan sisäinen liiketaloudellinen osaaminen tulee korostumaan. Mahdollisuudet hankkia osaamista riippuvat yksiköiden resursoinnista ja täten tulevan yliopistojohdon teknologiansiirtotoiminnalle kaavailmasta strategisesta roolituksesta.

JEL: O30, O38, O33, O34

Avainsanat: Strategisen huippuosaamisen keskittymät, SHOK, yliopistolaki, korkeakoululaki, teknologiansiirto, innovaatiojärjestelmä, tutkimus- ja innovaatiopalveluyksiköt

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ABSTRACT:

Finnish university technology transfer is currently caught in the turbulences of major changes in the national innovation system. Three virtually simultaneous changes are of special importance. The first is the massive on-going renewal of the Universities Act governing the Finnish higher education system in its entirety. It was originally initiated to provide universities with more financial and operational flexibility and autonomy and, thus, with better premises to fulfil the three mandates (i) to educate, (ii) to conduct academic research, and (iii) to impact societal welfare. The second change is the foundation of the so-called Strategic Centres for Science, Technology and Innovation (Finnish acronym: SHOK) that aim at establishing and re-enforcing long-term research cooperation between the academia and the Industry. The final change is the enactment of the new University Inventions Act in early January 2007. The Act provided universities with the rights of ownership to inventions made in sponsored research that, according to the principle of the professor's privilege, were considered property of the respective academic inventors prior to the change.

In the beginning of 2008 Etlaieto Ltd. interviewed 11 of 20 research universities active in Finland to capture the potential impacts the three changes might have on university technology transfer activities. The set of interviewees comprised professionals conducting different tasks in the technology transfer units of universities ranging from research directors to technology transfer officers to lawyers.

According to the results, the expected benefits of the renewal of the Universities Act mainly comprise of the increasing financial flexibility of universities hoped to translate into a proliferation of tools available for the transfer of university technology (support of start-ups, investments etc.), and a general increase in the profile of technology transfer functions that should alleviate their current deficiency in resources. Challenges regarding the Universities Act, on the other hand, relate to the lack of administrative and business related expertise in universities required to fulfil the up-coming tasks mandated by the Act, and the lack of commitment on part of universities' management resulting in insufficient resources.

SHOKs, in turn, are expected to enable longer project cycles, to reduce administrative burden, to encourage the setting of scientifically more ambitious research objectives, as well as to increase research collaboration and its efficiency. Challenges were identified to relate to proposed IPR-practices potentially endangering the academic freedom of university research, the incentive schemes of top researchers to participate in SHOK projects, the inefficiencies of a large participant base, and the dangers of a strongly industry driven mode of co-operation to academic values.

Finally, the benefits of the University Inventions Act are expected to emerge from the gradual dismantling of the "ivory tower of academe", an increase in the amount of received invention disclosures, and more efficient administrative practices in university technology transfer functions. Perceived challenges, in turn, include interpretational difficulties of the Act, the modest commitment of university management to university technology transfer in general, increasing administrative burdens, and strong cultural differences between researchers, industry and university administration.

JEL: O30, O38, O33, O34

Keywords: Strategic Centres for Science, Technology and Innovation, SHOK, Universities Act, University Inventions Act, university technology transfer, national innovation system, technology transfer offices

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Introduction

Finnish university technology transfer is currently caught in the turbulences of major changes in the national innovation system. Three virtually simultaneous changes are of special importance.

The first is the massive on-going renewal of the Universities Act governing the Finnish higher education system in its entirety. It was originally initiated to provide universities with more financial and operational flexibility and autonomy and, thus, with better premises to fulfill their three mandates (i) to educate, (ii) to conduct academic research, and (iii) to impact societal welfare. The transfer of university technology to societal use is considered one focal means to contribute to the latter mission. The renewed act will be enacted September 1st, 2009 and universities must show compliance with it by January 1st, 2010.

The second change is the foundation of the so-called Strategic Centres for Science, Technology and Innovation (Finnish acronym: SHOK) that aim at establishing and reinforcing long-term research cooperation between the academia and the Industry. Six SHOKs in six strategic sectors of the Finnish industry bring together companies, universities and research institutes that represent excellence in their particular fields. The participants of each SHOK jointly design a long-term (5-10 years) strategic research agenda based on the visions of future technological needs of the Finnish industry. The agenda is then implemented in SHOK-programs. SHOKs are financed by Tekes and the Academy of Finland.

The final change is the enactment of the new University Inventions Act in early January 2007. The Act provided universities with the rights of ownership to inventions made in sponsored research that, according to the principle of the professor's privilege, were considered property of the respective academic inventors prior to the change. The aim of the act was to update the incumbent legislation to better match the modern networked nature of academic research and its financing. In particular, the allocation of IPRs between diverse parties involved in different types of research, a task that was rather cumbersome under the incumbent legislative regime, was at the center of renewal and streamlining efforts.

In the beginning of 2008 Etlatieta Ltd. interviewed 11 out of 20 research universities active in Finland to capture the potential impacts the three changes might have on university technology transfer activities. It is the first and only study with this particular focus conducted in Finland today. The set of interviewees comprised professionals conducting different tasks in the technology transfer units of universities ranging from research directors to technology transfer officers to lawyers. Certain experts at relevant government agencies were also interviewed. The interviewees and their affiliation were guaranteed full anonymity. The interviews were semi-structured and rather extensive spanning over about three hours each. For each of the three changes separately, the interviewees were asked to discuss the perceived and expected benefits and threats the changes pose to the transfer of university technology as interpreted from the interviewees' respective positions. The 9 universities excluded from the study included three business schools and three universities

of arts. These were excluded deliberately from the study. The remaining three universities did not answer to our interview requests.

In this brief summary of results obtained in the study (reported in-depth in Tahvanainen, 2009), we proceed with discussing the three changes as separate topics. For each topic we depict the central aspects of the underlying change first, and then briefly summarize the respective views provided by the interviewees in the form of concise tables at the end of each chapter.

Reform of the Universities Act

Underlying megatrends

The reformed Universities Act will be enacted September 1st, 2009, and universities will be obligated to comply with it starting January 1st, 2010. The reformed Act will replace the current Universities Act enacted in 1997, and extends the financial autonomy of universities by converting their current status as governmental accounting offices into juristic persons of public law that are independent of governmental control. For universities it is the most significant change since universities were nationalized in the 1970s.

Finland has done well in recent evaluation of its university system. The Research and Innovation Council (formerly known as Science and Policy Council) evaluated the university system in 2003-2005, while the OECD completed its study of the Finnish higher education system in 2006. Both reviews identified some strengths. The Research and Innovation Council concluded that the Finnish system and its structures are well positioned in an international comparative landscape. Both the quality of research and the productivity of universities were found to have shown a significant and steady growth. The quality of education received praise as well. The OECD, in turn, listed the relatively large intake of students, the solidity of governmental financing and the broad student support system as indicators of strength. In addition, the quantity and level of expertise of graduates as well as the research conducted within the system were argued to be in line with international demand.

Some challenges were identified as well. These challenges relate mostly to long-term megatrends that, according to both reviews, need to be taken into account in the design and development of the Finnish university system. These megatrends comprise, for example, the globalization of economic activities and technological development, the functional and geographical split and relocation of respective activities and resources, the demographic change of societal structures, the structural change of economies, and, in particular, the change in the nature of research reflected in its professionalization, its more and more networked structure, the growth of unit sizes, and an increase in costs.

In the light of these challenges especially the OECD emphasizes the importance of the development and the continuity of innovation activities for the sustained success of Finland as a small economy. In this context universities are argued to play the most central role in the national innovation system. The reviews disclosed a number of more defined weaknesses of the university system posing a threat to the continuity of sustained innovation. Among others, these include (i) the introvert and rather closed-up organization of research failing to provide incentives for international cooperation, (ii) rigid career demands of researchers and professors, (iii) sharply defined boundaries between scientific disciplines inhibiting interdisciplinary and innovative research approaches, (iv) the long average duration of studies, and (v) the conservative, hierarchical leadership and management culture that has previously been in line with the prevailing university culture and the nature of university activities but does not match with the requirements of the contemporary developments of research activities.

Both reviews also propose countermeasures to tackle the challenges. The Research and Innovation Council suggests that the regional and quantitative development of the university system should emphasize the creation of fewer but larger units to focus resources and boost efficiency. This is also argued to have a simultaneous positive effect on the quality and content of research. The Council stresses that strengthening the structural linkage between science and its application in the industry is vital to the sustainability of innovation. The professionalization of university management was seen as one measure central to this strengthening. The extension of the financial autonomy of universities, however, was argued to be even more important. A more autonomous standing was seen as a prerequisite for the flexibility that is required in today's more professional, international and highly networked environment in which financing must be procured from various different sources.

The OECD was in agreement with this argument. According to the organization's assessment the general governmental budgetary legislation that universities are subjected to inhibits the universities' flexibility to act in the modern operational environment. The introduction of more autonomy would enable the diversification of the universities' financial basis. The procurement of external financing, free engagement in commercial activities, strategic investing, procurement and administration of assets, the strategic exploitation of profits and budgetary surpluses, the demand driven deployment of personnel, and the need-based reallocation of educational resources according to the fluctuations in demand would allow universities to be more efficient promoters of societal impact as producers and disseminators of technology.

Central aspects of the reform

The changes introduced by the reform will be unprecedentedly wide and thorough. Therefore, in the following we will discuss only those changes that are central from the point of view of university technology transfer operations.

The most central of changes is the conversion of universities from governmental institutions into independent juristic persons of public law. Nevertheless, universities will continue to uphold the governmental responsibility to fulfil their public mission as mandated in the educational and research policies. At the same time, foundations maintained by universities cease to exist as separate juristic persons, the assets of which will be incorporated into the balance sheets of universities directly. The University of Helsinki and the Åbo Akademi University will be exceptions, as their foundations will remain separate juristic persons.

The administration of universities will be reformed in a way that enables them to operate better and more independently in their new economic position. The election of university board members will still be handled internally but the share of external members will increase to at least 50 percent including the chairman. The task of external board members is to set down strategic university policies, to allocate resources, and to develop universities as organizations. Internal decision making power of the university community will be increased in issues of education and research with the objective to promote autonomy and self-direction. Furthermore, the power to appoint a rector is delegated to the universities'

boards as a measure to strengthen the management and administration systems further by providing the rector with more authority.

Another major reform will be the conversion of the university employees' status from civil servant to contract based employee. At the same time the rights to negotiate the terms of employment contracts is transferred to the universities. These reforms are expected to provide universities with more flexible tools for designing better incentive systems and for practicing better personnel policy.

In contrast, the degrees granted by universities and the educational responsibilities related to them will still be governed by decree of the Council of State. In parallel, the allocation of educational responsibilities among different universities will be governed by decree of the Ministry of Education. This is to ensure that the system provides an appropriate amount of higher education and that it does not exhibit too much internal overlap. Thereby, it is aspired to allocate resources efficiently and productively, and to ensure a coordinated match between the supply of education and the demand for educated workforce.

After the reform, universities as independent juristic persons will be excluded from the governmental budget system. This does not imply, however, that they will not continue to receive governmental funding anymore. The bill states (*loose translation*):

"[Universities] will annually be assigned funding by way of governmental budgeting for carrying out the tasks allotted to them in the Universities Act. This will be realized in such a manner that the responsibility of funding public functions of universities remains with the government, that the level of governmental funding does not deteriorate, and that further discretionary funding can be directed to more specified special tasks of national scale. The underlying allocation model of governmental funding rewards the quality, the impact and the efficiency of university operations [...]."

In addition to the above mentioned basic governmental funding, universities will still be entitled to applying for funding from the Academy of Finland, Tekes and the EU. What truly extends the set of funding tools universities could tap into are the more flexible possibilities to retain profits from universities' own business activities, donations, capital income, contract education, and tuition from students originating from outside the European Economic Area. Prior to the reform universities are not allowed to conduct proprietary business activities, and most extraordinary profits from diverse activities such as technology transfer have to be returned to the state. Also investments into commercial entities are subject to special permission granted by the Ministry of Education.

As a down-side of autonomy universities will be financially responsible for their operations and obligations. The government will no longer warrant the wealth of universities. Universities will have to attend to issues of liquidity, solvency and creditworthiness. This will require the capitalization of universities when the reform is implemented. According to the bill draft, the government will capitalize all universities adequately. At the same time, funding that has so far been provided to universities in a more retrospective manner will now be paid out in even lots at the beginning of each month, in a more front-loaded

manner, to enhance universities' liquidity. Economic responsibility of universities will be reflected in a newly emergent need for economic, commercial and legal expertise, and, among other things, will force universities to conduct risk analyses and to take adequate insurance coverage.

Intended impact

According to the bill draft, the general objective of the reform is to provide universities with operational preconditions that "[...] increase universities' opportunities to enhance their internationalization, quality, and societal impact, but also to improve their productivity and efficiency." Simultaneously, the reform seeks to align the regulations governing Finnish universities with those governing the world's leading universities. The latter has the objective to facilitate in securing funding, in competing for international financing, in establishing cooperation with foreign universities and research institutes, and in the participation in international markets for education.

The autonomy will motivate universities to set strategic targets by focusing resources on their respective strategic areas of research, for example. This, in turn, will help universities to profile and position them within the national innovation system. This will also have direct positive effects on the development of regions around universities through industry cooperation and the emergence of new companies. Especially the supply of contract research and consulting services should be easier under the reformed regime. Furthermore, the reform should enable universities to enhance their interactive capabilities with their surrounding environments and improve their reaction times to changes therein. This flexibility is expected to have a positive effect on innovation and the labor demand driven supply of education in general.

University mergers

The reform answers also to the critique of a too fragmented university system by legislating on the mergers of 7 Finnish universities. The merger of Helsinki School of Economics, Helsinki University of Technology and University of Art and Design, Helsinki, resulting in the establishment of Aalto University has received the majority of public attention. At the same time Turku School of Economics and University of Turku merge to form the new University of Turku. Finally, University of Joensuu and University of Kuopio will form the University of Eastern Finland.

The above mentioned university mergers will not be dealt with here as they were out of the scope of the underlying study.

The universities' perspective

Table 1 summarizes the central findings of the study regarding the reform of the Universities Act. It sums up the potential benefits and expected challenges of the Act as seen by

professionals working in university technology transfer at universities in Finland. The table is designed to be as comprehensive as possible, and will, thus, not be elaborated on further within the limited scope of this summary of results.

Table 1 The universities' expectations regarding the reform of the University Act

Benefits	Challenges
<p>Improvement of financial flexibility and autonomy:</p> <ul style="list-style-type: none"> • Detachment from frigid federal budgeting decreases fragmentation of financing and research projects. • Investment activities of universities become legitimate and expand the set of tools applicable to university technology transfer. • Investment activities enable universities to establish start-ups even without the inventors' active participation in their management. This is expected to result in a higher start-up rate. • With the renewal of the Universities Act the returns on technology transfer activities will be appropriated by the universities themselves, and not the federal government anymore. These returns can then be allocated directly to technology transfer activities again. • Universities will be able to form joint-ventures with companies as another new mechanism of technology and knowledge transfer. <p>Increase in resources for university technology transfer activities:</p> <ul style="list-style-type: none"> • The reform is expected to elevate the priority of technology transfer in the design and discussion of university strategy and, thereby, to affect an increase in resources allocated to technology transfer. • The reform is believed to increase competition for research funding due to the financial independence and the implicit financial responsibility of universities. In addition to an increase of resources in top research universities, this is believed to positively affect the general average quality of research in Finnish universities. • Competition for research funding is expected to emphasize the importance and role of fund raising services provided by technology transfer units of universities, which might find expression in increased resources. • Competition for resources and explicit recommendations issued in the bill motivate to centralize technology transfer functions across universities. This is expected to lead to a more efficient use of resources as well as a broader supply and availability of different transfer services for researchers and inventors in any given university. <p>Other benefits:</p> <ul style="list-style-type: none"> • The newly imposed requirement to monitor the working hours of university staff individually is hoped to alleviate the problem of not being able to determine the origins (project and individual inventors) of a given invention. This in turn, is expected to facilitate in the determination and allocation of IPRs and, thereby, in the negotiations with potential licensees and other types of users. • The administrative flexibility brought on by the reform is expected to be reflected in a more efficient and effective recruitment of relevant human resources and expertise. 	<p>Changes to the administrative structures and practices:</p> <ul style="list-style-type: none"> • Universities currently are not endowed with the expertise and know-how required to lead and organize an organization that is a financially responsible juristic person of public law. • Can universities attract the necessary administrative expertise from outside (external members of the universities' boards, Ministry of Education)? <p>The growing role of technology transfer activities:</p> <ul style="list-style-type: none"> • Technology transfer offices are not yet endowed with the necessary commercial expertise required to provide services related to commercialization of inventions in the interface of academia and industry. • The recruitment of commercial expertise is challenging due to the high opportunity costs that the appropriate professionals face. • Currently the majority of technology transfer officers active at universities is employed by the Foundation for Finnish Inventions and, thus, is funded externally. This renders the continuity of operations uncertain. • The availability of necessary resources required to fulfil the law-based mandate to affect societal impact through the transfer of technology is dependent on the commitment of university administration to the cause, which varies heavily among universities. • Demands of financial independency and profitability of technology transfer activities are ambiguous and vary among universities. • Demands of profitability might lead to the selection of research projects based on their financial lucrativeness instead of their scientific ambition. <p>The impact of the Decree of Public Charges of the Universities Act:</p> <ul style="list-style-type: none"> • Universities will have to monitor the flow of governmental money through single projects, laboratories and cost pools diligently in order to be able to determine the terms at which they can sell inventions. Inventions that are even partly financed governmentally must be sold at pre-determined terms, which has been a major inhibitor of technology transfer already prior to the reform. Furthermore, the implementation of the required monitoring systems and practices will cause substantial transaction costs. <p>The applicability of the copyright law to university activities:</p> <ul style="list-style-type: none"> • The growing share of copyright protected materials in education and a tight copyright regime might endanger the quality of university education if universities are required to carry copyright related fees themselves after the reform. Until now the Ministry of Education has carried a major share of the fees.

Strategic Centres for Science, Technology and Innovation (SHOKs)

Underlying megatrends

The need for strategic, if not exclusionary, choices in drafting and implementing national innovation policy emerged from several government-initiated reports that identified a number of global challenges for Finland addressing issues regarding, e.g., the quality and productivity of public services in a country with a rapidly aging population. The identification of these challenges provided the basis for a line of argumentation, according to which the public actors of the Finnish innovation system should affect an increase of private and public investments in R&D activities. These investments have traditionally been distributed rather evenly over all innovative activity in Finland. Through the Strategic Centers for Science, Technology and Innovation (henceforth SHOKs – the Finnish acronym), the aim is to break with the tradition and lay more emphasis on the scientific and economic relevance of innovative activity as the decisive criterion for public funding while, at the same time, acknowledging the significant role of basic research as a prerequisite for innovation as well. The overall objective is to promote growth and renewal of the economy and to generate employment.

The initial ideas leading to the establishment of SHOKs emerged as early as 2003 at the Research and Innovation Council (RIC), which is chaired by the Prime Minister, and advises the Council of State and its Ministries in important matters concerning research, technology, innovation and their utilisation and evaluation. It is responsible for the strategic development and coordination of the Finnish science and technology policy as well as of the national innovation system as a whole.

RIC's SHOK initiative is largely grounded in two separate, wide-reaching assessments by both the Council of State and the RIC evaluating the structure of publicly funded research in Finland. In its report on Finland's globalization published in 2004, The Council of State claimed that, in order to generate and maintain high-grade, competitive excellence in Finland, it would be necessary to create centers or agglomerations endowed with a sufficiently large critical mass in their respective sectors. According to the report, the creation of such centers would necessarily imply exclusionary selection, but, at the same time, also facilitate a targeted allocation of limited resources to those sectors of industry and academia considered most significant regarding the competitiveness of the Finnish economy. In its own assessment published later in 2004, RIC implicitly approved the conclusions derived by the Council of State. In the report, RIC emphasized the importance of setting priorities and selective decision making regarding international cooperation as well as in developing national operations. In congruence with the argument, RIC's report demanded the establishment of new, internationally noticeable, high-quality programs and centers of innovation, research and development.

Based on RIC's report, the government made a decision in 2005 to reallocate and provide additional resources for publicly funded research. Thus, RIC set up another committee in 2005 to conceptualise the SHOKs, a task that was completed in 2006. Based on this work, Tekes and the Academy of Finland started their work on facilitating the establishment of the

SHOKs in sectors that are considered best to meet the long-term needs of Finnish industry and society. The first SHOK was established by the forestry sector in 2007. Another three are operational by now (ICT, metal and machinery, as well as energy and environment) and further two will be founded in the course of 2009.

What are SHOKs?

In the SHOKs companies, universities and research institutes will agree on a joint research plan, a strategic research agenda, which aims to meet the projected needs of companies regarding the development of technology and innovations five to ten years from now. The research agenda is implemented through research programmes, consortium projects and company projects. The research programmes form the core of SHOK research activity and serve the purpose of creating a strategic foundation of knowledge and the basis for the development of applications in consortium and company projects in subsequent stages. In the programmes, participants develop shared know-how, shared technology and service platforms, and utilise shared research environments and research tools. That being said, the nature of research efforts and technology development in SHOK programmes is pre-competitive with a broad group of the SHOK shareholders and partners being jointly engaged in research.

Consortium projects and company projects are implemented by a smaller group of participants than research programmes. They support the objectives of and build on the SHOK research programmes and continue to develop ideas created in these towards market application. The projects help to ensure that the results of research programmes are applied efficiently and extensively. Consortium projects will be funded to a lesser degree by Tekes as companies take on more responsibility of financing.

The openness of cooperation in SHOK programmes is also reflected in the general IPR guidelines according to which all participants of single programmes are provided with the *right to use* any IPR emerging out of the programme's research world-wide and across the entire corporate structure *without having to provide compensation* to the original inventor of the IPR. The *ownership* to the IPR remains with the inventor. The IPR regime is still one of the most disputed issues among SHOK participants with considerable tensions existing between the industry's and the universities' perspectives.

As recommended by RIC, the administrative core of each SHOK is a limited company with the SHOK participants constituting its shareholders. In addition to companies, this includes also universities and research institutes. The company has a coordinating role preparing program funding applications, taking care of the internal organization of SHOK operations, and mediating between shareholders. As the corporate perspective is supposed to dominate and have a direct influence on research in SHOKs, universities and research institutes have been allocated a maximum cumulative share of around 30 percent in the respective SHOKs. 70 percent is allocated to industry participants. Shareholders of SHOKs are privileged to have board representation, to participate in the design of the strategic research agendas, and, thereby, to have an influence on the substance of research to be conducted in the SHOK environment.

This does not imply, however, that SHOK research is to be carried out in a close circle of shareholders exclusively. On the contrary, it has been a shared consensus among key SHOK organizers that the viability of SHOKs is dependent on broad domestic and international networking with actors that are endowed with strategic excellence in the relevant fields of industry and academia. Not being shareholders, these external actors are not entitled to board representation in SHOKs, and, thus, cannot have a decisive influence on the research agendas. They will, however, be integrated into the programs and consortium projects on contractual or other provisional basis. External participants will not have the same unlimited right of use to IPR as have the shareholders. In addition to the shareholders (companies, universities, research institutes, etc.) and external participants, public funding organisations (most notably Tekes - the Finnish Funding Agency for Technology and Innovation – and the Academy of Finland) commit themselves to providing funding for the centres in the long term.

Regarding the interrelation between the growth of economic productivity and the role of SHOKs, it is important to note that productivity growth increases in two dimensions; first, through the growth of productivity in existing firms, and second, via creative destruction, when firms of low productivity exit the economy and new firms of higher productivity enter it. SHOK's were created primarily to serve the former dimension by increasing the value added and improving efficiency in existing firms. The latter dimension has been excluded from the context of SHOKs, as they are being addressed through other innovation policy instruments. Nevertheless, SHOKs are expected to have spill-over effects impacting start-up activity, for example.

In summary, SHOKs were established to address the following aspects of the Finnish national innovation system:

- The need for stronger *strategic* choices in allocating public investments into innovative activity.
- Allocation should not be based on political agendas. Rather, the actors (companies, universities, research institutes, etc.) should decide on and, hence, commit to the choices themselves.
- Allocation choices should be based on their impact on the economy and society, industry strategies, and the existing knowledge base.
- The need to reallocate *existing* resources strategically, instead of exclusive focus on new resources.
- Strategic choices should aim at:
 - finding ways to improve quality through critical mass and co-operation,
 - securing economic and societal relevance of public investments,
 - improving international visibility and attractiveness, and
 - assuring strong interaction between knowledge producers (academic research) and its users (industry).
- The need to emphasize application- and problem-driven modes of research and R&D that combine different expertises instead of limiting the focus on single scientific disciplines or technologies.
- The need to promote strategic long-term research as well as applications thereof, which would motivate all parties to maintain their level of involvement.

The universities' perspective

Table 2 summarizes the central findings of the study regarding the universities' views on SHOKs. It sums up the potential benefits and expected challenges of the instrument as seen by professionals working in university technology transfer at universities in Finland. The table is designed to be as comprehensive as possible, and will, thus, not be elaborated on further within the limited scope of this summary of results.

Table 2 Universities' expectations regarding SHOKs

Benefits	Challenges
<p>Long-spanning, strategic, and program-specific funding is expected to facilitate:</p> <ul style="list-style-type: none"> • longer programs and funding cycles, the shortness of which has so far fragmented research and tied too big a share of researchers' time to the administration of research applications. • the design of more ambitious and rigorous scientific research agendas due to less short-sighted objectives and dead-lines. • the design of <i>strategic</i> research agendas that could help universities to profile themselves in the innovation system, focus resources efficiently on core research sectors and build up a critical mass of excellence as a competitive advantage on the international level. • the emergence of radically new inventions and innovations due to more ambitious research agendas. <p>Focusing funding on selected sectors of research is expected to:</p> <ul style="list-style-type: none"> • generate a larger volume of research programs, • facilitate and provide incentives for universities to invest into research infrastructure that opens up new possibilities for research and education in terms of substance and quality, • enable the recruitment of top research know-how and expertise due to increase in resources and quality of research, • provide necessary conditions and resources to international co-operation, • and facilitate investments into the development of relevant meta-sciences <p>in the respective sectors.</p> <p>The close and continuous co-operation network of SHOK-partners is expected to:</p> <ul style="list-style-type: none"> • decrease transaction costs related to the search of funding sources and potential industrial partners. • enhance cooperation efficiency as common practices become established and institutionalized over time. • broaden the geographical horizon for peripheral and secluded universities to find partners that, so far, have been scarce in the respective local settings. • enable research at a given university to expand into new fields as SHOKs bring together partners of different types not having cooperated before. • facilitate the accumulation of knowledge of and experience in industrial business logics and objectives thereof that has been lacking in universities so far. 	<p>The <i>unrestricted</i> right to use inventions and other materials resulting from SHOK-projects endangers:</p> <ul style="list-style-type: none"> • the emergence of spin-off companies from universities, because their IPR position is too weak to attract external financing or because the incentives for the aspiring entrepreneurs is too low, for example. • the ability of universities to operate and cooperate in subsequent research projects outside the SHOKs. As research is cumulative and one project builds on the results of the former, universities need unlimited access to and freedom to operate with materials from past research, including materials emerging from SHOK-projects. Especially, if universities' rights to utilize materials emerging from SHOK projects in industrially sponsored projects is limited to any extent, future research is severely hampered. <p>The right to use inventions and other materials resulting from SHOK-projects <i>without compensation</i> to the inventing party endangers:</p> <ul style="list-style-type: none"> • the participation of top researchers in SHOK projects, as the expected returns from other types of industry sponsored projects are much higher for these individuals. • the legality of operations in the light of the decree of public charges (integral to the up-coming Universities Act) and EU-legislation. <p>The strong industry-dominated drive underlying the setup and execution of SHOKs may lead to:</p> <ul style="list-style-type: none"> • a short-sighted design of research agendas based on short-term corporate objectives. • a cut in the length of projects already considered too short for scientifically ambitious objectives. • a decrease in scientific ambition. • a weakening of the competitiveness of Finnish research in the international arena. <p>Limiting or encumbering scientific publication in SHOK-projects might:</p> <ul style="list-style-type: none"> • endanger the participation of top researchers. • impede the publication of theses, which is prohibited by law. <p>An oversized base of partners might:</p> <ul style="list-style-type: none"> • jeopardize the efficiency of decision-making. • result in inefficient compromises. • dilute the concept of excellence sought after by the SHOK-program. • result in the failure to focus resources, one of the central objectives of the SHOK-program. • lead to poor-quality research. <p>Inadequate preparation practices have led to:</p> <ul style="list-style-type: none"> • a lack and fragmentation of information. • an inflamed atmosphere characterized by misunderstandings. • hesitation to participate on part of the universities.

Reform of the University Inventions Act

Underlying megatrends

The new University Inventions Act was enacted on 1.1.2007 after a decade of extensive preparations. The need to reform the Act was driven by permanent changes in the nature and framework of university research - developments the incumbent legislation was falling behind from. The incumbent legislation was effective in regulating a research environment characterized by university funded research conducted by single groups. After the 1980s the environment started to evolve quickly, and universities began to complement the basic university research budget from external sources to an increasing degree. To shed more quantitative light on the development, in 1985 the share of external funding constituted 8 percent of universities' total general budget. In 2002 the share already exceeded 35 percent. When talking just about research budgets, the share of external university research funding exceeded 50 percent in 2001. For polytechnics the figure added up to 74 percent. 70 percent of external funding originated from governmental sources such as Tekes, the Academy of Finland and different ministries. Explicitly demanded by the set criteria for obtaining external governmental funding, universities started to conduct co-operative research in networks based on funding from a multitude of complementary sources. In 2001 15 percent of research funding originated from corporations. As a consequence of the change towards a more networked regime of research and financing, issues regarding the allocation of IPR, for example, became more complicated. At the same time, the significance of inventions and IPRs as a source of social welfare in a knowledge-based economy began to increase, and demanded a more strategic approach regarding legislation.

Due to the rapid developments and a lagging legislation one was forced to interpret many different, separately designed Acts originally enacted for very different purposes and forming a jungle of clauses that were hard to navigate through. The development of the new Act was initiated to (i) clarify and streamline IPR issues, (ii) to assure that universities are provided with sufficient legal, economic and other premises necessary to exploit their inherent expertise and knowledge, (iii) to strengthen the ties between research and economy by developing appropriate and supportive practices and rules of conduct, as well as (iv) to expand the duties of universities to encourage and support the exploitation of university technology for the well-being of the society. In the following, we briefly present some of the most central issues the Act was designed to address in detail.

Some specific issues of concern

According to the bill draft (HE 529/2004) one of the most central problems with the incumbent legislation was related to the exceptions provided to researchers in the Employment Invention Act that normally accorded all rights to inventions made by employees to the employer. The so-called "researcher exception" assigned researchers employed by a university ownership to their own inventions. With the advent of the emergent and increasingly wide-spread practices related to co-operative research described

above the exception was found to cause severe difficulties in interpretation and application. To be more specific, in a setting in which researchers with a multitude of different backgrounds of employment co-operate in a single project it was difficult to determine to whom the exception was applicable to. The mode of employment became the sole factor in determining who was assigned the rights to inventions even when all participants were contributing to projects and, thereby, to the creation of inventions equally. External factors like the contribution of materials or data by third parties could not be taken into account, for example. Different employment relations also lead to situations in which rights to invention had to be split up between a number of parties inhibiting the efficient use of the IPR in subsequent endeavours.

In addition to practical problems, the exception was argued to be outdated also in its basic principles. The exception was originally based on the assumption that the work of researchers is much more autonomous and self-governing than a standard employee relationship with the researchers themselves carrying a lot of responsibility in shaping their work, designing projects and carrying them out starting from the idea all the way through to the results. Given this autonomy and responsibility, an invention was argued to be the accomplishment of the researcher more than that of the employer who, in a standard employment relationship, contributes to a greater extent to making an invention by providing essential input in a way or the other. With the recent developments in the way academic research is being conducted, however, the differences in responsibilities and the autonomy between an academic researcher and standard employees (e.g. researchers working at private research institutes) are continuously diminishing as external sponsors provide ever more input in terms of defining the research objectives, providing data and facilities, and involving their own personnel into the project. Thus, the grounds for the exception are not necessarily justifiable today.

According to the bill draft HE 529/2004, another key objective of the reform was the prevention of circumstances in which inventions remained unexploited due to the lack of interest on part of the researcher or due to any other potential conflicts regarding commercialization. It was argued that a single researcher *not being interested in engaging in the commercialization of his/her inventions* exclusively could not invest an efficient amount of resources in protecting the invention, assessing its commercial value and potential, establishing the necessary network of contacts, agreeing on appropriate terms of use with possible licensees, guarding him-/herself from the often superior position of large industrial licensees in negotiations etc. To prevent these cases, the idea was to provide universities with the right of ownership to inventions if the inventor expressed his/her disinterest in commercializing the invention.

Lastly, universities' were intended to be provided with new and better tools for monitoring the emergence of academic inventions and their commercialization, which was rather inefficient under the incumbent legislative regime that did not require the obligatory disclosure of inventions.

Specific reforms introduced by the Act

The Act introduced four separate major reforms to the incumbent legislation. First, the scope of the Act's application was extended to cover not only universities but also polytechnics. This had the intention to harmonize and level the playing field in cooperative research between universities and polytechnics regarding the allocation of IPRs and the legal interpretation practices thereof. The Act covers all patentable inventions (as defined in the Patent Act 550/1967). This contributed to maintaining common standards regarding requirements of inventiveness and patentability between the Employment Invention Act and the University Invention Act, which, thereby, was supposed to harmonize rules of conduct in cooperative university-industry research.

The second and probably most significant change concerns the classification of research into categories that determine the allocation of IPRs among research participants. The Act introduced three categories (independent research, contract research and other research), the former two of which only are of real significance in the context of technology transfer. *Independent research* comprises those endeavours that have not been conducted in cooperation with an external party partly financing the project. For example, research financed by the universities' own research budget or personal research grants are classic examples of *independent research*. Inventions emerging from *independent research* implicitly belong to their original inventors as they did before the enactment of the reform. The most significant difference to the earlier regime in this category is the new obligation to make a formal invention disclosure that precisely specifies the origins of the invention. Furthermore, the universities now have a secondary right to the invention that they can evoke in the case that the inventors are not willing to commercialize the invention themselves.

While the conditions of *free research* resemble those characteristic of research regulated earlier by the "researcher exception," *contract research* shares many similar traits with research conducted under the regulation of the Employment Inventions Act. This category comprises all research funded by an external party and conducted jointly with an external partner. To give an example, virtually all projects financed by Tekes fall into this category. All inventions that emerge from *contract research* belong now to the universities. The respective university has the obligation to declare whether it is going to use its right to the invention and promote its commercialization within six months of the date of disclosure of the invention, or the rights will automatically be returned to the inventor. In nearly all cases, in which a university has evoked its right of ownership, it has been transferred to the industrial partner of the original research project as has been the custom in Finnish university-industry cooperation. As the right of ownership remained with the inventors prior to the reform, separate IPR transfer agreements had to be drafted with each researcher in each project individually. This constituted a rather large administrative burden. One of the reform's central aims was precisely to lessen this burden by automating the transfer of IPR to the university. With the rights of ownership resting with the universities instead of a large number of individual researchers, the reform was expected to create an easily approachable interface, a "one-stop-shop" of sorts, for the industry that was supposed to decrease search and other transaction costs related to university cooperation, coordination and the definition of roles for companies.

The third reform introduced by the Act is the above mentioned obligatory invention disclosure that is applicable to both categories of research. In addition to its obvious advantage of revealing a larger number of inventions that would have not surfaced under the prior legal regime, the obligation to disclose was expected to have positive impacts on administrative tasks as well. Among other things, the disclosure identifies precisely all of the original contributors to an invention. Earlier it was not uncommon that the project leader took all of the credit for a given invention. In addition to the inventors, the disclosure identifies the exact project of an invention's origin, and, thereby, facilitates the designation of a project into the three categories of research. The reforms are expected to help in defining the appropriate compensation for inventors and lessen conflicts in allocating IPRs among participants.

The fourth and final reform legislates that an inventor is to be compensated appropriately no matter in which research category the invention has been made in. This implies that universities are expected to evoke their right of ownership to an invention only in cases in which economic returns are expected to arise. The compensation is seen to recompense the inventor for the added value that the invention has provided the university with in excess of the inventor's contractual duties to his/her employer.

The universities' perspective

Table 3 (next page) summarizes the central findings of the study regarding the universities' views on the reformed University Inventions Act. It sums up the potential benefits and expected challenges of the Act as seen by professionals working in university technology transfer at universities in Finland. The table is designed to be as comprehensive as possible, and will, thus, not be elaborated on further within the limited scope of this summary of results.

Table 3 Universities' expectations regarding the reform of the University Inventions Act

Benefits	Challenges
<p>The deconstruction of the "Ivory Tower" of academia:</p> <ul style="list-style-type: none"> Universities' mandate to promote the societal and economic exploitation of emerging university technology, as laid down in the Act, generates trust towards tech transfer functions among researchers that traditionally regard such activity as dubious. The Act signals the expansion of the role of universities and academic research in society beyond mere search for the truth. The Act encourages and legitimizes potential academic entrepreneurs so far being inhibited by the anti-commercial university culture to act against conventional academic norms and actively participate in start-up and other economic activities. The mandate to promote the societal and economic exploitation of emerging university technology has activated discussions in university administration to emphasize the role of technology transfer efforts in future. The expected increase in university-industry-society interaction is hoped to raise the relevance and, thereby, the quality of academic research. <p>A slight increase in invention disclosures:</p> <ul style="list-style-type: none"> In a number of universities the amount of yearly invention disclosures first plummeted, but then returned either to the same or a slightly higher level than before. The increase is credited to stronger promotional efforts of technology transfer units and a resulting increase in confidence among researchers. Much emphasis had been laid on convincing researchers that it is not in the universities' interest to exploit them and make profits based on inventions. The availability of resources for tech transfer activities seems to be positively correlated with the amount of annual invention disclosures. <p>Restructuring of internal administrative practices and routines:</p> <ul style="list-style-type: none"> Act imposed deadlines, processes, notifications, standardization, etc. have introduced coherence and efficiency into an existing landscape of colourful and heterogeneous practices. It facilitates communication and interaction with different parties and creates transparency, as everyone is conscious of the same principles of conduct. It reduces prejudice and uncertainty among researchers. <p>Increase in resources:</p> <ul style="list-style-type: none"> Universities' mandate to promote the societal and economic exploitation of emerging university technology, as laid down in the Act, is expected to be reflected in an increase in resources allocated to tech transfer activities. Today, tech transfer activities are mainly funded through external sources such as Tekes' TULLI-program, NOT through internal budgeting. 	<p>Room for interpretation in the allocation of inventions into invention categories determining the assignment of IPRs :</p> <ul style="list-style-type: none"> Co-operative research is mostly conducted by researchers with different affiliations. Depending on the affiliation and funding background of an individual researcher, the inventions arising from such co-operative research will be categorized differently for each researcher. This can lead to severe difficulties in assigning IPR ownership, because researchers working on the same invention may be treated differently in the light of the new Act ending up with different claims to the ownership of IPR. Because of the former issue, there is the danger that participants will be selected for projects based on their affiliation, not their expertise, in order to avoid hassle in assigning IPRs. The issue is even more difficult when an invention's project of origin is hard to identify, which is often the case as different projects may have significant overlap in terms of participants and substance. <p>Challenges related to new administrative burdens:</p> <ul style="list-style-type: none"> The universities' automatic right of ownership to IPR arising from externally funded research has no alleviating impact on the administrative burden due to the restriction of rights to patentable inventions only. Individual ownership transfer agreements with each researcher must still be made to cover inventions that are protected by copyright etc. Processing invention disclosures and other administrative tasks imposed by the Act have added to the burden of administration. <p>Lack of resources and commitment on part of universities' management:</p> <ul style="list-style-type: none"> Already under-funded tasks and duties have increased without being allocated additional resources. New resources are required to actively shape the conventional academic culture of researchers towards one that is more approving and understanding of the commercialization of research. A major share of university tech transfer operations is dependent on and financed by Tekes' TULLI-program (TULLI: "From research to business"), because resources have not been dedicated from basic operational budgets due to, e.g., a lack of university managements' commitment. A continuous, sustainable and institutionalized basic budget allocated from the universities' general operational budgets is seen as a prerequisite for the strategic development of tech transfer operations in universities now mandated by law. <p>Universities' secondary right to IPR is redundant:</p> <ul style="list-style-type: none"> Technology cannot be transferred effectively without the approval and active participation of the inventors in facilitating the commercialization of inventions as a major part of technology is tacit. As the secondary right to inventions is specifically aimed at making sure that inventions will find application in the case an inventor is not interested in it herself, the right is seen as inefficient. <p>Cultural differences:</p> <ul style="list-style-type: none"> The research profession is still characterized by a culture that is predominantly anti-commercialist at a number of universities. Incumbent generations of researchers inhibit the promising cultural change among younger generations of researchers. Cultural inhibitors have been observed among universities' management as well (lack of commitment, risk aversiveness, etc.)

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