This document presents the draft summaries of the case studies of the knowledge triangle carried out by countries participating in the OECD project.

Introduction

1. Higher education institutions (HEIs) and public research organisations (PROs) are central actors in innovation systems. The Knowledge Triangle approach in policy calls for a better integration of education, research and innovation at HEIs and PROs in order to increase their contributions to the local and national economy. But the diversity of institutional models means that their contributions to innovation vary greatly within and among countries.

2. This document presents the draft summaries of a series of country case studies that have been prepared by countries participating in the OECD-TIP project, using a common template, in order to explore the national policy frameworks and institutional level practices for integrating research, education and innovation activities of higher education institutions. The project is therefore particularly focused on the policies, or suites of policies, and institutional practices that can improve the collective contribution of research, innovation and education to economic growth and integration of higher education and public research institutions into regional and national innovation systems.

Theoretical framework

3. The knowledge triangle is a policy framework that stresses the need for an integrated approach towards research, innovation and education policies, especially those directed towards higher education institutions which fulfil several important roles in national innovation systems. As such the KT concept is grounded in the national innovation systems (NIS) framework which emphasises the systemic nature of innovation and the role of different actors (firms, public research in an innovation system and their relationship with others actor and the surrounding environment, notably markets). The role of universities within national innovation systems depends on a range of factors such as the level of R&D performed in universities compared to public research organisations (PROs) or the structure and levels of business R&D. In OECD countries, the national innovation systems can be characterised as firm-centric or public – research centric (and with this last category, university-based or public research institution-based). As a result, the place that HEIs occupy within national innovation systems can be argued to be inherently tied to long-term, structural economic factors in a path-dependent process (Mowery and Sampat, 2005).

4. The nature, type and quality of the interactions between research, innovation and education are important determinants of the overall performance of national innovation systems. Investments in one side of the KT tend to positively affect not only the other two sides but also create external impulses, from upgrading the labour market and fostering structural economic change to inspiring society, at large – often with a strong, place-based context.

5. Notwithstanding these differences in national innovation systems, the knowledge triangle approach attributes a central role to higher education institutions (HEIs) in fostering the integration of
innovation, research and educational activities. The KT framework postulates that each of the linkages in the triangle can be strengthened by means of platforms and processes that build bridges between education, research and innovation (Sjoer et al., 2011). The KT acknowledges the potential complementarity and conflicts between research, innovation and education and promotes a holistic approach to harnessing all three levers for economic growth and welfare. A novelty of the knowledge triangle concept is that it draws attention to the contribution of education and entrepreneurship to research and innovation and vice-versa. Traditionally, higher education and research policies have been concerned with the contribution of education for labour market success or the training of higher quality graduates for research activities. With regard to the innovation function, most policies in the last decade have focused on increasing the contribution of research to innovation through legislative reforms (e.g. Bayh-Dole Act) and the establishment of hard and soft infrastructure in the form of technology transfer offices or other interfaces between public research and industry. However more recently the HEIs are facing pressure to measure and quantify the their contribution to innovation in the context of international ranking and evaluation exercises.

6. The central idea behind the KT framework is that creating new knowledge from research and high quality education are in themselves are not enough to gain prosperity and economic growth (Stam et. al, 2016). In contrast to the Triple Helix model of university-industry-government collaboration, the KT framework places a premium on the role entrepreneurship both as a channel to diffuse knowledge generated at HEIs but also as way to foster greater societal engagement from within the institution. It is in this way it is more outward and directionally oriented than Triple Helix models where the emphasis is on a strict division of labour among the actors (university-industry-government) and the modes of co-operation between them. Furthermore, the KT framework recognises the need for institutions themselves to innovate within institutions in order to better articulate and carry out their different missions.

Main cross-cutting messages from the case studies thus far

National policies, budgetary pressures, demographics and global competition are putting pressure on higher education to differentiate themselves and strengthen their engagement with society and socio-economic impacts

7. In the large majority of OECD countries, the pressure on higher education institutions to engage with society at national, local and global level is high. Furthermore, the rise of the global competition for talent and for national research funding is also putting pressure on institutions to differentiate themselves and develop their institutional profiles vis-a-vis not only national ministries but especially students, faculty and companies. In some countries like Sweden, this pressure is felt in all dimensions of the missions of the universities. Institutions are under increasing pressure to maintain and strengthen excellence in research, education and societal engagement. This leads them to find ways to combine their missions in a strong “knowledge triangle” (Benner, et. al. 2016). In other countries, such as Estonia and the Czech Republic and due to funding arrangements (i.e. a large share of competitive research funding or reliance EU Structural funds) this pressure (for excellence) is felt mainly with regard to the research function of institutions.

Low prevalence of the “knowledge triangle” concept outside policy circles despite increased attention towards third mission and KT activities

8. The analysis from the case studies suggests that while governments and higher education institutions recognise the importance of industry-science relations, the term “knowledge triangle” is not widely used outside policy circles. Even in Germany, to which some observers attribute the first “triple
helix” institutions in the form of the Kaiser Wilhelm Institutes of the 19th century (Fuller, 2009), the knowledge triangle is not explicitly mentioned by the institutions surveyed in the case study. However, there are many KT related developments taking place in Germany, mostly between research and innovation (i.e. traditional “third mission” of HEIs) and between research and education (strongly reinforced in the past few years by instruments aiming at a higher quality of teaching and between innovation and education (e.g. via business participation in the accreditation process of new Bachelor and Masters study programmes) (Daimer and Rothgang, 2016). In Sweden and Norway the knowledge triangle concept is well anchored in governmental, institutional and political discourses and also used by institutions. In other countries such as the Czech Republic, Japan or Korea the discourse regarding the third mission is more around technology transfer and industry-science relations. In Estonia, engagement by universities with society is a relatively new phenomenon given the country’s socialist economic history.

There is a diversity of HEIs, diversity of needs and a diversity of approaches to the knowledge triangle

9. Another key message is that because of the diversity of HEIs (i.e. comprehensive universities, universities of applied sciences, technical universities or regionally oriented universities) in countries, regions and innovation eco-systems more broadly, it is likely there is no single model that countries should aspire to. Institutional characteristics vary between and across countries. The case studies in Norway for example show that KT-practices differ significantly between scientific fields. Health sciences have a clear mission to contribute to high-quality healthcare services and KT-practices are integrated in the specialist health care services through the national system for interaction between the public hospitals and medical faculties, and are as such top-down driven.

10. The perceived societal role and impacts of HEIs on innovation varies across countries due to historical, economic and cultural factors. Levels of government oversight vary significantly across countries and, as a result, institutions have very different levels of accountability and freedom to decide their own practices. While research and doctorate training are common ways in which knowledge is generated and from HEIs, and as illustrated in several of the case study, a significant share of HEIs do not undertake significant research or teach doctorate degrees. These issues are likely to differ according to scale and geographic location. Smaller institutions or those in low-R&D areas face different challenges in interacting with external research and innovation than large institutions in large cities (See paper on place-based policies for HEIs: DSTI/STP/TIP (2016)1).

11. In fact, governments in many OECD countries envisage different national and regional roles for different types of institution. For example in Finland, universities are considered to have a stronger national and international role, while polytechnics are assumed to focus on their regional role (OECD 2007a). In Greece and Estonia, universities of applied sciences have been assigned a regional role that is different from the more international role of comprehensive universities. This does not mean that only certain types of HEI contribute to certain missions. However there is an element of specialisation and differentiation in higher education systems that will shape the type of “knowledge triangle”. This also means that some HEIs will have different needs when implementing strategies for the KT. Some may need to focus more on strengthening education in order to link with innovation for example.

12. Nevertheless countries- and HEIs- share many of the same challenges in integrating research, education and innovation policies and the case studies of HEI eco-systems suggest there are certain areas of policy and institutional set ups that will require attention.
The first of these concerns the influence of the governance of STI and higher education policies at national level. Governance of HEI activities is a complex and contextually based. Different structures have emerged according to historical processes and policy changes. The second concerns the role of diverse funding sources and contractual arrangements may have on HEI incentives to change or to influence their behaviour. A third area concerns the link between place-based policies and HEI’s global-local engagement; and fourth element concerns the role that evaluation and impact assessment criteria play in supporting KT activities.

Multi-level governance arrangements for the knowledge triangle

HEIs have been the object of government-initiated reforms for the past decades. Four main policy goals have characterised reforms. First, successive reforms have granted increased autonomy and accountability of higher education institutions across OECD countries. Second, increasing demand for access and quality in higher education and third, increasing the quality and excellence of research. A fourth goal and one that is often pursued either sequentially or independently of the other two, is the promotion of industry-science relations.

In all of the countries surveyed in the case studies, governance mechanisms such as project-based funding, university performance contracts and research assessment exercises are common tools to increase the accountability of HEIs on the one hand, and to enhance knowledge triangle activities. However, because of the autonomy granted to HEIs, the task of co-ordinating and integrating the multiple missions of universities falls on the institutions themselves.

One of the lessons from performance contracts in OECD countries is that they have helped HEIs improve strategic planning and adapt to a changing funding landscape and position themselves in a global market for research and education. But the challenge remains how to properly assess performance and to make the performance of individuals accountable to the institutional performance.

Diversity of funding, performance indicators and evaluation practices make implementing and measuring KT activities difficult. The funding sources of HEI are increasingly diverse in terms of their source (i.e. national, regional, international, business and charities) but also their nature (institutional block grants, competitive project-based, or industry contract-based). This diversity is reflected also in the indicators and metrics for monitoring the use and impact of the funds.

Evaluation results serve as a basis for the distribution of institutional funding of research organisations. While competitive funding streams often encourage the diffusion of research outputs to society, the metrics used will vary according to the project or reporting requirements of the funder. In some cases, however, KT activities are not included in the evaluation criteria. As a consequence, the indicators to evaluate HEIs are pre-determined and biased towards the goals/criteria of the funding sources.

In the case studies, several countries noted the fragmentation in governance. At national level, the co-ordination of education, research and innovation policies is important. In many countries, this co-ordination takes place through inter-ministerial councils or through strategic documents (i.e. innovation strategy documents) that set out the direction for joint policy action. But co-ordination is needed also with regional and, increasingly, municipal governments.
**Funding structures**

20. Between and within OECD countries, the funding structures vary and depend on the private and public status of higher education institutions. Generally however, education funding and research funding streams are distinct. However, the silo model of funding and regulations for the different missions, however, does not facilitate the tasks of integrating KT activities at institutions. This altogether places large expectations on universities to align the missions and create interaction between the different tasks (Benner, et al. 2015). This results in a dual and sometimes fragmented governance system. Institutional choices are determined by internal governance structures (e.g. rectors, faculties and departments) that are influenced by (supra) national, and regional policies with regard to legislation, quality assurance, and funding.

21. In the Austrian case for example (Figure 1), the main instrument to steer HEIs towards KT activities with regard to block funding is embedded in the three year performance agreements which contain the “Lead Institutions Initiative” (Leitinstitutionen-Initiative) beside other strategic targets. The “Lead Institution Initiative” sets out the respective requirements concerning the strategic interaction of universities and their location (region) in order to contribute to the development and implementation of regional STI strategies as knowledge based lead institutions. Furthermore the process of priority-setting among universities should be promoted, entailing the definition of strategic research and teaching priorities and longer-term objectives, as well as the associated strategic planning of resource allocation by the universities themselves. In a KT context, the Lead Institutions Initiative is a holistic effort to place HEI as acknowledged partners of the business sector in shaping regional innovation ecosystems, and to shift the focus from purely institutional planning to the development of profiled knowledge places. As in other countries, competitive funding is used to steer and encourage HEIs to develop their institutional profiles and for this Austria has range of funding instrument for strengthening partnerships between universities and business.
In the past, neither public policy nor the higher education institutions themselves have tended to focus strategically on the contribution that they can make to the development of the regions where they are located (OECD, 2007). Indeed, in many countries, higher education and research funding policies are “spatially blind”. This is now changing as policy makers recognise that geographic distribution of knowledge production and its application is a critical factor that underlies the globalisation – as well as – the localisation of economic activities, and hence the sources of growth and well-being. Another reason for this change is that innovation policies have expanded their rationales. Rather than focusing only on market failures, the modern approach to regional innovation policy has expanded towards a broader logic of correcting a whole range of “system failures” in regional innovation ecosystems. System failures include network failures, incentive structures or principal-agent problems. As universities are increasingly autonomous, independent and “entrepreneurial”, they can engage with regions and cities. Programmes to support clusters and excellence hubs are frequently used, but more so at regional than national level. Furthermore, regional governments account for a notable and growing share of public spending on innovation-related matters. In Sweden the SRAs, SIAs and CDI funding modalities are all new mechanisms that aim to catalyse multi-stakeholder interactions at the regional level (OECD, 2016).
23. The role of HEIs in the regions also depends on the relative power of the actors; in a government-pulled model, entrepreneurial universities assist the development of existing industries and creation of new industries in response to incentives from government. In an industry-pulled model, universities respond to opportunities for co-operation with industry to co-operate on specific problems or deliver services (Lindqvist et al. 2012).

24. Notwithstanding the rise of interest in place-based innovation policies, in some OECD regions, co-operation between universities and external partners has a long history and has been supported by existence of industrial and scientific infrastructure in the region (e.g. science and technology parks) as well as clusters and regional support structures to foster innovation. In others, this collaboration had been promoted by (supra-) national or regional-level policies and by the availability of increased funding to foster research, innovation and knowledge transfer.

25. The case studies with a focus on place-based innovation highlight three important trends:

- **New governance structures to engage regional stakeholders.** The Austrian case illustrates the role that regional university conferences can play in the joint planning of activities of HEIs at a region of location, e.g. the alignment of curricula and research profiles but also the exploitation of results and strategic co-operation with business sector. Furthermore they serve as coordinated voice of HEIs in the development and implementation of regional STI strategies by the public sector. The Netherlands case shows that while HEIs are increasingly engaging local stakeholders on university boards or for fund raising, the corollary is also important. Economic development agencies can arguably do more to engage HEIs in their public service delivery missions, urban planning or “smart city” initiatives. The case study of the HEI eco-systems in Netherlands suggests that the funding and management capabilities of regional boards has an impact the effectiveness of regional actors in steering entrepreneurial eco-systems (Stam, E., et. al. (2016)

- **Open innovation platforms** can be a tool to combine different knowledge base and organize innovation related interactions with external partners. The platform approach used in Finland distinguishes itself from the cluster approach through its focus on people-based interactions and openness (Raunio et al. 2013). The rise of platform approach to collaboration is an extension of the digitalisation of technology and production which fosters the emergence of new modes to organize co-operation also in innovation and production activities. OIPs should foster the combination of knowledge towards innovative solutions at least in three levels: a) combination of different knowledge bases, including both science and experience-based knowledge; b) combination of codified and tacit knowledge (i.e. digital platform and physical innovation hubs that represent the new modes of co-working and co-creation spaces and; c) combination of citizens and public services with the development process in business development and innovations refers to extension of knowledge bases to the people and the public sector of the region.

- **Innovation Networks** are established around publically supported innovation projects that are carried out by companies, research institutes, governments and other organisations (e.g. EU Funding).

**Institutional management and leadership**

26. Analysis of case studies of HEI eco-systems suggests that adopting a KT approach requires modern management practices and leadership, not only at level of universities but also in the broader HEI
eco-system (i.e. the vocational/technical colleges, PROs, clusters, regional development agencies). Another barrier observed in some of the case studies is that there are weak incentives for knowledge triangle practices in institutional recruitment and evaluation systems (Borlaug, Siri, B. et. al, (2016).

**Individual action versus collective action**

27. It is also important to consider the issues of the knowledge triangle from the perspective of individuals. One of the issues that emerged in several of the case studies was that KT activities can often be explained by the actions and incentives of individuals within those institutions. As mentioned in the Estonian case, successful integration of research, education and innovation at HEIs are in many cases based rather on the initiative of faculties. This is also one outcome of the project-based funding system, as the availability of strategic funds on the university level is restricted.

**Third mission and broader engagement**

28. Third-mission activities can refer to a number of different practices, and can themselves be categorised to those referring to research (e.g. technology commercialisation and knowledge transfer), education (e.g. lifelong learning/continuing education), and social engagement (public presentations, voluntary work by staff etc.) (EU, 2012). As such, “third-mission policies” encompass a range of policies from commercialisation structures to softer recognition of societal role. Commercially oriented activities, although limited in the majority of institutions, do provide an important revenue stream for some HEIs in some countries. Income from contract research, for example, has become an important source of income for a range of HEIs (OECD, 2013a). In Germany there is also an explicit commitment to the third mission on a legal basis: The Framework Act for Higher Education defined “knowledge and technology transfer” as a third task for HEIs in 1998. Some countries have dedicated innovation funding schemes to encourage ‘third-mission’ such as interaction with small- and medium-sized enterprises (SMEs). Indeed, a lack of dedicated funding was referred to in some case studies as a barrier to greater engagement in innovation-related activities.

29. Third mission policies therefore partially represent a more active state role to orientate higher education towards societal concerns and towards innovation. Some countries and institutions have made explicit commitments to the third mission. Sweden for example has long recognised the “third mission” of HEIs and the mission is officially recognised in the 1992 Higher Education Act. This sets Sweden apart from most OECD countries, where the third mission is often an implicit rather than explicit aim or expectation of government policy. However, despite the legal backing, the third mission is an unfunded mandate. In other countries, there is dedicated innovation funding to encourage knowledge exchange activities such as interaction with small- and medium-sized enterprises (SMEs). Some countries have also made efforts to measure and record collaboration and dissemination activities. Such policies can also be seen as a response to the “innovation paradox” and concerns in many countries that high-quality research has not translated into innovation performance (IPP, 2015a). The concept of the third mission also highlights the role of HEIs as nodes within broader innovation ecosystems and the two-way interactions between HEIs and other actors.

30. There are potential trade-offs between the third mission and the traditional teaching and research missions. An increased commercialisation and profit-seeking attitude associated with financial autonomy may have competing effects on an HEI’s research activities. For instance, a push for commercialisation could impinge on an HEI’s willingness to extend informal expertise. The institutionalisation of knowledge
transfer activities at HEIs may also hinder rather other forms of knowledge flows (Guena, 2015). Faculty that could earn money from consulting activities could also have less incentives (and time) to engage in community outreach. Another concern is that there are trade-offs between teaching and other missions. Teaching and research tend to be complementary although the evidence shows nature of the relationship between the two is likely to vary by fields of science and education. Nevertheless, the long-running increase in the rewards to research relative to teaching is often argued to have weakened the relationship between the two.

31. These tensions were apparent in some of the case studies, notably in the case of the comprehensive universities.

Impact assessment and evaluation

32. The role and impact of universities depends on a range of external factors. For instance, the existence of public research institutions or publicly-supported “bridging” institutions can affect the impact of higher education research, or the ability of HEIs to find collaboration partners. However, treatment of HEIs in the analysis of the knowledge triangle must recognise the diversity of institutions. It is clear that HEIs cannot be treated as a “black box” – the way they are organised, how they teach, and the relationships that staff build outside the institutions all have an impact on innovation outcomes. The criteria of stakeholders such as research funding agencies, ministries but also business influences the design and use of evaluations and impact assessments. In some cases, the criteria are not always aligned with university missions and this factor has to be taken into account when trying to ensure the results feed back into national policies and institutional strategies.
CASE STUDY SUMMARY PROFILES

Austria .................................................................................................................. 12
Canada .................................................................................................................. 14
Czech Republic .................................................................................................... 17
Estonia ................................................................................................................... 18
Finland ................................................................................................................... 19
Germany ............................................................................................................... 20
Greece .................................................................................................................... 21
Hungary .................................................................................................................. 23
Ireland ................................................................................................................... 25
Japan ......................................................................................................................... 28
Korea ....................................................................................................................... 29
Netherlands .......................................................................................................... 30
Norway ................................................................................................................... 31
Spain ......................................................................................................................... 33
Sweden ................................................................................................................... 34
Russia ..................................................................................................................... 36
Austria

**Place-based dimension in higher education policy making**

**Summary:**
The Austrian case study focused on the place-based dimension at different levels of Austrian higher education policy making and the role of governance mechanisms, including performance contracts and new structures to involve universities at regional level.

**Authors:** Maximilian Unger, Daniel Wagner-Schuster, Wolfgang Polt, Joanneum Research, Austria

**Funding**
The “Lead Institution Initiative” ("Leitinstitutioneninitiative") is embedded in the three year performance agreements between the Austrian universities and the Federal Ministry for Science, Research and Economy as basis for the allocation of government block funding. Strategic targets that are formulated in the “Lead Institution Initiative” are:

- to position universities as self-confident partners in the development of locations and regions on equal levels with other stakeholders in the knowledge triangle (‘turning stakeholders into partners’),
- to increase international visibility of universities as regionally embedded knowledge hubs for scientific and business cooperation,
- to shift the strategic perspective from individual institutions towards the development of knowledge locations leveraging administrative, infrastructure and competence synergies,
- to increase the quality of cooperation and coordination in management, teaching, research and innovation activities as basis for the provision of public funds for location oriented projects (e.g. procurement and use of research infrastructure, establishment of joint core facilities, alignment of curricula according to location specific needs, joint appointments by institutions, permeability between different types of institutions at a location, management activities).

Universities are asked to develop strategic concepts and milestones according to the targets of the initiative. Furthermore a variety of competitive instrument exists to promote knowledge transfer, especially between academic research and the business sectors. Funding for science-industry relations in Austria is based on funding along institutional medium-term and long-term programmes, bringing together partners from academia and business in formalised collaborations e.g. in the form of independent legal entities such as laboratories or research centres, rather than providing funding at a project level.

**Place-based policies**
The "Lead Institution Initiative" puts specific emphasis on the promotion universities role a knowledge based lead institutions for regional development and as strategic partners in the development and formulation of regional STI strategies of the public sector, according to the concept of Smart Specialisation.

The implementation of regional higher education conferences (regionale Hochschulkonferenzen) in most Austrian regions (‘Länder’) that host universities was an important step in operationalising horizontal co-ordination between different HEIs in a region. Regional higher education conferences are designed to address the needs for co-ordination of public universities, universities of applied sciences (UAS), university colleges engaged in teacher education, and, in some regions, private universities. The university conference at the national level (UNIKO) mainly acts as a political voice for universities by allowing them to adopt a coordinated position concerning questions relating to social or higher educational matters. In contrast, regional higher education conferences act as hubs concerning the implementation of co-ordinated projects and initiatives (together with other components of the knowledge triangle), both in terms of research and education.

**Key measure to promote KT activities:**

- The Austrian Competence Centre Program, COMET
- Christian Doppler Research Association (CDG). These programs aim to improve industry-science linkages by promoting collaborative research and innovation projects and the development of human capital, e.g. via doctoral education and employment mobility.
- The AplusB-centres (academia plus business program), located throughout Austria at hosting universities, provide support for the creation of academic spin-offs.
- The “Knowledge Transfer Centres and IPR-utilization” (Wissenstransferzentren, WTZ) was launched in 2014 to support universities’ patenting activities.
Policy lessons:

- The “Lead Institutions Initiative” provides an example for how an enlargement of universities’ spectrum of activities and missions can be promoted by governance mechanisms related to the block funding.
- Regional engagement through regional university conferences is essential.
- Competitive funding instruments that anticipate KT principles are typically targeted towards the development of medium- to long term structures for collaboration rather than projects. Programmes and institutions such as the COMET centres of the Christian Doppler research labs are especially important with regard to the development of human capital to work at the interface of universities and industry.
Case study on Canada and the Waterloo Region

Knowledge Triangle

Summary:
Abstract of the scope, methodology and findings

This case study examines the relationship between the three corners of the knowledge triangle from a Higher Education Institution (HEI) perspective, specifically focusing on the university level from a national science and innovation perspective.

The Canadian case study consists of five sections. The first section: Overall State of the Knowledge Triangle in Canada provides insight into the characteristics of Canada’s national innovation ecosystem; the second section: HEI in Canada and the Knowledge Triangle examines the characteristic and contributions of HEIs to the three corners of the knowledge triangle and the interplay between the three corners. The third section: Institutional Level Policy provides insight into the Government of Canada’s strategies to guide federal investment in science, technology and innovation in relation to the three corners of the knowledge triangle. The fourth section: Funding showcases the Government of Canada support for HEIs as well as federal programs and initiatives under each corner of the knowledge triangle. The fifth and final section: The Waterloo Region case study: provides an example of the knowledge triangle in the Canadian context by showcasing a Canadian University (the University of Waterloo) and how its characteristics, programs, policies encourages innovation in the Waterloo Region.

In Canada, the relationship between education, research and innovation at HEIs have traditionally been less integrated than that of some other countries. As a result in Canada, governments (federal, provincial and territorial) have tended to treat each corner of the knowledge triangle as distinct and individual functions. However, there is significant overlap and interplay between the three corners. Within Canada, innovation ecosystems exist at the local, regional/provincial and territorial level and at the national level. At each of these levels there are different factors (e.g., structure of the economy, political priorities and economic circumstances, etc.) which influence the interactions and relationships within an innovation ecosystem. As a result, governments at all levels have and continue to implement measures that support the three corners of the knowledge triangle which will help achieve their desired economic and science, technology and innovation objectives.

Canadian HEIs activities support all three corners of the knowledge triangle. Currently, Canada has approximately 100 universities and approximately 300 colleges (with 2/3 of them being publicly funded). Over 2 million students are enrolled in these HEIs. These HEIs play an important role in their local communities and economies by providing an educated and skilled workforce, access to research infrastructure and expertise. HEIs can also anchor clusters of innovation activities in their local communities and act as bridges between businesses, governments and other countries.

The knowledge triangle concept is not explicitly used by the federal/provincial and territorial governments. These orders of government indirectly support the knowledge triangle concept through their policy instruments supporting innovation. To support innovation, governments use a broad suite of direct (e.g., grants, contributions, vouchers, loans and equity financing, etc.) and indirect (e.g., tax credits) instruments. Many of the Government of Canada’s programs and initiatives are designed with flexibility so they can be applied to and meet the needs of Canada’s diverse regional economies.

The Government of Canada’s direction for science, technology and innovation has also been driven by broad policy frameworks. Most recently, the new federal government committing to develop a new Innovation Agenda. On 14 June 2016, the Government of Canada announced the six key areas of action for the development of its new Innovation Agenda. They include: promoting an entrepreneurial and creative society; supporting global science excellence; building world-leading clusters and partnerships; growing companies and accelerating clean growth; competing in a digital world; and, improving ease of doing business.

Funding and governance to promote KT

In Canada, the relationship between education, research and innovation is not typically characterized through a knowledge triangle concept. Neither the federal or provincial/territorial governments (10 provinces-3 territories) have established policies which directly refer to the knowledge triangle. Despite this, the interplay between the three corners of the knowledge triangle is addressed through policy and programs. In Canada, provincial and territorial governments have jurisdictional responsibility for education. As a result, the federal government does not have a department of education, there is no top down higher education policy, nor is there an integrated national system for education in Canada. Furthermore, HEIs operate largely independently in terms of their curriculum and administration.

Place-based policies

The Government of Canada’s direction for science, technology and innovation has also been driven by broad policy frameworks, with the new federal government committing to develop an Innovation Agenda. Provincial and territorial governments have also tailored their efforts to support their regional innovation ecosystem to support their priorities and economic interests. The Innovation Agenda will put focus on building world leading clusters and partnerships.

- HEIs surveyed/interviewed: The University of Waterloo

Policy lessons:

- One of the biggest challenges facing Canadian HEIs is transferring their knowledge to industry. This in fact is illustrated in Canada’s lagging results for licensing activities and the creation of spinoff companies and start-ups at Canadian universities. There are several factors which influence the commercialization of research and knowledge produced by Canadian HEIs. They include: the different cultural orientations within Canadian universities; a university’s intellectual property rights policy; and, finally the structure of the Canadian economy which largely consists of small-medium-sized enterprises.

- The content and administration of intellectual property policies vary significantly across Canadian universities. Some universities have an institution-owned intellectual property policy, giving the University ownership and the rights to all inventions made by faculty, staff and students using the institution’s facilities. Contrary to this, other universities have intellectual property policies that provide full ownership of intellectual property to its creator, which can make the commercialization of these ideas more attractive. Some evidence suggest that the more liberal an intellectual property policy is, the more it encourages entrepreneurial thinking by faculty and students, contributing to the creation of start-ups. Other evidence suggests that the nature of the inventions, the overall quality and resources of technology transfer offices at HEIs, and the HEIs’ culture surrounding partnership with industry appears to play a large role in influencing commercialization results. However, overall commercialization outcomes are similar between HEIs in which the university owns the intellectual property rights and those in which the researcher

- The current promotional systems of universities are largely based upon publications. As a result, faculty may have limited interest in completing applied research or being involved in entrepreneurial activities. In addition, a university’s intellectual property policies may cause tensions for faculty along with the reallocation of their time from basic research to applied research as well as their teaching responsibilities.

- The Waterloo Region case study provides insight into the interactions between the three corners of the knowledge triangle from a Canadian University perspective. The success of the Waterloo Region can be attributed to a number of factors, including a diversified industrial economy (which includes multinational corporations) with strengths in various sectors; a concentration of HEIs (two universities and one college); a strong financial services sectors; a highly skilled workforce; support from federal/provincial and municipal governments; and a number of business incubators and accelerators.

- The University of Waterloo is an excellent example of an entrepreneurial university that operates within the environment of an innovative regional ecosystem and that encourages its students, faculty, professors and staff to be innovative. The University’s co-operative education program helps reinforce the informal and formal relationship amongst students, faculty, professors, alumni and the private sector. In addition, the University’s alumni, representatives from industry, professors and faculty are actively engaged in the University’s programs and centres designed to commercialize the University’s R&D and provide support to start-ups. Their support ranges from mentoring, access to financial networks and providing technical advice.
owns the intellectual property rights.

- The administration of intellectual property through University Technology Transfer Offices also varies significantly across universities. Some universities manage intellectual property in house, while others use external-not-for-profit organisations. The mixture of administrative practices for managing intellectual property can make it challenging for an intellectual property creator to negotiate licenses, particularly when there are multiple universities involved.
- The knowledge and research produced by Canadian universities may not align with the interests and needs of industry. Since the 1980s, both federal and provincial governments have been implementing measures to encourage Canada’s universities to become more “entrepreneurial” and to support R&D that addresses the needs of industry. To achieve this, governments have modified the requirements of some granting funding by requiring collaboration and matching funds from industry for some programs.

- The University’s culture aligns with the entrepreneurship culture of the Waterloo Region. The Region promotes an environment conducive to innovation and entrepreneurship. Within the Region there are significant networks among the labour force, industry and post-secondary institutions.
- To foster greater innovation conversations and to encourage innovation activities the University of Waterloo established the annual Waterloo Innovation Summit. The most recent Summit occurred from 16-18 September 2015 in partnership between the University and Communitech, a leading business incubator and accelerator. The Summit brought together top academics, business and policy decision makers where they heard from innovation influencers, shared best practices and learned how to develop an innovation culture through the continued development of technologies, approaches and industries.

- The University of Waterloo contributes to fostering innovation within the Waterloo Region through its entrepreneurial culture; its intellectual policy; and, support to entrepreneurs to commercialize their discoveries. It is a Canadian HEI leader for supporting innovation and for collaborating with the private sector. Many Canadian provincial governments and HEIs are looking at the Waterloo Region for inspiration to strengthen their innovation ecosystem. Entrepreneurship is promoted both in the University’s programs and in practice, through co-operative education programs.
Czech Republic

| Higher education systems and industry-science relations |

Summary:
The Czech Republic higher education sector is characterised by underdeveloped structures for KT activities; a low integration of educational, research and innovation activities and low revenues from R&D co-operation with industry. The evaluation of research and human resource polices also do not foster KT initiatives. Considering the small territory of the Czech regions, research focus of the universities as well as their co-operation with the business sector has largely trans-regional, i.e. national or international character.

Authors: Vladislav Čadil and Miroslav Kostić, Technology Centre of the Czech Republic, Prague

Funding
Funding of the selected universities is strongly dependent on public resources, only a minor share of resources is generated by business activities of universities. Another feature of financing, typical for the majority of Czech HEIs during the last years, is a high share of the EU Structural Funds on revenues – reaching 33% on the total revenues of TUL and even 37% in the case of UPO in 2014. The EU Structural Funds have been recently of a great importance especially for building new research infrastructures and modernisation of existing research facilities. However, financial sustainability of the newly built large infrastructures tends to be a major R&D policy challenge in the near future.

Place based policies and HEIs
Neither the Czech legislation nor policies or strategies distinguish between individual types of universities. All universities are equal and are managed and funded by the same rules and from the same resources. Involvement of the business sector in relevant bodies of the universities (Scientific Board, Board of Governors) is relatively low, only in the Board of Governors of the UCT the business sector has a half share on the number of representatives.

The three universities belong to the key stakeholders at least in their regions in terms of connecting education, research and innovation. The two universities located outside Prague (UPO, TUL) represent the main research institutions in their regions and cooperate the most intensively with regional authorities on regional development issues, especially on the design of regional strategies.

Types of co-operation at the regional level:
- Co-operation with regional authorities on regional development issues (drafting and implementation of regional innovation strategies and plans)
- Co-operation with research organisations and businesses in the region, activities of science & technology parks
- Linking the research and educational orientation of universities to the regional economy.

Higher education institutions surveyed
- Traditional university – Palacký University Olomouc
- Technical university – University of Chemistry and Technology (UCT), Prague
- Regional university – Technical University of Liberec, highly specialised university (TUL)

Barriers to KT activities
- HEI leadership staff is elected mostly from academia. Thus, inbreeding and weak managerial background of the top leadership is a barrier to the promotion of KT activities in the Czech higher education sector as a whole.
- During selection procedures for new researchers, co-operation with industry is only partially considered in the evaluation at the UCT.

Policy lessons:
- In very general terms, knowledge triangle activities are relatively little institutionalised.
- A thorough evaluation of results and impacts of such activities and initiatives seems to be a major challenge for the three HEIs and for the other Czech HEIs as well.
- On the other hand, knowledge triangle development at HEIs is in a gradual progress. It is therefore possible to notice recent acceleration of these on-going processes at the Czech HEIs, expressed e.g. in the development of institutional structures for knowledge and technology transfer.
- The trend to connect education, research and innovation in the higher education sector are influenced by different starting conditions, possibilities or aims of individual universities. Among the three different types of Czech universities in the case study, there are differences in the emphasis put on the particular angles of the triangle. Nevertheless, a balanced concentration on the three angles according to the dispositions of individual HEIs should be the aim of all universities in order to maximise their benefits for the society.
Kadri Ukrainski, University of Tartu, Estonia

Summary:
KT relations in Estonia are evolving in funding environment where the share of project-based funding instruments especially in research funding is extremely high and growing in education funding. On the country level, it can be concluded that the understanding of universities as important players of KT has also reached gradually the managements and governing bodies of the universities. However, the universities are struggling in balancing the new roles with the traditional academic ones and have difficulties in enforcing the new roles in their internal policies and procedures. It has been argued that many R&D institutions of Estonia are simply not ready or not motivated to change the procedures, way of thinking and culture of organisations (Okk 2015). Also, the low, but evolving capabilities of firms and the concentration of R&D activities in small number of firms is related to the context of building KT relationships. Therefore, the KT relationships are evolving, but not at the speed that could be expected in the country of such small size as Estonia.

Funding
In Estonian universities, project-based competitive funding represents more than 90% of research funding in all public universities, smaller R&D institutes are often 100% project funded. One of the reasons behind is high dependence of the research system (about 60%) from EU Structural funds. Clear focuses (strengths) of the case universities in the KT relationships can be profiled.

Industry-science relations
As the universities are relatively small, but opening up to global competition, their capabilities and resources to create high-quality knowledge transfer mechanisms are very limited both financially and in terms of competences. Here greater co-operation is needed, which has only started between UT and TUT. Here the high dependence from project based research and innovation (but growingly also education) funding comes to play as an additional factor that is not supporting the competence building at the university level and is further inhibiting the development of KT relationships and the development of longer term capabilities according to the main specialisations of the universities.

Institutional case studies
- University of Tartu (UT) a large and the only comprehensive university in Estonia involving traditional variety of fields of science (including medicine), being also the oldest in Estonia (created in 1632) with location in Tartu (Southern Estonia).
- Tallinn University of Technology (TUT) is a technical university, which historically was created in 1920 as a higher education institution focusing on technical education. However, during recent decades has been focusing more on social sciences.
- Estonian University of Life Sciences (EULS), an example of regional university, which was created in 1951 by separating three agricultural faculties from the UT into a separate university. As EULS is still specialised in rural life, rural economy and in areas related to the sustainable use of natural resources, it has been selected here as the example of regional university as 68% of the students in this university originates from Southern Estonia).

Policy lessons:
- No systematic approach towards integrating all of the aspects of KT.
- The main activities and decisions related to the KT are decentralised to the faculties and research groups.
- In practice, KT activities are fragmented despite strategic documents that emphasize the need and aims for integrating the fields of research, education and innovation.
- The examples of successful KT integration are in many cases based rather on the initiative of faculties.
- This is also one outcome of the project-based funding system, as the availability of strategic funds on the university level is restricted.
- In the universities studies, mainly two out of three KT pillars are targeted (e.g. research–teaching, research–innovation or teaching–innovation).
Open innovation platforms as policy tools fostering the co-creation and value creation in knowledge triangle

Authors: Mika Raunio, Research Center for Knowledge, Science, Technology and Innovation Studies, (TaSTI), School of Social Sciences and Humanities, University of Tampere, Petri Räsänen, Council of Tampere Region, and Mika Kautonen, (TaSTI) University of Tampere, Finland

Summary:
The Finnish case study focuses on the role of open innovation policy platform (OIPs) as to illustrate the operation of the KT framework. In KT context the OIPs may be seen as a collaboration model that HEIs' may deploy when they interact with the surrounding society and economy, i.e. fulfil their “third mission. The goal of these platforms is to organise value creative innovation processes through the open innovation platforms. The main hypothesis is that the evolution from science parks and cluster (sectoral) based policies with science based and semi-closed development projects led by a few big companies are moving towards more agile and user driven processes of innovation, where open innovation and platform models are key elements of the new practice.

Broader transition aim
Open innovation platforms provide a new generation of co-creation spaces facilitating the interaction among the research, education and innovation thorough bottom-up process. Recently evolution extends from local activities towards regionally linked networks of open innovation platforms (Tampere region) and further to national policy agenda (National 6Cities strategy). The value proposition of OIP approach is to engage much broader knowledge base to innovation activities while offering the “city as a living lab” and user oriented open innovation services for the use of the firms and other actors (clients). Further, it organize the increasingly open public data bases and public procurement practices in order to enable both new business applications as well as development of public services in this context.

The future challenges and systemic sore-spots may be simplified to the four themes; 1) emergence of OIP networks, 2) OIPs' capability to create “network effects” and further foster the civic engagement, 3) cultivation of open innovation culture among the local firms, public organizations, and start-ups, and 4) capabilities to offer public sector's open data and public procurement processes as new sources for innovative business development and public service renewal. In the following these themes are shortly discussed. Actively investing in learning is hardly ever done. Still, both cases show signs of policy learning.

Policy lessons:
- The active change agent in the case of the Demola project was not the university, but the regional development agency (owned by the University of Technology) and industry who have fostered the university-industry collaboration, or even “civic engagement” in practice.
- There is clear lack of incentives for the universities to foster civic engagement, which may partly explain the situation.
- OIP approach to reach out from the HEIs towards much wider society and its renewal.
- Civic engagement goes beyond the business oriented KT approaches. This requires new indicators and performance measures for the HEIs in order to foster their activities in this co-operation with the society.

- Pressure to create collaboration models has so far emerged mostly from outside of the HEIs
- The innovation and economic activities continue to agglomerate into city-regions along with social and urban problems.
- Therefore, fostering of innovation activities through open innovation and co-creation processes that engage the wider group of users and other stakeholders to the processes, far beyond the university-industry-government collaboration in business development, is a crucial (and systemic) question.
The term “knowledge triangle” is not widely used in Germany. Third mission policies and science-industry linkages are thriving, but adoption by HEIs and PRIs is very different, depending on the institutions' structure, culture and location (regional context). In the HEIs studied the KT concept does not explicitly play a role in the strategic development of their activities. However, the activities that relate to the KT are rather important for both. The main activities and strategies of both HEIs are located in different angles of the KT. The mission of Heidelberg University has excellent research at its core. The institutional strategy of the university was successful in the national excellence initiative. Important activities are located between research and education as well as research and innovation. In the strategic fields of focus (like medicine), the university aims at integrating research and teaching and achieving a high quality of teaching. The university has close links to industry, some of which are institutionalized by long-term activities and programs (like industry-on-campus-programs, a federally funded research campus and two federally funded Leading-Edge clusters).

**Authors:** Stephanie Daimer, Fraunhofer ISI, Michael Rothgang and Jochen Dehio, Rheinisch-Westfälisches Institut für Wirtschaftsforschung, Germany

**Funding**

1. **Substantial increase in Government R&D expenditure since 2007**
   - "New architecture" of the science system (High-tech Strategy; Excellence initiative)

2. **HEI financing: closer co-operation of federal and Länder governments**
   - Share of Federal R&D expenditure increased to 57% in 2012
   - 2014: Liberalization of the “co-operation ban” in the constitution: The Federal Government can now finance HEI more continuously.

3. **Project-based funding: shift to priority areas**
   - Addressing societal and global challenges.
   - Increasing the importance of complex programmes (cluster, network development).

**Policy findings:**

- Different approaches towards the KT are partly caused by the differences between a general university and a university of applied sciences.
- Other factors play an important role in the positioning of the HEIs in the KT:
  - (1) Historical paths and the structure of the innovation system (what firms, other HEIs, or PRIs are in the region?);
  - (2) Länder policies and strategies that foster certain paths of development of the HEIs in and with their regions
- (3) Strategies and perceptions of the acting persons both in the relevant Länder ministries and HEIs; and
- (4) HEI policies at the federal level (e.g. the excellence initiative).
Greece

Knowledge Triangle in Greece

Authors: Dr. Charalampos Chrysomallidis, Dr. Nikolaos Karampekios and Tonia Ieromninon, National Documentation Centre under the direction of Evi Sachini, National Documentation Centre, Greece.

Summary:
The recent crisis, which led to the reduction of institutional funding to HEIs in Greece (the main performer of research) has forced HEIs to diversify the sources of funding and to reconsider their strategies and at the same time has given greater importance to third mission activities. Universities are exclusively public in Greece according to the constitution. As regards, the linkages between the main RDI stakeholders, the share of the R&D that is performed by higher education sector and is funded by business sector is one of the highest among EU countries. The case study shows that interactions of higher education institutes with other KT-related actors vary. More specifically, HEIs have the strongest relations with research centres regarding research collaboration in scientific fields of common interest, mobility of academic staff and students, etc. These interactions are structured on an ad hoc basis that relies on territorial parameters, mostly being the case in regions beyond the capital region of Attiki. In addition, research teams in HEIs have important linkages with international academic community, partly as a result of their strong participation in EU R&D projects. More formal channels of industry-science relations such as technology transfer office, suffer from a lack of institutionalization due to funding gaps. Furthermore, EU Structural Funds and the Smart Specialisation Strategies are steering the priorities of HEISs towards third mission and engagement with the business sector.

Funding and governance arrangements
The Ministry of Education that determines operation matters such as recruitment, payroll, students’ enrolment, etc.
A certain degree of autonomy for higher education institutes can be observed in dealing with academic and managerial issues (e.g. structure), yet they rely heavily on institutional funding from the Ministry. The severe reduction of the latter to more than 45% has led to a major change in HEIs’ attitude towards seeking alternative, non-institutional – and diverse sources of funding. As far as institutional initiatives supporting the knowledge triangle are concerned, NSRF 2007-2013 has funded the establishment of the Innovation & Entrepreneurship Unit (IEU-MOKE) in all HEIs, aiming at integrating research, education and innovation, for instance via seminars, presentations and mentoring on entrepreneurship, etc.

Understanding of the Knowledge Triangle
In this new context, HEIs reconsidered their strategies intending on broadening their activities, running against past dominant perceptions which focused on education and research, offering mostly theoretical and general knowledge. Although the definition of a clear, a general rule is not easy, as some HEIs or even specific faculties may be more “business-friendly” or facilitate linkages with the business sector, than others, the dominant perception has not come in terms with HEIs’ “third mission” or the third dimension of the “knowledge triangle” scheme. Therefore, it is widely accepted that gap between academia and the business community should be further reduced in terms of R&D collaboration, mobility, spin-offs, etc. In line with this, it is not surprising that HEIs’ external evaluation committees often highlight the need to foster business and entrepreneurship closer to HEIs.

Place-based dimension
Local embeddedness of HEIs varies. To start with, and even in in Regions that are non-R&D intensive, the level of embeddedness into the social fabric is important, for example via the housing and infrastructural amenities. Furthermore, there is usually a high rate of domestic students’ enrolment in local HEIs, while HEIs care for local societal challenges, as expressed by local authorities via requests for planning and consultative services. Furthermore, Regional Operational Programmes – operated by Regional authorities within the framework of NSRF- finance RDI-related investment requested by local HEIs, research centres, etc. It is expected that this interaction will increase due to the implementation of smart specialisation strategy.

Institutions surveyed:
- University of Crete (UoC): One of the largest regional universities, covering humanities, social sciences, S&T and medicine. The UoC has a long tradition of collaboration with the Foundation of Research &
- AUTh is elaborating on an institutional strategy facilitating the transition from knowledge to innovation, in addition to having established strong interrelations with the Regional authorities and participates in a
Technology (FORTH), the public research center of Crete, where mobility and scientific interface are significant. UoC participates in the Crete Innovation Initiative, the Science and Technology Park (STEP-C) incubator and has established strong interconnections with the Regional authorities.

- Aristotle University of Thessaloniki (AUTh): The largest university in Greece, including a wide range of faculties (hard sciences, humanities, engineering, etc.). R&D intensity (total R&D expenditures as a % of total budget) in these HEIs range between 25% and 40%.

- Athens University of Economics and Business (AUEB): One of the oldest universities, with a strong tradition in the fields of Economics and Business that has recently broadened its scientific areas (informatics, statistics). AUEB stands as the first Greek HEI that introduced courses in entrepreneurship and implemented a strategy for “Innovation and Entrepreneurship” since the early-2000s. Its main tool for supporting third missions is the Athens Center of Entrepreneurship and Innovation (ACEiN), the University’s incubation center.

pre-incubator establishment of the Municipality of Salonika for entrepreneurship development (OKIThess).
### Hungary

<table>
<thead>
<tr>
<th>KT enabling policy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Summary:</strong> The Hungarian case study focused on a broad range of policy measures to strengthen KT at all levels.</td>
</tr>
<tr>
<td><strong>Authors:</strong> László Bocsá, Director, Technology and Knowledge Transfer Office; Dr. Brigitta Bodzay, Research fellow, Department of Organic Chemistry, office head, R&amp;D InfoPont, Deans Office, Faculty of Chemical Technology and Biotechnology.</td>
</tr>
<tr>
<td>A large number of national strategies addressing R&amp;I issues have been adopted in recent years that acknowledge R&amp;I as a key driver and policy instrument for enhancing competitiveness and growth. These strategies have been strongly driven and inspired by the EU context (e.g. the new Horizon2020 and other new policies adopted for the new programming period 2014-2020) and have a broad coverage of relevant R&amp;I issues. They are also based on a multi-annual planning, which is expected to improve planning and predictability of funding. A formal dimension of regional innovation policy has been introduced by the National Smart Specialisation Strategy (S3). It brings about a focus on current or emerging regional R&amp;I strengths and also tests some soft instruments for innovation financing, like pre-commercial procurement (PcP) and two pilot measures for strengthening University-Industry links. An emphasis on R&amp;I that goes beyond science and technological research into the development of an innovative ecosystem has been introduced by the National RDI Strategy and is supported in particular by the EU Economic Development and Innovation Operational Programme (GINOP).</td>
</tr>
<tr>
<td><strong>KT related policies</strong></td>
</tr>
<tr>
<td>The programme “Start-up_13” launched in 2013 aims at developing the Hungarian start-up ecosystem, in particular by supporting technology start-ups exploiting R&amp;D results which have the potential to grow into dynamic international firms. The programme operates in two stages: 1) technology incubators and accelerators hosting technology start-ups are accredited, 2) most promising technology start-ups are selected in view of incubation and enabling them to enter and grow on international markets. Two specific pilot measures that address University-Industry interaction (“Open laboratories” and “Higher Education and Industry Collaboration Centres” (FIEK) are foreseen in the National Smart Specialisation Strategy, published in November 2014. Another measure that supports the establishment of 8-10 “Knowledge Parks” in collaboration with local governments and universities was adopted in December 2014. In the programming period 2014-2020, the Economic Development and Innovation OP (GINOP), in particular Priority 1, supports the improvement of SMEs’ competitiveness by the establishment and further development of business incubators with an indicative budge to of EUR 30 million. In addition, GINOP also foresees the further development of industrial parks and science parks. It is also important to mention here that the Hungarian Intellectual Property Office (HIPO) collaborates with university TTOs and Chambers of Commerce in almost all counties for supporting the operation of PATLIB centres that offer IP consultancy services and IP training to researchers and local SMEs. Entrepreneurship, education and training in university are limited to an elective course. There is a clearly stated policy focus on the development of TT and technology start-ups initiated in 2013 and continued in 2014, which is supported by the funding from the Economic Development and Innovation OP (GINOP) to SMEs’ competitiveness, business incubators, industrial parks and science parks. It is, however, too early to see visible effects in the R&amp;I system.</td>
</tr>
<tr>
<td><strong>Key measures to promote KT activities:</strong></td>
</tr>
<tr>
<td>- Budapest Runway 2.0.2.0.—A Start-up Credo” published in November 2013, envisioning Hungarian capital as the start—up centre of Central and Eastern Europe. Four types of measures for building a competitive start-up and innovation ecosystem are proposed: i) education and training, ii) access to funds, iii) taxation and regulation, iv) enabling environment</td>
</tr>
<tr>
<td>- Law on “Scientific Research, Development, and Innovation” supports the RDI-driven competitiveness of companies and the creation of high added-value jobs, while the new Higher Education Strategy includes measures to foster collaborative RDI activities between HEIs and companies, as well as tailoring the curricula toward the needs of the business sector.</td>
</tr>
<tr>
<td>- The New National Program of Excellence (NKP) helps to make the researchers career more attractive. NKP is to be financed from central budget; in 2016, the amount to be allocated to scholarships is HUF 1.32 billion.</td>
</tr>
</tbody>
</table>
### Policy lessons:

- KT targeted policies need to reflect a broad spectrum of stakeholders and initiatives
- A balanced STI policy approach is needed
- Hungarian policies are very much in line with European policy initiatives which imposes a threat of mainstream policies instead of targeted place based policies
Ireland

Summary: The Irish higher education sector has a central role in the knowledge triangle by providing skills, facilitating technology transfer and commercialisation, and enhancing wider societal impact of education and research through an engagement agenda. The case study covers these and reviews key national policy initiatives and current institutional practices in three HEIs.

Authors: Ruaidhri Neavyn, Higher Education Authority Ireland as part the HEInnovate country review Ireland

Funding
The Higher Education Authority’s funding model that has three main elements: (i) an annual recurrent grant that is allocated to each HEI based on known formulae relating to the number of students and their subject areas, (ii) performance related funding that is allocated to HEIs based on benchmarked performance in delivering on national objectives, (iii) targeted/strategic funding that supports national strategic priorities and which may be allocated to HEI on a competitive basis. As a signalling measure, a limited amount of performance funding of EUR 5 million was reserved from the allocation of the 2014 recurrent grant to higher education institutions to be released subject to satisfactory engagement with the strategic dialogue process. This part of the funding model is expected to account for up to 10% of annual funding in time.

RDI activities in HEIs are funded through competitive funding. Core funding covers the salaries of core academic and support staff engaged in RDI activities as well as some recurrent costs associated which such activities. A national ‘research prioritisation’ exercise in 2011/12 identified 14 priority areas for research funding. The choice reflects an overwhelming importance given to STEM (Science, Technology, Engineering and Mathematics); apart from modest opportunities available through the Irish Research Council, researchers in non-STEM fields are expected to look outside the country for funding. Directing requests to multiple funding agencies also increases the share of resources spent on administrative staff and procedure costs and reduces investment in innovation.

Key national policies
The national strategy for higher education recognises that engagement takes many forms. It includes engagement with business and industry, with the civic life of the community, with public policy and practice, with artistic, cultural and sporting life and with other educational providers in the community and region, and it includes an increasing emphasis on international engagement. The strategy further recognises the multidimensional nature of many of the social, economic and civic challenges which will require inter- and multidisciplinary approaches, and that HEIs are uniquely well placed to lead, develop and apply these.

A central role in strengthening the role of HEIs in knowledge triangles plays the strategic dialogue and performance compact agreements. The purpose is to align the missions, strategies and profiles of individual higher education institutions with national priorities, and to agree strategic objective indicators of success against which institutional performance can be measured and funding can be allocated. The strategic dialogue process involves annual meetings between the executive of the HEA (supported by independent national and international experts) and the executive of the individual higher education institutions at which their performance compact submissions and progress against targets are discussed and assessed in detail.

Key policy initiatives to enhance skills development and reskilling include the Springboard programme, which offers the unemployed free degree programmes to reskill and return to work, and the ICT Action Plan which will have doubled the output of Bachelor and Diploma graduates, also from conversion and reskilling programmes, by 2018. At a regional level, Regional Skills Fora, recently introduced by the Department of Education and Skills, are expected to provide robust labour market information and analysis of employer needs, better alignment of education and training provision with the skills needs of each region and enhanced progression routes between further and tertiary education. This builds on the Regional Cluster initiative, which has started almost a decade ago as HEI-HEI collaboration. In the five clusters (Dublin/Leinster I, Dublin/Leinster II, West/North West, The Shannon Consortium, and the South) significant progress was made in academic planning and student pathways. Regional Clusters, which have taken advantage of already existing collaboration structures were better prepared to meet the challenges of implementing reconfiguration and rationalisation measures and developed at a faster pace.

Commercialisation is enhanced by Knowledge Transfer Ireland, whose role is to maximise innovation from State-funded research by developing the knowledge transfer system; a national protocol for the commercialisation of intellectual property developed in HEIs is in preparation. The Technology Transfer Strengthening Initiative by Enterprise Ireland funds
technology transfer infrastructure and targeted support measures in HEIs. Currently, a more-regionally and locally tailored approach of the Enterprise Ireland initiatives is underway.

**Institutional case studies**

- Translating research into real world applications drives the activities of the approximately 13,000 students and 1,300 staff at the University of Limerick (UL). UL’s role and leadership in partnerships with multinational corporations and local companies in pharmaceuticals, agrifood and software has been widely recognised for its innovativeness. UL’s new strategic plan – Broadening Horizons – seeks to underpin these achievements by building a culture of entrepreneurship and innovation in staff and students alike. UL has commenced with the development of case studies on research impact and has brought together groups of researchers from different faculties and worked with them in order to develop an understanding of “what” impact is and “how” it can be measured. It includes the preparation of case studies and stories about the impact of some of the research at the institute and, how and where this can be demonstrated, for example by translating research findings into practical guidelines and tracking the practical implications of using those guidelines on developments in policy design and implementation. Training is offered and templates are available to raise impact awareness and thinking when formulating research activities.

- **University College Cork (UCC)** is a research-led university, which punches well above its weight and successfully attracts high quality researchers and multiple sources of funding. Its five research areas are derived from the National Research Prioritisation exercise. To enhance research collaboration with local SMEs, the vice president for research and innovation regularly organises events for local firms to learn more about and get involved with UCC research, and in particular H2020 projects. A notable initiative to enhance the translation of UCC research into local development is CARL, the Community-Academic Research Links initiative. Since 2010 important pieces of research were produced and implemented, some of which have impacted on national public policy. CARL researchers work with non-profit voluntary and community organisations on a range of research topics. Selected research projects are intended to result in practical applications. One example of this is a checklist for Munchausen Syndrome patients, which can be used by family members and care

- The Limerick Institute of Technology (LIT) is the fourth largest IoT in Ireland, with more than 6,000 full time and part time students and 600 staff on five campuses within a 100 kilometre radius of Limerick. Plans to expand the main campus are underway. Applied research in conjunction with local and regional business is one of LIT’s strengths. LIT has the largest Art and Design school outside of Dublin and is a major partner in the City’s application to be the EU’s Capital of Culture. LIT’s education and research activities both set and respond to local demands; one example of which is LIT’s part time ICT conversion programmes for engineering students. LIT operates a ‘One Stop Shop’ customer relations management system to respond, track and deliver student services. LIT and UL are key drivers of the Shannon Consortium which was created in 2007, involving local community and businesses, city and county councils. The Shannon Consortium is regarded as one of the most, if not the most successful examples of a Regional Cluster. The Chairperson of the Shannon Consortium is a retired senior civil servant and former diplomat from Limerick City, and not being associated with any of the partner HEIs, facilitates better decision making in the consortium. The impact of the Shannon Consortium is significant. For example the multinational company Northern Trust would not have chosen to locate in Limerick without the consortium being in place, which enabled fast response times to the development of staff training programmes, the provision of office space etc. This has led to 400 new jobs being located in Limerick.
personnel as a first diagnosis tool. As part of the research agreement, students, community partners and the UCC academics agree that completed research reports are posted online. CARL is now extending its activities within all four colleges.

**Policy lessons:**

- **Co-ordination of the policy structures responsible for higher education, research and innovation and broadening the scope for non-STEM areas in research priorities.** The sharing of policy and funding responsibility for knowledge triangle activities in higher education across two government departments may lead to competing policies and overlapping funding instruments. To avoid this, it will be important to consider a consolidation of funding into a small number of agencies and a high-level coordination committee to prevent gaps, in particular with regard to non-STEM research or duplication.

- **Support HEIs in Ireland in creating collaborative and mentor links with entrepreneurial HEIs abroad.** Individual HEIs or groups of HEIs within Ireland should consider creating strong collaborative and/or mentor links with HEIs abroad that are advancing and embedding entrepreneurship and innovation within their strategies and practices. There is a role for public policy in facilitating peer learning in a systemic approach rather than single HEIs building their own links.

- **Enhancing Regional Clusters.** To achieve the overall aim of the Regional Clusters to strengthen research capacity and capability, promote enterprise and innovation, and to attract and retain talent from home and abroad, a next phase in the Cluster development will be needed, in which the focus is on including knowledge producers other than HEIs, and knowledge users and transformers from businesses, industry and civil society. Entrepreneurship and innovation should be considered as a core action area within the Regional Clusters. The recruitment of experienced personal from industry in full time or adjunct lecture positions should be considered to strengthen the capacity of HEIs to innovate and to generate entrepreneurs. A “one-size-fits-all model” should be avoided and buy-in from all involved HEIs ensured. For this guaranteeing full institutional autonomy and valuing the contributions of individual HEIs will be essential. Sharing good practices between the Regional Clusters is recommended.
Summary:
In Japan, the large share of business R&D performed that characterizes Japan’s innovation systems has focused attention on the role of HEIs in producing human capital to meet the needs of a high tech and medium tech export based industry.

Authors: Prof. Eiichi Yamaguchi, D.Sc., Kyoto University, Graduate School of Advanced Integrated Studies in Human Survivability (GSAIS), Japan

Current KT status
Policy drafting and implementation stage

HEIs surveyed: One comprehensive university, Kyoto University, was surveyed.

Examples of programs at Kyoto University to support KT activities

- **The Graduate School of Advanced Integrated Studies in Human Survivability (GSAIS)**, a completely new type of graduate school based on a program for leading graduate schools entitled “Schools of Advanced Leadership Studies” (SALS). SALS were selected for the Program for Leading Graduate Schools (All-Round Model) project by the Ministry of Education, Culture, Sports, Science and Technology - Japan (MEXT) in April 2011. The target profile for a graduate student is an individual who is willing to assume responsibility as a global leader and an entrepreneur. This program is nicknamed “Shishu-Kan”, as it is the field (Kan) to create knowledge and entrepreneurship by thinking (Shi) and practicing (Shu). Internships, fieldwork, and project-based research are important course requirements. The students also undergo one-year overseas internship with an international organization. They live in a residential college on campus, which enhances the environment for learning by facilitating student interaction across disciplines, and professors are available onsite to provide necessary support and mentoring. Further, eligible students receive a scholarship from the University as well as a financial support for their research activities.

- **The Graduate School of Management** (GSM), established in April 2006 differs from the conventional graduate program which to educate advanced professionals. GSM focuses on nurturing business leaders and entrepreneurs with highly specialized and advanced knowledge in various fields, by utilizing the knowledge acquired through research and university education.

- **Office of Society-Academia Collaboration for Innovation (SACI)**, established in 2007, aims to provide a one-stop shop for companies who are interested in collaboration with Kyoto University. SACI provides up-to-date information on technology developed by Kyoto University at various stages, i.e. not only research results such as patents but also technology which is in the process of being researched. SACI supports various collaborations with the help of external organizations such as TLOs (Technology Licensing Organizations). A Venture support programme promotes entrepreneurship education in the University community. The Venture Support helps Kyoto University inventors, innovators and entrepreneurs make their ideas and concepts more commercially successful for the benefit of society, the Japanese economy, the inventors and the University. Furthermore, Venture Support promotes funding to entrepreneurs through linking Kyoto University Venture Fund (KUVF) to entrepreneurs. KUVF was established in 2007 with a mission to provide funding to promising startups related to the Kyoto University.

Placed policies for HEIs
The Kyoto Innovation Belt (KIB), consists of 15 campuses of universities, 11 incubation facilities, and 13 industrial zones (IZ) and is spread over 40 km (North to South) and 12 km (East to West) and almost the same size as Silicon Valley. The KIB is supported by Kyoto City as well as Kyoto Prefecture. Kyoto University has been working as main sources of scientific / technological knowledge as well as intellectual human resources for KIB. One of the Kyoto campus, the Katsura Campus includes the Katsura Venture Plaza an incubation facility that was established by the collaboration of Kyoto University, Kyoto City and Kyoto Prefecture as well as the Organization for Small & Medium Enterprises (SME Support) in 2004.

Policy lessons:
- N/A. Case study to be completed.
**Summary:**
Diverse KT-related practices are found in the Korean universities, which are driven by the Korean government's policies to foster University-Industry cooperation, although the concept of "Knowledge Triangle" is not widely used in Korea.

**Authors:** Hyungjoo Kim, Kyung Mo Sung, Younghun Lim, Yoonsik Chae, Science & Technology Policy Institute (STEP), Seoul, Korea

**KT related policies:**
The Korean government has promoted strong innovation policies, however, universities has not played a critical role in the industrial innovation until the 1990s. Instead, the Government Research Institutes (GRIs) have developed technologies necessary for industrial innovation through applied research, and the role of universities was limited to that of higher education until the early 1990s. Korean universities began to conduct research activities with the increase of R&D funding from the national government in the 1990s.

Since the 1990s, The Korean government has promoted a university-industry collaboration policy and supported universities to contribute to industrial competitiveness and national development through their research and education. The policy and laws that promote technology transfer of universities had been established, and the national government began to actively support projects that transfer research result into private area. In the early 2000s, the Act on the Expansion of Industrial Education and the Promotion of University-Industry Collaboration was established, and, University-Industry Collaboration Units were established as a form of a separate corporation in each university. And the University-Industry cooperation policies expanded to include changes of university education to respond the demands of industries. More recently, entrepreneurship education is emphasized in many Korean universities and supported by the government’s 'creative Economy' policies.

**Place-based policies and HEIs**
Traditionally, the role of Korean universities did not include a regional dimension. In the late 1990s, the Korean government started to promoted regional policies for balanced development. Population and industrial innovation were concentrated in the capital region whereas innovation capacity was scarce in the rest of the country. Universities are relatively equally distributed across the country, and the Korean government supports universities to play a major role in knowledge creation in each region (especially less developed regions). However, the regional engagement of universities is still limited.

**HEIs studied:**
- Korea Advanced Institute of Science and Technology (KAIST) is a specialized science and technology university supervised by the Ministry of Science, ICT, and Future Planning.
- Chonbuk National University is a national comprehensive university located in a less industrialized region.
- Jeju National University is a national university located in the largest island of Korea, which is the 'Special Self-Governing Province.'

**Major Policy Project:**
Leaders in Industry-University Cooperation (UNC) supports universities (1) to improve the university education system and to resolve the job mismatch dilemma through university-industry cooperation; (2) to expand the scope of university-industry cooperation as one of the major activities of universities along with research and education; (3) to respond to the demand of regional industries. The Ministry of Education provided KRW 201.2 billion (Euro 152 508 584) to 19 universities in 2014.

**Policy lessons:**
- The University-Industry cooperation policies driven by the Korean government have brought a limited accomplishment, however, they provided Korean universities a momentum to recognize the significance of the third role of HEIs.
- Each university has a specific condition in which they can contribute to regional development. Bottom-up leadership and strategies are as much important as top-down policies and guidelines.
**Netherlands**

<table>
<thead>
<tr>
<th>An Entrepreneurial eco-system approach to the KT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Authors:</strong> E. Stam, A.G.L. Romme, M. Rosso, Van den Toren, B.T, Van der Starr, Utrecht, Eindhoven and Birch Consultants, Netherlands</td>
</tr>
</tbody>
</table>

**Summary:**
The case study focuses on research-education-innovation dynamics within Dutch entrepreneurial ecosystems. Any knowledge triangle does not evolve in a vacuum, but is part of a broader set of interdependent actors and factors which, if coordinated in an adequate way, might enable productive entrepreneurship within a particular territory. This report focuses on the role of regional governance (i.e. networks and leadership) in the knowledge triangle and the entrepreneurial ecosystem more broadly.

**Funding**
The Dutch innovation support system relies heavily on tax incentive schemes for R&D assets and labour costs; it does not invigorate cooperation. More than 22,000 firms made use of these incentives in 2014 (Ministry of Economic Affairs, 2015). Data on these schemes are not public and have not been taken into account in the case study. Most of public R&D stimuli are technological in nature. The European Framework Programme covers a wide variety of subjects, whereas most Dutch incentives are related to the Top Sector Policy, involving strongly technology-driven sectors. In terms of absolute numbers and financial size the innovation projects are skewed towards the European programmes: nearly half of the projects have a European public financial source.

**Place-based policies**
The performance of knowledge triangles embedded in (entrepreneurial) ecosystems is highly conditioned by local and historical factors — such as culture, formal institutions, physical infrastructure, financial resources, and the available pool of talents. The knowledge networks provide connection in such an ecosystem, whereas leadership involves a mechanism for giving direction. Knowledge networks and leadership capabilities are two critical systemic conditions for entrepreneurial activity and value creation, but their role and impact cannot be isolated from the broader set of conditions.

**HEI institutions surveyed:**
- The Amsterdam, Utrecht, Brainport and South-Holland regions do not differ substantially with respect to the structure of their knowledge networks, all having better scores than the national average.
- The network characteristics of the Twente region are, however, significantly different (e.g. more dense and connected) than those in the other four regions.
- The knowledge networks in Amsterdam are dominated by a larger set of HEIs. In the Brainport region two large OEMs as well as two HEIs are central.
- The Amsterdam, Brainport and Twente regions have been developing ‘triple helix’ forms of regional governance, involving an ongoing dialogue between key stakeholders.
- However, these three regions are also demonstrating distinct patterns and abilities. The three regions differ significantly in how they (as an entrepreneurial ecosystem) are configured, and therefore also face fundamentally different challenges in terms of economic growth, competitiveness and employment.

**Policy Lessons:**
- A collective sense of urgency about the local economic situation is a critical condition for initiating a strategy for geographical clustering and co-location.
- Each region has a unique history in shaping collective action, and has also been developing a (region-specific) balance between top-down steering and bottom-up leadership.
- The three case studies suggest there are substantial differences between regional boards, with regard to their ability to choose where, when and how to act — especially as a result of how they are funded and organised.
- Overall, entrepreneurial ecosystems emerge and develop in highly specific historical, social and geographical settings.
- As such, there is unlikely to be a single-best solution for shaping and governing (the development of) entrepreneurial ecosystems, and local governments and other agents should therefore be very careful and cautious in any attempt to copy ‘best practices’ observed in other regions.
**Norway**

<table>
<thead>
<tr>
<th>The knowledge triangle in policy and institutional practices</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Summary:</strong> There is a strong policy focus on research-based innovation and commercialisation of research, and hence on inter-linkages between research and innovation. In addition, entrepreneurship education has been a priority. While these are still considered important areas, the contribution of education to innovation more broadly is gaining increasing attention in policy, along with inter-linkages between research and education activities in higher education institutions. The majority of HEIs are state-owned, and although innovation is seen as important in policy and by governmental agencies, the state in its governance of HEIs mainly emphasizes research and education, which conditions HEIs potential for integrating education, research and innovation.</td>
</tr>
</tbody>
</table>

Authors: Borlaug, Siri, B., Aanstad, Siri and Solberg, Espen Nordic Institute for Studies of Innovation, Research and Education (NIFU), Norway.

**Funding**

At the national government level, the so-called “sector-principle” means that the ministries are responsible for research and innovation within their respective sectors, and this poses challenges in terms of horizontal coordination between the ministries. The Ministry of Education and Research has the overall responsibility for coordinating Education and R&D-policies, while the Ministry of Trade and Fisheries coordinates innovation policies. One research council, the Research Council of Norway (RCN), covers all research disciplines and sectors, and also provides support for industrial R&D and research based innovation. It also has the mandate to advise the government on research policy and to facilitate networking and communication between different actors in the Norwegian research and innovation system. The rather unique model of having one research council embracing all disciplines and forms of R&D means that the science-innovation link is embedded in the institutional set-up. In parallel, the national innovation agency, Innovation Norway, promotes innovation, entrepreneurship and business development through a number of measures, some of which are related to R&D. This means that funding programs for strengthening the interplay between research and innovation are many, but few support the integration between education and innovation. The public agency responsible for higher education (NOKUT) has a more specialized focus on quality assurance and is less important in terms of funding of higher education. Hence, on the policy and agency level, the links between education policies and research and innovation are less developed.

In general, Norwegian higher education institutions are mainly financed through public block-funding allocated from the Ministry of Education and Research. This funding stream covers almost all higher education activities, while R&D-activities are financed with around 2/3 from public block funding and 1/3 from external funding (primarily RCN). Another feature of funding of HEIs is that direct industry funding is relatively modest, accounting for 4% of HEIs’ total R&D expenditure. Additionally, there are few private donors and research foundations.

**Observations from the institutional case-studies**

- **UiT The Arctic University of Norway:** Comprehensive university: strong regional mandate academic university locally embedded, strong ties to the public sector, regional industry small and geographically dispersed, new types of adjunct positions involving public sector and industry
- **The Norwegian University of Science and Technology:** a technical university: national mandate with strong ties to industry and the public sector innovation «anchored» in the management «vice-rector for innovation»; well-developed eco-system for commercialization and entrepreneurship, co-operation with industry on education, but tensions between the tasks; few incentives for cooperation with industry and commercialization.
- **Buskerud and Vestfold University College:** a regional university college: regional mandate integrated ties with industry and public sector co-operation on strengthening education, innovation and research, cluster-programs important for developing KT-practices, new types of adjunct positions involving industry.
Policy lessons:

- The policy areas are largely managed separately. One consequence is that it limits the HEIs possibility to integrate KT-activities.
- A strong policy environment and dedicated sector ministries provides good opportunities for an integrated approach to KT-activities.
- Long term funding is important for developing and institutionalizing co-operation structures between HEIs and public/private actors. It offers the possibility to work strategically to strengthen interaction between education, innovation and research.
- The availability of local flexible funding, characterized by short-term application and decision processes, may offer a possibility for researchers to explore potential innovative ideas together with industry or the public sector, which may further develop into larger KT-projects.
- New types of adjunct positions and expanding the use of dual affiliations can enhance knowledge exchange and facilitate KT-practices.
- Academic career systems can be used to incentivize KT-practices, by including innovation and education as promotion criteria.
Spain

The AgriFood Campus of Excellence – ceiA3

**Summary:**
To address the major challenges and weaknesses detected in the diagnosis of the Spanish university system made by Strategy University 2015, the CEI programme was established to strategic co-operation and networking among universities and other research institutions and business placed within the campus, to develop university-centred knowledge clusters, acting as regional hubs of international excellence and contributing to the regional economic development, social cohesion and employment. The main objectives of CEI Program were:

- To improve the international visibility of the best Spanish university campus through the promotion of strategic aggregations to reach critical mass and excellence;
- To promote the diversification and specialisation of universities;
- To promote the development of innovative regions whose economic development is based on knowledge.

The evaluation criteria included the appraisal of three transversal dimensions, mainly the quality and sustainability of the strategic co-operation (aggregation), internationalization and specialisation. The programme was supported by several departments of the Spanish Government, particularly the Ministry of Education and Ministry of Science and Innovation, which put in place a comprehensive effort to improve the quality of services, activities and initiatives of the Spanish Campuses.

**Authors:** Luis María Delgado Martínez, Ministry of Education, Culture and Sports, Lola del Toro Jordano, ceiA3 and Fernando Mérida Martín, Ministry of Economy and Competitiveness, Spain

**Funding**
The CEI Program introduced a new funding instrument at institutional level to support new forms of co-operation – competition at national level among universities and other knowledge-related agents, around a new concept of university campus. The impact of the CEI programmes after three consecutive calls in 2009, 2010 and 2011 with selection of 32 CEIs and the monitoring and assessment of their progress by an International Commission set up by the Ministry of Education, Culture and Sport MECD in the period 2012-2015 has been demonstrated and recent studies even show an improvement in the average position of Spanish universities in the average and top position of global university ranking.

**Policy lessons:**
- The CEI programme allowed close co-operation between universities, other knowledge-related agents (research centres, scientific and technological parks) business, regional administrations and civil society organizations of the region.
- This integration of education, research and innovation in a given territory favours the creation of communities oriented towards excellence in specific knowledge domains, fulfilling the objectives of specialisation and, thus, the internationalisation of their activities.
Sweden

A knowledge triangle for quality and impact – Challenges for Swedish universities

Summary: There is currently no explicit policy in Sweden targeting the knowledge triangle. Still, it is a political priority and a living concept rhetorically. There are a number of characteristics and developments in the Swedish university landscape and system that condition the way in which knowledge triangle principles are realised.

Authors: Sylvia Schwaag Serger Halmstad University and Technical Research Institute of Sweden (SP), Eugenia Perez Vico (Vinnova, Lund University) , Emily Wise (Lund University), Sienna Bankler-Jukes (KTH) and Mats Benner (KTH and Lund University), Sweden

Funding
The central public funding streams for the three tasks of the KT are separated and isolated from one another, creating fragmentation and weak integration of tasks. In addition, Sweden’s research funding system is characterized by a relatively large number of funding organizations, which creates further fragmentation. The funding system has targeted selected research groups or even individuals, while it has undermined the leverage of university management and its ability to exert strategic leadership (Jacob 2015). Resources and thus leverage are centred around and reside primarily with research groups or even individuals which have considerable independence and decision-making power. The result is that the ability for universities as organizations to act strategically and drive change is quite limited. Rather, changes occur through specific R&D programmes which yield effects that are limited to specific research groups or academic disciplines (Benner 2013). Thus, much of the steering power lay in the hands of research funding agencies and research groups.

Industry-science relations
During the 1970s and 1980s, a number of initiatives and policies created a more institutional approach to interaction with the surrounding society. Offices and publicly funded programs aimed at promoting cooperation between industry and academia were set up. Technology parks emerged, as did other forms of ‘intermediaries’ or ‘bridging functions’ between academia and the surrounding society, with a strong focus on the business sector in general and technology-based firms in particular. An important threshold event occurred in 1998 when the government officially made cooperation with surrounding society one of universities’ core missions. In the wake of this decision, public funds were earmarked and increasingly made available to universities for cooperating with industry. By 2013, the proportion of public funds to universities requiring collaboration had reached more than 11%. Interaction can also be argued to have been unsystematic and centred and revolving around certain individuals, groups or communities. Personal relations and path dependencies played an important role in these interactions.

Observations from the Institutional Case Studies
• Lund University: tension between the tasks, and the tension between the roles of central administration in relation to the faculties.
• Chalmers University: strong managerial tradition provides an example of an ambitious university by purposefully orchestrating the knowledge triangle through the introduction of a matrix organisation. Yet, tensions have risen as the new organisation has increased complexity. These tensions are identified both vertically from management level down to individual researchers, as well as horizontally between different university tasks (i.e. education, research and societal engagement). In addition, tensions stem from the diverse ways in which the knowledge triangle is interpreted, valued and employed.

• Malmö University has predominantly been oriented around education and vocational training, and its profile is highly education-driven. As a result, they have been pushed to find innovative ways of seeking external funding and expanding their research base, primarily through collaboration with the local community, either via industry, NGO and state sector partnerships. Malmö sees societal engagement as a core value that forms an identity of serving society, differentiating it from older and more prestigious traditional universities. Malmö is a national hub for social innovation and prizes its engagement with civic society. As such, collaboration and integrating education with research and innovation is almost part of Malmö’s DNA, making specific ‘models’ such as the knowledge triangle obsolete in everyday parlance for staff.
Policy lessons:

- The policy areas of relevance to the knowledge triangle (research, education and societal engagement) are largely managed in silos.
- The result is that the ability for universities as organizations to act strategically and drive change is quite limited.
- Much of the steering power lay in the hands of research funding agencies and research groups.

- The specialised universities include the technical, agricultural and medical universities that all have long-standing ‘natural’ ties to related industries, sectors and networks.
- Many universities have adopted strategies for cooperation with industry and society. This has also spurred changes in organisational structures, recruitment or other policies. However, there is broad variation in universities’ approaches to establish a link between their strategies for societal engagement and their operational practices (in research and education).
Russia

Higher education policy and the knowledge triangle

Summary:
The Russian case study focused on the HEI development dimension at different levels of Russian higher education policy making and the role of governance mechanisms and new structures to involve HEI at regional level.

Authors: Dirk Meissner, Anastasiya Narkhov, Higher School of Economics. Moscow, Russia

Funding drivers
There are two main sources of funding education and research in Russia: budget and non-budget. Budget funding mostly allocated in a project basis. This scheme was launched in 2006 within the National Priority Project “Education”. At the first stage 57 universities support to implement 2-year innovative education strategies. Total amount of government funding accounted for RUB 30 billion, and in addition those universities attracted RUB 8 billion from non-budget sources. In 2009-2014 Federal Universities received RUB 35 bln subsidies from budget, and earned RUB 15 bln in collaboration with business-partners, and providing educational services. National Research Universities received earmarked subsidies in total amount of RUB 49 bln, and RUB 20 bln from non-budget sources. The amount of non-budget funding depends on the university enthusiasm and activeness. Since 2007 all Federal Universities started to adopt the practice of Endowment Funds.

Education policies
In 2009 the Ministry of Science and Education launched a programme for developing a network of National Research Universities. This status was granted to 29 universities on a competitive basis after the two rounds of the selection procedure (in 2009 and 2010). The winners received access to the total budget of RUB 48.9 billion (in 2009-2014), and were obliged to receive 45 billion from off-budget sources for establishing university’s innovation development strategies, creating new academic programs, improving research infrastructure, rising academic mobility and enhancing professional competences of teaching and research staff. To maintain the status of a National Research University all participants must undergo annual efficiency evaluation process, based on the methodology and quantitative and qualitative indicators designed by Ministry of Science and Education. In parallel another policy for establishing Federal Universities was introduced (Presidential Decree № 718 07.05.2008 «On Federal Universities»), where the Federal University is a result of the university merger process on the regional level. Several (two or more) universities of different profiles (classical, polytechnic, pedagogical etc.) were united under the common transparent governance, received additional direct earmarked funding for the purpose of becoming centres of scientific and educational excellence, and more generally, national platforms for providing stakeholders with high value-added competences. The Ministry of Science and Education also claimed that Federal Universities will play a role as main drivers of regional economic development and innovation activities. These initiatives are based on the objectives to increase the level of engagement of university staff in R&D and academic entrepreneurship as well as to fulfil the demand of innovation economy for qualified professionals. The quantitative target to increase the GERD performed by universities to 13.5% by 2018 was set in the May (2012) Presidential Decree “On measures to implement state policy in the field of education and science” (No. 599). The main feature of Federal University governance is the obligation to establish a Supervisory Board as a peer public governance body. The Board is responsible for ensuring transparent procedures and favourable environment for strategy implementation aligned with regional economy specific and features and composed of representatives of regional/federal authorities, entrepreneur unions, forming industries, top level academic experts.

Key measures to promote KT activities:

- Government Decree №211 16.03.2013 «On measures to support leading Russian universities for the purpose to increase their competitiveness among the leading global centres of scientific and educational excellence»
- Government Program ‘Development of Science and Technology in 2014-2020’
- Presidential Decree «On measures to implement state policy in the field of education and science (No. 599)» Presidential Decree №718 07.05.2008 «On Federal Universities»
- Cluster policies in Russia
### Policy lessons:

- HEIs’ impact on regional innovation infrastructure is strengthened through the elaboration of innovation ecosystem around particular universities, active cooperation with regional industry and consultancy for business innovation development, building strong networks among other stakeholders of regional innovation processes.
- HEIs' contribution to the regional STI development is determined by the growth of appropriate technical base (e.g. machinery and ICT resources), allowing creation of Centers of Collective Use and Centers of Engineering Excellence, where joint R&D activities are taking place. Federal Universities are engaged in Innovative Clusters through IP offices, TTOs, business incubators, centres for innovation competence training.
- HEIs have freedom to develop organically and apply state of the art HEI management models.
ANNEX: METHODOLOGY FOR THE KNOWLEDGE TRIANGLE CASE STUDIES

Structure of the case studies

The case studies are structured in two parts according to a common template. Part 1 consisted of a survey of national policies where respondents were asked to describe features of their research and higher education systems (a qualitative description) with respect to the four themes of the KT project: funding and governance, place-based policies, evaluation and impact assessment. Part 2 of the case study template was used by countries to perform detailed case studies of a diverse range of higher education institutions: A large, comprehensive university; a technical/science university; and an institution with a distinct regional profile. Part 2 surveyed the policies and strategies adopted at the institutional level to promote the development of KT activities and practices. See below for detailed summaries of the institutional case studies.

Empirical materials

National delegations executed the case studies according to a common template (Table 1). While several countries closely followed the template, several countries chose to diverge from the template and took a thematic focus, notably as regards the issue of higher education institutions in place-based policies and open innovation networks.

Table 1. Template for the case studies on the knowledge triangle

<table>
<thead>
<tr>
<th>Part 1: Nation policy frameworks for KT activities</th>
<th>Description of strategic initiatives at national/regional level to support knowledge triangle developments in higher education.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1: The overall state of interaction between research, education and innovation (i.e. the knowledge triangle)</td>
<td>Description of the main channels, actors and current state of KT at HEIs.</td>
</tr>
<tr>
<td>Q2: What is the position of the higher education sector in the knowledge triangle?</td>
<td>Description of the main funding sources for research and education and effects on KT interactions.</td>
</tr>
<tr>
<td>Q3: How is research and higher education funded?</td>
<td>Description of the local embeddedness on the HEIs and how this is reflected in policy strategies, governance and funding at institutional level.</td>
</tr>
<tr>
<td>Q4: The role of place-based policies in the KT</td>
<td>Description of the types of the criteria, measures and indicators applied to evaluating research and higher education funding and relationship to the KT.</td>
</tr>
<tr>
<td>Q5: Relation between national practices for the evaluation practices for higher education and research funding and the KT.</td>
<td></td>
</tr>
</tbody>
</table>

Source: OECD.
Implementation

Delegates contracted the case studies to policy analysts and academic researchers in the areas of research and innovation policy with expertise on higher education institutions. The country analysts surveyed national policy documents on research and innovation strategies and programmes and the extensive documentation on higher education institutions. For part 2 of the case study template, interviews were conducted with decision makers at HEIs (e.g. rectors, deans, leaders for R&D centres and projects) as well as research institutes and collaboration partners. Case study leaders also analysed quantitative data on collaborative research funding at programme, project or institutional level. In March 2016, case study leaders met to review the results of their draft case studies and discuss the calendar and outline of the final report to be prepared for the December TIP meeting.