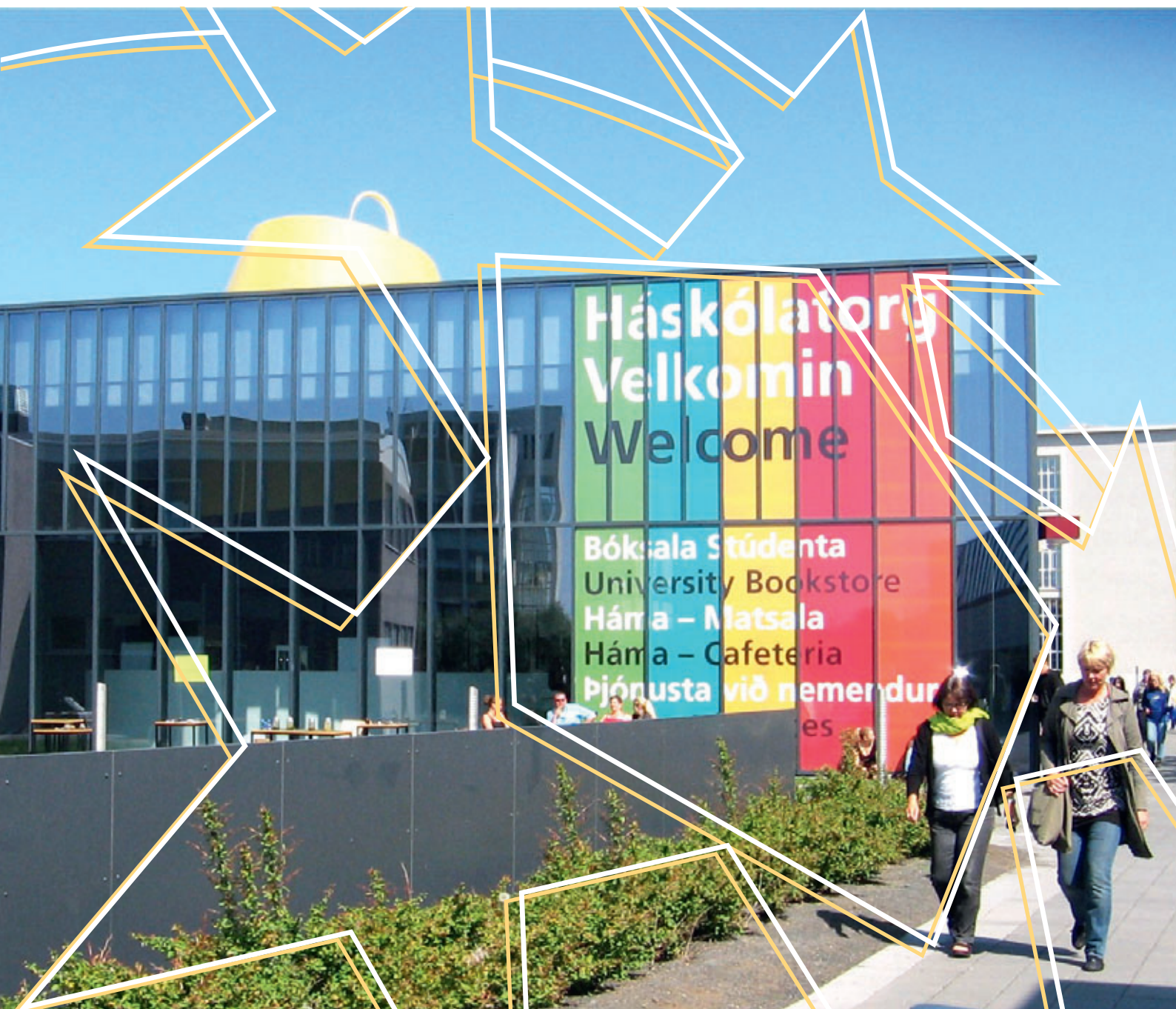


Strategies for Interaction and the Role of Higher Education Institutions in Regional Development in the Nordic Countries

Maria Lindqvist, Lise Smed Olsen, Apostolos Baltzopoulos

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Stockholm, Sweden, 2012

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Preface

This project was initiated in late 2009, as a follow-up to a previous project on 'Regional universities and university colleges, their regional impact on innovation, attractiveness and economic performance', commissioned by the Nordic Senior Officials' Committee for Regional Policy, Nordic Council of Ministers. The focus of the study is on the various roles of higher education institutions (HEI) in regional development. Important issues concern different strategies and incentives for university collaboration with external parties. The study has included different types of regions in terms of size and population density to offer a better understanding of the role of HEI in different regional contexts.

The project manager at Nordregio was Maria Lindqvist. The Nordregio project team also consisted of Lise Smed Olsen and Apostolos Baltzopoulos, with support from Veera Lehto, Moa Hedström and Lisa Hörnström. The quantitative pilot study of student mobility, based on micro data, was performed in collaboration with Anders Broström of the Royal Institute of Technology (KTH) in Stockholm.

A reference group consisting of the following representatives of all five Nordic countries was established; Peter Arbo, University of Tromsø, Eija-Riitta Niinikoski, University of Oulu, Sigríður Elín Þórðardóttir, Byggðastofnun, Göran Reitberger, Royal Institute of Technology (KTH), Maria Lönn, County Administrative Board of Stockholm, Morten Solgaard Thomsen, Danish Agency for Science, Technology and

Innovation, and Monika Mörtberg Backlund (replacing Kristian Möller), Nordic Council of Ministers. The reference group had three meetings to discuss the structure of the project and to participate in the final analysis of the results. The case study of the University of Tromsø was written by Peter Arbo while Henna Hintsala provided valuable support in completing the Finnish case studies on HAMK and University of Lappeenranta.

Interviews were carried out between April 2010 and October 2011. The report has benefitted from the possibility to develop synergies with other on-going projects at Nordregio, for example the Regional Innovation Monitor project (Technopolis/DG Enterprise), participation in the development of an internal quality policy for external collaboration (KTH) and an analysis of cluster collaborations in the region of Värmland (Region Värmland). Valuable input was also provided by participants at a concluding policy workshop in December 2011.

In addition to this report, the eight case studies undertaken for this project are presented in full in 'Strategies for Interaction and the Role of Higher Education Institution in Regional Development in the Nordic Countries – Case Studies', Nordregio Working Paper 2012:3. The reports can be downloaded from www.nordregio.se.

Stockholm, February 2012

Summary

This is the final report of a project initiated in late 2009 and funded by the Nordic Council of Ministers. The project focuses on the various roles of higher education institutions (HEI) in regional development. Important issues concern different strategies and incentives for university collaboration with external parties. The project includes a combination of a literature review, case studies and a quantitative pilot study of student mobility, based on micro data.

During recent years, non-material assets (knowledge, skills, culture and institutions) have received increased recognition as underlying mechanisms of growth. In this context, the importance of agglomeration economies and the significance of location-specific factors for competitive advantage are being stressed. The ability to produce economically useful knowledge locally becomes an important condition for regional growth and universities become not only important sources of knowledge but also key regional actors. However, commercialization of knowledge cannot be carried out independently by universities. It is in this framework that the concept of the entrepreneurial university, interacting with other institutional spheres of the triple-helix model (university-industry-government), has developed. Entrepreneurial universities may contribute to regional development in a number of ways, ranging from creation of knowledge and human-capital, transfer of existing know-how and technological innovation, to active participation in regional leadership and investment in knowledge infrastructures. The role and level of engagement by a university in its region's development will depend both on the type and size of the university and the type and size of the region. Despite clear expectations on the role of HEIs in regional economic development, significant limitations exist in our ability to measure the impact of HEIs.

In this project, a pilot study was carried out in order to assess the suitability of micro-databases for carrying out university-impact assessment studies. Using Swedish census data, post-graduation employment and entrepreneurial patterns of HEI alumni have been investigated. The results indicate that the number of HEI graduates in Sweden grew almost steadily between 1998 and 2007. On average the alumni retention rate in a region (number of local graduates who enter the local or regional labour market) is roughly 60 per cent for all graduates and 70 per cent for advanced degree holders (PhDs and Licentiates). The retention rates

vary considerably among different fields of studies, with the lowest values for 'Agriculture, Forestry and Fishing' and 'Services' whereas graduates in 'Health' show the greatest inertia. Stockholm is a best performer with rates close to 80 per cent, but core regions (major urban centres) in general outperforms the periphery in retaining local graduates. In terms of employment effect, the absolute number of jobs attributed to entrepreneurial activities of alumni is not impressive, but there are important variations between HEIs and regions. Moreover, three quarter of the alumni-founded firms are started in the business service industry, illustrating an important contribution to the renewal of regional industry structures.

In order to provide a framework for understanding the greater context in which HEIs and regional policy makers are active, a summary of national structures and policies related to higher education, innovation and regional development in the Nordic countries is presented. Over the last decade, government expenditures on tertiary education in USD per student have increased, particularly in Norway. In Norway, Sweden and Finland, there is a two-tiered system for higher education, with universities and university colleges. In Norway and Sweden, the different roles and characteristics have become increasingly blurred over time. Today, there is an ongoing debate in Sweden and Finland concerning the possibility to increase quality in education and research by reducing the number of HEIs or supporting HEIs' collaboration. In Denmark, a national consolidation process was initiated already in 2007. In most countries, there is a broad portfolio of various policy initiatives, including for example programmes for development of clusters or 'excellence' environments, programmes encouraging human mobility and work placement projects, or programmes stimulating collaboration between different sectors. Other initiatives are more unique, like the Norwegian SkatteFUNN, a tax scheme that allows firms to apply for tax reductions of up to 20 per cent to cover the costs of R&D activities.

In a separate working paper, eight case studies of Nordic HEI are presented. Case studies were performed on the following Nordic regions; the North Jutland region, the municipality of Hornafjörður in Iceland, Nordland County and the region of Northern Norway, the counties of Värmland and Stockholm in Sweden, and the regions of Häme and Lappeenranta in

Finland. The case studies were selected to include HEIs of different types and from different regions in terms of size and population density so as to offer a better understanding of the role of HEIs in different regional contexts. In a comparative analysis, it is noted that the different roles of HEIs are affected by the type of HEI as well as by regional characteristics. Moreover, the history of a HEI in a region has an important impact on its role. In Stockholm, for example, the role of KTH in regional development has evolved during the last decade, while in other regions it has been an important argument for HEI's establishment. In most HEIs, there are several activities to support entrepreneurship and innovation. There are also often ambitions to integrate education, research and collaboration, even if the concept of the Knowledge Triangle seems to be more commonly used in a Swedish context. Overall, HEI management seems to have an important role in supporting a culture of collaboration. Even if regional development and collaboration is mentioned in various strategy documents, there are few specific strategies for

regional development in HEIs today.

In the final chapter the roles of HEIs in regional development are discussed in terms of general economic impact, the traditional roles (of education and research), the third role (of collaboration with the surrounding society) and the broader role as an engaged university. Apart from the direct effects of the various roles, it is argued that HEIs also have an indirect effect on regional image and attractiveness. For HEIs to support regional development, three mechanisms have been identified; integrating regional development into university strategies, taking active part in regional partnerships and developing internal cultures, attitudes and incentives. From a policy perspective, the potential of various regional and national initiatives to support increased HEI participation in regional development are identified, including the formation of regional partnerships, stimulating cluster development through multi sector policy initiatives, clarifying the expectations of different types of HEIs and developing a Nordic system for HEI quality assessment and ranking.

1. Introduction

This project, financed by the Nordic Council of Ministers, is a continuation of a previous study carried out by Nordregio in 2009 resulting in the report 'Higher education institutions as drivers of regional development in the Nordic countries' (Hedin, 2009). In addition to providing an overview of Nordic higher education institutions (HEIs), the study explored, on the basis of six 'good practice' case studies in the Nordic countries, how universities and university colleges can interact with the surrounding business environment and work as instruments of regional development. Some examples of how HEIs collaborate with the surrounding society are as follows:

- education programmes that match the needs of public and private employers in the region
- project/problem-based learning and student outplacement, industrial PhDs
- entrepreneurship programmes and up-skilling and lifelong learning modules
- applied and need/user-driven research
- science parks and incubators to support knowledge transfer and entrepreneurship

Hedin (2009) highlighted a number of public policy implications derived from the case studies. First, they identified the need for a clearer definition of what

the mission of collaborating with the surrounding society entails. Education and research policy and regional development policy are usually managed by different ministries, and thus better coordination between these authorities may be required. Second, incentive structures do not sufficiently support researchers in the mission of collaborating with the surrounding society and could be developed further. Third, funding opportunities for collaboration projects are usually short-term, whereas the study indicates a need for funding of more long-term structures for collaboration projects. Finally, more knowledge on the direct effects universities potentially have on regional development is needed.

In this study, the objective has been twofold: to further develop our understanding of HEI strategies, incentives and activities to support collaboration and regional development; and to identify regional and national policy measures supporting this. As a basis for further research on the economic impact of HEI, a pilot study, based on Swedish micro data, has been performed on direct effects in terms of student mobility and entrepreneurship.

In the selection of case studies, a wide coverage has been attempted with the aim of exploring strategies and policies in different types of region and different types of HEI in the Nordic countries.

2. The new roles of higher education institutions

The foundations of modern growth theory were laid in neoclassical growth theory, pioneered by Solow (1956) and Swan (1956). The theory failed, however, to provide insight into the underlying mechanisms of growth that could potentially guide policy-makers. As theory developed towards an endogenous growth theory (Aghion & Howitt, 1998), focus shifted to non-material assets (knowledge, skills, culture and institutions) and the ability to produce, circulate and apply knowledge became more fundamental to competitiveness than the traditional tangible wealth-creating assets of land, labour and capital (Chatterton

& Goddard, 2000; Harloe & Perry, 2004). Abundant evidence of this trend can be identified: the growth of high-tech industries and the expansion of the scientific base; the move away from manufacturing to service-based economy; the development of new information technologies and accelerated technological change; the increasing complexity and sophistication of production processes; the reliance on specialist skills; the rising importance of the use and transfer of knowledge for economic activities and the implications of knowledge accumulation for production of further knowledge (Neef, 1998; Bryson et al., 2000; Harloe & Perry, 2004).

Importance of knowledge dynamics

These developments have drawn considerable attention from both academics and policy-makers expert on the process of knowledge creation and dissemination. In this context HEIs take centre stage as knowledge creation is part of their traditional functions and because of market failures related to the public-good¹ nature of knowledge that leads to the under-investment (from a societal perspective) in private research and development (R&D). Knowledge has the added characteristic of spilling over, a term commonly used to describe the process of non-deliberate knowledge dissemination. Because of these characteristics of knowledge society stands to benefit from high rates of private investment in R&D since any breakthroughs would add to the regional and national (and to some extent international) aggregate knowledge capital. Yet firms lack the incentives for over-committing resources in R&D since they will not be able to realize the returns of their investments fully. Mechanisms such as 'patenting' help to mitigate but not fully eliminate the problem (Jaffe, 1986; Audretsch & Feldman, 1996; Audretsch et al., 2002).

At the same time national governments are experiencing the paradox of having to address economic

development at a regional rather than a national level in the wake of an ever-intensifying globalization. The opening-up of national borders has put regions in the position of having to compete in a constantly growing and highly competitive global market with metropolitan regions becoming international rather than national economic hubs. This trend has made regional disparities even more pronounced than before. This shift in territorial scale and the rise in importance of the sub-national level are also mirrored in economic theory with the prevalence of the New Economic Geography (Krugman, 1991; Fujita et al., 2001) where the spatial location of economic activity receives formal treatment. In the same vein, the work of Michael Porter (1990) stresses the importance of agglomeration economies and the significance of location-specific factors for competitive advantage. Furthermore, a stylized fact concerning knowledge spillovers is that their strength quickly dissipates with geographic distance given the growing complexity of knowledge that makes codification and dissemination over large distances extremely hard and costly (Jaffe et al., 1993; Audretsch & Feldman, 1996).

¹ Goods that are non-excludable as well as non-rival. This means it is not possible to exclude individuals from the good's consumption. Commonly cited examples are fresh air and national defence.

New models for collaboration

Against this backdrop, the ability to produce economically useful knowledge locally becomes an important condition for regional growth, and universities become not only important sources of knowledge but also key regional actors. Note however how the requirement for knowledge to be marketable and economically useful is not perfectly aligned with universities' traditional role of producing scientific knowledge. Gibbons and colleagues. (1994) describe this distinction as a shift from 'mode 1' knowledge creation, which is highly disciplinary and hierarchical with clearly defined boundaries between different academic disciplines, to 'mode 2' knowledge production that is heterogeneous, transdisciplinary, and carried out with a view to producing marketable applications (Chatterton & Goddard, 2000). The commercialization of this type of knowledge cannot be carried out independently by universities alone, giving birth to the triple-helix model of knowledge-based regional development.

Whereas industry and government were the driving institutions of industrial society, the triple helix of university, industry and government comprises the key institutional framework of the post-industrial knowledge-based economy. The triple-helix model comprises three main elements. First, it implies a more prominent role of universities in innovation processes, alongside industry and government. Second, there is a movement toward collaborative relationships between the three institutional spheres through which innovation is more frequently an outcome of interaction rather than a recommendation from government. Third, in addition to filling their traditional functions, each institutional sphere also takes on the role of the others in the sense that they operate both horizontally in their traditional function and vertically in their new role (Etzkowitz & Klofsten, 2005; Etzkowitz et al., 2008).

A region with a cluster of firms rooted in a particular technological paradigm is in danger of decline

if the paradigm is superseded by other technologies and products. Therefore the need to renew the industrial base is an increasingly national and regional concern, causing government as well as firms and universities to explore new ways to develop and utilize knowledge to provide a greater contribution to the economy and society. In the triple helix, in addition to its traditional role as provider of education and research, the university acts as a source of firm formation and regional development. Government supports new developments through changes in the regulatory environment, tax incentives and provision of public venture capital. Industry takes on a similar role to that of universities in the development of training and research, often at the same high level as universities. In addition to the three institutional spheres of the triple helix, other actors such as labour and social NGOs may be represented (Etzkowitz & Klofsten, 2005).

Business incubators provide a good example of how universities engage in activities promoting firm formation and regional development, and of university-industry-government interaction. Incubators were first developed as the result of a convergence of public and private interests with a common goal of systematizing the transition from invention to commercialization of new technology. University incubators typically offer a combination of financing and mentoring to newly established high-technology firms. Business start-up activities are often located according to related technology themes in a common physical space where learning can more easily take place between them. The point of incubators is that firm formation can be improved by being organized as an educational process, with formal and informal aspects (Etzkowitz, 2002). Further examples of organizational mechanisms of the triple helix are science parks and business angel networks, which, as incubators, facilitate community development and international exchange (Etzkowitz & Dzisah, 2008).

The entrepreneurial university

It is in this framework that the concept of the entrepreneurial university has been born. The entrepreneurial university interacts with innovative actors in other institutional spheres of the triple-helix model of university-industry-government interaction to promote regional growth. It plays an important role in a broader social context. Moreover, the entrepreneurial university is expected to be generative and proactive and take on a leadership role in the triple helix, also

adopting some of the traditional roles of industry and government. Entrepreneurial universities contribute to industry in a number of ways. For example, academics may influence firm formation through generous leave policies or through permission to provide advisory services while maintaining a full-time position at a university (Etzkowitz & Zhou, 2008). Another example involves encouragement to circulate personnel across the different helices by the appointment by universities

of so-called 'professors of practice'. These persons have administrative and business expertise in 'practice', and thus they integrate business and academic roles and help bridge the university-industry divide (Etzkowitz & Dzisah, 2008).

The requisite for creating an entrepreneurial university is a critical mass of research with commercial potential. The main factors in creating an entrepreneurial university are internal culture and external environment, especially the industrial environment. It is possible to influence change in both of these factors through initiating measures to encourage entrepreneurship and

regional development. Entrepreneurial universities play different roles in various triple-helix constellations, which can be guided to a greater extent by one of the three institutional spheres. In a university-pulled triple-helix model, entrepreneurial universities take the lead in regional innovation. In a government-pulled model, entrepreneurial universities assist the development of existing industries and creation of new industries at the request of government. In an industry-pulled model, such universities typically cooperate with industry in product and process innovation (Etzkowitz & Zhou, 2008).

Roles of HEIs in regional development

Because of their multi-faceted functions HEIs affect local economies through several different routes. Apart from their direct economic impact, previous research identifies as many as eight different functions or outputs of modern research universities: (1) creation of knowledge, (2) human-capital creation, (3) transfer of existing know-how, (4) technological innovation, (5) capital investment, (6) regional leadership, (7) knowledge infrastructure production and (8) influence on regional milieu (Goldstein et al., 1995; Drucker & Goldstein, 2007).

Huggins and Johnston (2009) provide an analysis of the contribution of universities in the UK to the economic development and innovation of regions. They distinguish between two categories, competitive and uncompetitive regions. Competitive regions are described as having the ability to attract and maintain firms with stable or rising market shares in an economic activity, while maintaining stable or increasing standards of living for those involved. Uncompetitive regions are characterized by lagging behind their counterpart regions in terms of indicators such as output per capita and employment levels, as well as knowledge based indicators such as innovation, patenting, and density of knowledge-intensive firms. This type of region is also more likely to lack innovation-driven public or private sector entities, while depending on small and medium-sized enterprises which exhibit low growth trajectories.

In their study on UK regions, Huggins and Johnston (2009) distinguish between traditional pre-1992 universities and newer post-1992 universities. In the UK context pre-1992 institutions represent the leading research-intensive universities, and post-1992 institutions are often characterized by intentions to broaden access to higher education, especially through professional teaching. Hedin (2009) provides an overview of the historical development of HEIs in the Nordic countries. As a number of HEIs came to be

established in the Nordic countries outside metropolitan areas from the 1960s onwards, a general distinction is made between pre-1960 and post-1960 HEIs. The HEIs in the Nordic countries indicate a similar situation to the UK, as education levels and R&D intensity tend to be higher in areas with pre-1960 universities.

Boucher et al. (2003) further propose that the level of engagement by a university in its region's development will depend both on the type and size of the university and the type and size of the region. After considering several case studies they identify four distinct tiers of engagement by universities with their region's development that are worth taking a closer look at. The first typology concerns single-player universities in peripheral regions. Such institutions play a key role in encouraging local entrepreneurship (often because peripheral regions do not offer adequate employment opportunities for the highly educated) and in science and technology transfer, being a key player owing to what one could describe as a monopoly situation. The second typology concerns multiplayer universities in peripheral regions. Boucher et al. (2003) describe such institutions as excelling in forming regional consortia (a necessity when the local market is too small to support competition between institutions) and cultural networks, in regional promotion and telematics networks. The third typology is that of traditional universities in core regions that mainly engage in regional development through the provision of education and training, contributing to the sustainable development of the region (for example through research into environmental technologies and programmes raising community awareness), and through strategic planning and knowledge transfer. Finally, the last distinct typology they identify is that of newer technologically-oriented universities in core regions that contribute to the regeneration of cities and reach out to non-traditional students (for example by focusing on ethnic minorities).

Assessing the impacts of universities

Despite clear expectations and well-articulated arguments on the role HEIs can (or according to some sources should) play in regional economic development significant limitations exist to our ability to measure such an impact in the form of a quality-assurance exercise. It should be obvious that not all functions are equally easy to identify, quantify and assess. For some of them it is difficult even to distinguish the output of one function from the output of another. Perhaps one of the most common approaches in the literature is to assess the impact of university spending or investments on an aggregate regional production function. Such approaches are obviously guided by data availability rather than efficiency concerns and fail to capture the underlying mechanisms of any identified correlation. Other types of approaches implemented are single-university impact studies, surveys and quasi-experimental designs. For more details and a critical assessment of each approach see Goldstein et al. (1995).

Considerable research on the topic has been carried out in the UK, with the University of Strathclyde (UoS) acting as a common point of reference for several

projects and publications. The ‘overall impact of higher education institutions on regional economies’ was one of four major research projects of the Fraser Allander Institute of UoS and was carried out over a period of four years (2007-10). Based on a computable general equilibrium model (CGE) the supply-side impacts of HEIs in regional economies have been investigated. The results suggest substantial regional economic impacts in terms of both output and employment and point to the possibility that the challenges HEIs will face in the near future as the populations in Europe are progressively ageing and the cohorts from which students are recruited are shrinking could have adverse effects on regional economies. (McGregor et al., 2009a, 2009b and references therein).

All these intricacies make a complicated mosaic. The current project will try to shed further light on the role of HEIs in regional development by providing several in-depth examinations of the role of different institutions across different regions of the Nordic area and also assess the suitability of unique micro-databases for carrying out university-impact assessment studies.

3. National Frameworks

Denmark

Institutional structure

Denmark has eight universities (University of Copenhagen, Aarhus University, Technical University of Denmark, University of Southern Denmark, Aalborg University, Roskilde University, Copenhagen Business School, and the IT University). The universities are all regulated by the University Act of 2003. A consolidation process in 2007 merged 12 universities and 13 government research institutions into eight universities and four government research institutions (Ministry of Science, Technology and Innovation, 2009). These two reform processes, the University Act of 2003 and the merger of HEIs and public research institutions in 2007, have influenced the development of the higher education system in Denmark during the last decade. The Globalization Strategy introduced by the Danish Government in 2006, which is highly focused on the role of HEIs in the transition towards a knowledge-based society, has also influenced higher education. The universities are under the auspices of the Ministry for Science, Technology and Innovation.

The aim of the University Act of 2003 was to strengthen university research, education and knowledge exchange through changing the institutional framework of the universities. Thus, the status of the universities translated them from government institutions into 'independent institutions under public sector administration'. The purpose of this was to increase the universities' prioritization and decision-making capacity in such a way that academic self-government was maintained and universities remained independent of special interests (Ministry of Science, Technology and Innovation, 2009). With the 2003 Act the 'third mission', which involves knowledge dissemination and collaboration with the surrounding society, was introduced as a main purpose of the universities alongside their traditional missions of education and research (Reglab, 2006).

The Globalization Strategy launched in 2006, entitled 'Progress, Innovation and Cohesion Strategy for Denmark in the Global Economy', was developed by the Globalization Council set up in 2005. The strategy introduces key strengths and weaknesses;

one of the latter is that the Danish education system is not sufficiently geared towards a knowledge society. Consequently the Globalization Strategy has become an education and research policy strategy. University-oriented policy goals are intended inter alia to: raise the public investments in research from 0.75 to 1 per cent of the Danish GDP; double the number of PhD students; and integrate the government research institutions into the universities (Ministry of Science, Technology and Innovation, 2009, p.22).

The university merger process in 2007 was an outcome of the goal set in the Globalization Strategy of integrating government research institutions into the universities. The integration was intended to stimulate research synergies between the two previously institutionally separate functions, and to facilitate university access to practice-oriented research, which implies a closer contact with the surrounding society. The intention of the Ministry of Science, Technology and Innovation in also merging universities, which was not a goal of the Globalization Strategy, was to create a reduced number of universities which would be stronger in an international setting (Ministry of Science, Technology and Innovation, 2009).

In 2009 a strategy for integration of entrepreneurship throughout the entire Danish education system was introduced by cooperation between the Ministry of Children and Education, the Ministry of Science, Technology and Innovation, the Ministry of Culture, and the Ministry of Economic and Business Affairs. As part of the strategy, investments are made to support entrepreneurship education in school, youth education, higher education and research. The Danish entrepreneurship strategy is unique in terms of the amount of earmarked funding, the involvement of all levels of education, and the integration of entrepreneurship into the strategies of education institutions (Melin & Blomkvist, 2011).

Innovation policy

The Danish Council for Technology and Innovation,

in collaboration with the Danish Agency for Science, Technology and Innovation and under the Ministry of Science, Technology and Innovation, is responsible for the Ministry's knowledge dissemination and innovation initiatives. In line with the Globalization Strategy of April 2006 and the subsequent Globalization Agreement of November 2006 between the Government, the Danish Social Liberal Party, the Social Democratic Party and the Danish People's Party, the Danish Council for Technology and Innovation developed the first innovation action plan, in dialogue with relevant stakeholders. Currently, the second action plan is in place, which is called 'Innovation Denmark 2010-2013: knowledge to firms creates growth' (Rådet for Teknologi og Innovation, 2010). Moreover, the Government in 2010 launched its innovation strategy 'Strengthened Innovation in Firms' which addresses the objective of the Government that firms in Denmark shall be among the most innovative in the world by 2020 (Regeringen 2010).

Compared with most other OECD countries the ratio of funding by private companies to university research is low in Denmark at 2.3 per cent. Three main factors which may explain this have been suggested by the Ministry of Science, Technology and Innovation (2009). First, traditionally in Denmark there has been a high ratio of public funding, combined with a high level of taxes in the country. This indicates that university research is regarded as the responsibility of the State, and that it is a public good which enterprises might benefit from. Second, the low degree of private funding of university research may be related to the fact that the Danish industry structure is dominated by small and medium-sized enterprises, which have less tradition and fewer means for financing research. Third, the low percentage of private business financing only shows the direct industry financing; it does not include the funds provided by large independent foundations established by large companies such as Carlsberg, Novo Nordisk and Lundbeck.

According to the action plan 'Innovation Denmark 2010-2013: knowledge to firms creates growth', research and development activities in both the private and public sector have increased slightly during recent years. The global financial crisis has had an impact on development in Denmark, however, and the action plan encourages firms, especially SMEs, to increase their research and development efforts and become more focused on innovation. Three of four main focus areas of the action plan emphasize the role of universities. The first focus area is concerned with the interplay between research and firms, which

is implemented through measures such as innovation networks. The second focus area involves the importance of getting more employees with higher education, e.g. more industrial PhDs, in firms. Finally, a focus area is the increase of commercialized research, which will be implemented through measures such as innovation environments (The Danish Council for Technology and Innovation, 2010).

Funding for collaboration projects between private enterprises and knowledge institutions on research, development and innovation are distributed through various schemes under the Danish Council for Technology and Innovation. Moreover, other similar funds are administered by other councils and ministries. In order to provide easy access to firms that are interested in learning about public innovation opportunities, a portal (www.vaekstguiden.dk) was established in 2010. Moreover, a call centre has been established which is able to give advice to firms with regard to the innovation opportunities that match their individual needs.

Regional development policy

The Danish Enterprise and Construction Authority, under the auspices of the Ministry of Economic and Business Affairs, is the authority responsible for regional development policy in Denmark. As part of the local government reform in 2006, six regional growth fora were established under the Danish Enterprise and Construction Authority. Through partnership agreements between the government and each of the growth fora, the goals of the Globalization Strategy are also integrated into regional development policy. The growth fora include the following stakeholders in each region: representatives from the region; the local authorities; knowledge and education institutions; the business community and the labour unions. The executives and the secretariat of the growth fora are part of each region's regional development department. The main missions of the regional growth fora are to formulate regional business development strategies; to monitor regional and local conditions for growth; and to propose co-financing of regional business development activities, including allocation of EU Structural Funds in the regions (Lindqvist, 2010).

Universities are represented in the regional growth fora, and are thereby able to contribute actively to the regional development processes, at the strategic level as well in terms of implementation, as universities can also receive regional development funds for collaborative projects.

Iceland

Institutional setting

The establishment of the University of Iceland in 1911 marked the beginning of the modern Icelandic system of higher education. This first national university was established by merging three professional schools founded during the previous century, a school of theology, a school of medicine and a law school, and adding a new faculty of arts. Before that time Icelandic students had usually travelled to Denmark for higher education.

At present there are seven higher education institutions in Iceland. Higher education institutions include both traditional universities and institutions which do not carry out research. Four higher education institutions are operated by the state, and private parties with state support operate three institutions. There is no charge for tuition in higher education institutions operated by the state, only registration fees, but higher education institutions operated by private parties do charge tuition fees. All the institutions are under the auspices of the Ministry of Education, Science and Culture.

The higher education institutions vary in the extent to which they engage in research and the number of study programmes offered. They can also be categorized into four groups according to their specialization, three institutions offering a wide range of studies, two agricultural institutions, one academy of arts and one business school.

Over the last decade institutions of higher education have increasingly started to offer postgraduate programmes. This has been done to meet demands from society and to accommodate an increasing number of students. Programmes at Master's and PhD level are still not offered in all fields of study, however. At present two higher education institutions offer PhD degrees. In spite of this development Icelandic students continue to travel abroad for their postgraduate studies.

The Higher Education Act of 2006 establishes the general framework for the activities for higher education institutions. The role of each public higher education institution is further defined in a separate act of parliament regarding its activities. The charters of private institutions define their terms of engagement.² In recent years, providing access to higher education via distance learning has become an increasingly important part of the Icelandic higher education system. Most of

² http://eacea.ec.europa.eu/education/eurydice/documents/eurybase/national_summary_sheets/047_IC_EN.pdf and http://eng.menntamalaraduneyti.is/media/MRN-PDF-Althjodlegt/IC_EN_Tertiary-Education.pdf

the higher education institutions offer distance learning courses in some areas of study.

The traditional role of universities is to provide research and education, but they have increasingly undertaken a 'third mission' which implies a more direct involvement in cooperation with firms and various actors in society in general (OECD, 2007). This development is slowly occurring in Iceland, although no 'third mission' is directly mentioned by the Icelandic government or the University of Iceland. Instruments to stimulate innovative activities and regional development in Iceland have taken various forms, an example of which is the establishment of the Institute of Rural Research Centres and its build-up of small university centres in the rural regions around Iceland (Nielsen, 2010).

Since 1999, contracts, which are renewed every three years, have been set up between the Ministry of Education, Science and Culture and the individual universities. The contracts are adapted to the specific characteristics of individual universities and specify the performance and volume of activity expected of the universities with regard to teaching and research. Moreover, the contract forces universities to take into account national priorities; to work with other research institutions; to tender for national funding; and to consider the quality of their research (Neave et al., 2008; Taxell et al., 2009).

Innovation policy

The Science and Technology Policy Council of Iceland (the Council), under the Office of the Prime Minister, is the body responsible for the design and coordination of research and technology policy in Iceland. The Council is organized in two Committees, the Science Committee and the Technology Committee, appointed by the Minister of Education, Science and Culture and the Minister of Industry, Energy and Tourism respectively. The two Committees prepare the decisions of the Council. The Chairman of the Science Committee is also the Chairman of the Board of the Research Fund, which allocates funding to research and scientific institutions in the country. The Chairman for the Technology Development Fund is appointed directly by the Minister of Industry, Energy and Tourism (Nauwelaers, 2009). The Science and Technology Council has launched a strategy for 2010-12, which inter alia is concerned with establishing links between

research and innovation, e.g. the strategy recommends firms and institutions to apply for funding from Marie Curie (People), a European program on human mobility within FP7, and encourages technical and business-related studies (Melin & Blomkvist, 2011).

The Icelandic Centre for Research (Rannis), part of the Ministry of Education, Science and Culture, assists in the development and implementation of science and technology policies in Iceland by serving as an adviser to the Council, its subcommittees and the broader scientific community. The centre coordinates international collaborative projects in science and technology which involve Icelandic organizations. Furthermore, Rannis administers the funds for research and technology, and is tasked with monitoring and evaluating the results of programmes and projects.

Innovation Centre Iceland, which was formed after a merger between the Technological Institute of Iceland and the Building Research Institute, is the main public actor with regard to technology transfer and the provision of advisory services to industry. A service centre specifically for entrepreneurship and small and medium-sized enterprises, Impira, is set up as a semi-independent unit within the centre. Innovation Centre Iceland operates under the Ministry of Industry, Energy and Tourism.

Science and technology policy in Iceland thus mainly involves two ministries, the Ministry of Education, Science and Culture and the Ministry of Industry, Energy and Tourism. Moreover, a distinction is made between science (the Research Fund) and technology (the Technology Development Fund).

Government contributions to research and development as stated in the 2010 national budget in fixed prices, amounted to 17.4 billion ISK (approx. 106 M. EUR) in 2010 and 15.3 billion ISK (approx. 94 M. EUR) in 2011. Approximately 40 per cent of this was allocated to the higher education sector and 30 per cent to various public institutions. In 2011, public competitive funding of research and development amounted to approximately three billion ISK (approx. 12 M. EUR). Public competitive funding accounted for 17 per cent of the total R&D expenditure. The total R&D expenditure in fixed price terms has increased by 700 million ISK (approx. 4 M. EUR) since 2007. GDP, however, has decreased by 200 billion ISK (approx. 1 B. EUR) since 2007. In 2009, 49 per cent of the total expenditure on R&D was financed by the private sector, 40 per cent by the government and 10 per cent came from abroad. In total 5,500 people performed R&D in Iceland in 2009, accounting for approximately 4000 full-time equivalents (FTE) (Research and Development in Iceland, 2011).

In October 2008, the banking and financial sectors collapsed, affecting Iceland's economy and its

citizens severely. The recession which followed has obliged the government to review its policies, and to find alternative approaches to growth and development, which for example involves creating better links between education and innovation in a knowledge-based economy. Iceland faces extraordinary budget cuts, estimated at 10 per cent in 2009 and 2010. At the same time a GDP contraction of almost 10 per cent is expected, which marks a dramatic change in the trend from recent years.

At the beginning of 2009 the Minister of Science, Education and Culture made the decision to establish a national task force to give advice on the future of Iceland's education, research and innovation policy. This group was complemented by a panel of international experts. This led to a panel report which provided a number of recommendations for the future of education and innovation policy (Taxell et al., 2009). Amongst other things, the panel report stresses the need to streamline education and research. In connection with this, it advises that two university amalgamations should take place to replace the seven universities currently in place, and that greater interaction between departments as well as stronger linkages with public research institutions and the private sector should be established. This recommendation has until now not led to an actual merger of HEIs in Iceland, but it has meant that a national network of public HEIs is being established.

A collaborative network was established in December 2010 between the four public HEIs. As noted above, the panel report stressed the need to streamline education and research and advised that two university amalgamations should be created, one public and one private, to replace the seven universities currently in place (Taxell et al., 2009). According to the Pro-rector of Academic Affairs at UI, there is currently no political will to carry out a merger of the HEIs. Instead an incentive was provided by the Ministry of Science, Education and Culture to the four public HEIs to form a collaborative network.

Regional development policy

The Institute for Regional Development is the main implementing authority of regional policy in Iceland. It is an independent institution owned by the Icelandic state with the Minister of Industry, Energy and Tourism as its managing authority. The purpose of the Regional Development Institute is to work toward the strengthening of regional and economic development in Iceland outside the greater Reykjavik area. The Institute supports eight industrial regional development agencies in Iceland, one in each constituency. These include municipalities, federations of municipalities,

trade unions, business representatives, and various other parties who wish to participate in the economic development of these areas.

In accordance with its purpose, the Institute engages in the preparation, organization, and funding of projects and the granting of loans with the aim of supporting settlements, strengthening local economies, and encouraging industrial innovation (Icelandic Regional Development Institute / Ministry of Industry, Energy and Tourism, 2011).

The main objectives of the Regional Development Policy 2010-2013 are innovation and business development with emphasis on growth agreements and centres of expertise; tourism with emphasis on infrastructure, better knowledge and long term planning; foreign investment with emphasis on further use of renewable energy and foreign investment and venture capital in Icelandic industry; culture and society with emphasis on connection of culture and creative arts in innovation and business development.

The Iceland 2020 Policy Statement is a long-term planning document for social and economic development. It contains a number of policy targets relevant to regional policy. Long-term regional action and investment plans for the whole country are to be based on the objectives of the policy statement.³

The Regional Development Agencies have several responsibilities in the field of economic and socio-economic issues in the region. The agencies are run in accordance with an agreement with the Icelandic Regional Development Institute to enhance the region's economy and society. The agencies work closely with municipalities, research institutions, universities, companies and entrepreneurs in various projects.⁴

Regional Growth Agreements have been introduced for eight rural districts outside the capital region. The main objective of the agreements is to increase the level of economic, regional development and innovation. The Growth Agreements are implemented through a bottom-up approach with active involvement of local representatives from business, the public sector, universities, interest groups, etc. Regional Development Agencies are responsible for the implementation of the Growth Agreements. The main emphasis in the execution of the Growth Agreements is on local economic regional development and innovation through a cluster methodology, promoting the active participation of local SMEs, while also involving regional and external universities, research organizations and businesses in line with the triple-helix approach (Ministry of Industry, Energy and Tourism, 2011).

³ <http://eng.forsaetisraduneyti.is/iceland2020/>

⁴ http://www.byggdastofnun.is/page/samstarf_innlent

Norway

Institutional setting

Norway has eight universities (Oslo, Stavanger, Bergen, Trondheim, Nordland, Tromsø, Agder and the Norwegian University of Life Sciences in Ås), six specialized universities and 25 university colleges (Research Council Norway, 2011a). Since 2000, university colleges have been able to advance to universities through the introduction of master's and doctoral programmes. This has meant that an increasing number of university colleges are in the process of preparing to become universities.

In Norway, tertiary education is under the auspices of the Ministry of Education and Research, which conducts annual consultative meetings with each institution, and these meetings play a role in the coordination and governance of higher education. Other government agencies that play key roles in terms of higher education are the Research Council of Norway (RCN) and the Norwegian Agency for Quality Assurance (NOKUT). RCN allocates research funds to tertiary education institutions and to research institutions for both basic and applied research, whereas NOKUT is responsible for auditing the institutions' quality assurance systems, discipline and programme evaluations, and institutional accreditation. Another agency is the Norwegian Centre for International Cooperation in Higher Education, which promotes international cooperation in education and research and coordinates efforts to internationalize higher education in Norway. Other actors in the higher education system are the Norwegian Council for Higher Education, which represents rectors of universities and university colleges in discussion with the Government; a similar network for private higher education institutions; and organizations that represent students and staff (OECD, 2009a).

New legislation in tertiary education entered into force with the 1995 Act, which was amended in 2002, with the purpose of encouraging HEIs to be more responsive to the needs of society and the economy, reflecting competition in the global economy. For example, it specifies the role of HEIs in disseminating knowledge. Today, most tertiary institutions in Norway recognize that they have a responsibility to promote transfer of knowledge through research and consultancy (OECD, 2009a).

In order to promote a strong entrepreneurship culture, and to strengthen cooperation between education and the business community, the Ministry of Education and Research, the Ministry of Local

Government and Regional Development, and the Ministry of Trade and Industry in cooperation have introduced an action plan for entrepreneurship in education. The action plan comprises the entire education system, and entrepreneurship should be anchored in teaching plan at all levels of education in Norway (Melin & Blomkvist, 2011).

A recent initiative by the government to strengthen the cooperation between HEIs and the business community, and to increase the quality and relevance of education programmes to the business community, is the requirement for HEIs to form councils for cooperation with the business community (in Norwegian: Råd for samarbeid med arbeidslivet). The HEIs will develop new strategies in cooperation with their council which include labour market representatives, student representatives, and other relevant representatives from the regions. Strategies should have clear objectives, and an on-going dialogue with the business community about the development of education programmes should be ensured (Kunnskapsdepartementet, 2008-2009).

The university and college sector carries out approximately 25 per cent of Norway's total R&D activities. These research efforts are financed through the institution's basic allocations, grants from the Research Council and contracts from industry, public administration, private funds, etc. The total R&D investment in the independent institution sector, which encompasses over 200 institutions, is roughly equal to that of the higher education sector, i.e. approximately 25 per cent of the national R&D volume. The private sector provides approximately 50 per cent of the overall R&D investment in Norway. The most comprehensive R&D activities take place within industrial companies, which carry out over half of the activities within this sector, and R&D activities within the service industry are on the rise. In general, whereas Norwegian trade and industry are dominated by small and medium-sized companies, R&D within the industrial sector is mainly concentrated within a few major companies (RCN, 2011a).

Innovation and regional policy

SkatteFUNN is a key measure to support R&D activities of the business community in Norway, introduced in 2002. The scheme is administered by the Norwegian Research Council in cooperation with Innovation

Norway and the Norwegian Tax Administration. The scheme implies that SMEs and larger firms can achieve up to 20 per cent tax reduction to cover the costs of R&D activities. A requirement is that the projects are targeted at developing new knowledge or competences which can lead to new or better goods, services or production processes (Forskningsrådet, 2011).

In Norway the Department of Research and Innovation, under the Ministry of Trade and Industry, is responsible for research and innovation policy, regional policy and port and maritime transport policy. In 2008, the Ministry created a white paper with the title 'An Innovative and Sustainable Norway' (Norwegian Ministry of Trade and Industry 2008). This document forms the basis for further development of innovation policy in Norway, which entails the establishment by government of strategy councils in the areas of tourism, the maritime industry, small and medium-sized enterprises, and environmental technology. These areas are considered main strengths of Norway, and the white paper stresses that Norway needs to continue focusing on doing what it is good at. Moreover, it aims to strengthen research in industry by increasing allocations to user-oriented research programmes and R&D contracts, as well as strengthening the industrial doctorate system and efforts to commercialize research results.

Three institutions are engaged with innovation policy and regional development in Norway, the Research Council of Norway, as described above, Innovation Norway and SIVA.

The Research Council of Norway (RCN) is the main agency with regard to innovation and research. It has three main functions. First, the Council is a strategic adviser on the government's research policy. Second, it is charged with an operational role in financing research by the business sector, the university and university college sector and the research institutions. The RCN develops policy instruments, manages research programmes, promotes international research cooperation and disseminates research findings. Third, the Research Council builds networks for producers, funding bodies and users of research (Ministry of Trade and Industry, 2011).

Innovation Norway offers products and services intended to help boost innovation in business and industry nationwide, foster regional development and Norwegian industry and promote Norway as a tourist destination. It has offices in all Norwegian counties and maintains a presence in approximately thirty countries worldwide. The organization's role is to provide or arrange financing, link customer enterprises to know-how and help them build networks for their innovation projects (Innovation Norway, 2011).

SIVA – the Industrial Development Corporation

of Norway facilitates the infrastructure for innovation in Norway. SIVA aims to develop strong regional and local industrial clusters through ownership in infrastructure, innovation centres, investment and knowledge networks via the mobilization of local and regional actors in public-private partnerships. SIVA is involved in research and knowledge parks, business parks, incubators, seed capital and venture companies throughout the country (Ministry of Trade and Industry, 2011).

A number of policy programmes are managed by these three authorities, examples of which are the VRI programme, the ARENA programme and the Norwegian Centres of Expertise scheme.

One of the initiatives of the RCN involves the VRI programme, which is an initiative targeted towards research and innovation at the regional level in Norway. The VRI programme is a national programme with an initial time-frame of ten years (2007 to 2017). The programme is designed to promote greater regional collaboration between trade and industry, R&D institutions and the government authorities, and to establish close ties to other national and international networks and innovation measures such as the ARENA programme, and Norwegian Centres of Expertise (NCE). Fundamental components of the VRI programme include research activity, exchange of experience, learning and cooperation across scientific, professional and administrative boundaries (Research Council of Norway, 2007).

ARENA is a national programme initiated in 2002 as a shared initiative by Innovation Norway, SIVA and the Research Council of Norway. The programme approves new projects on the basis of open announcements, and fixed selection criteria and procedures. It has a close dialogue with the regional public support system, which is responsible for supporting the development of new projects through pre-studies and pilot studies. The ARENA programme offers both specialist and financial support for long-term development of regional business clusters. The various clusters comprise individual companies working together and often involve educational institutions. The objective of the development processes is to strengthen the clusters' innovative ability by establishing a stronger and more dynamic interaction between industry, R&D institutions, universities and the public sector (Innovation Norway, 2008).

The Norwegian Centres of Expertise scheme (NCE) encourages industrial innovation in a regional context through cooperation between companies, researchers, university colleges and the public authorities. The scheme was established by RCN, in cooperation with Innovation Norway and SIVA (RCN, 2011 b). There are a total of nine NCE clusters in Norway. The NCE programme has a long-term perspective.

The companies which are participating are offered professional and financial support for development processes for up to ten years (NCE, 2011).

A recently established research programme with a regional focus, initiated in 2009, is the Regional Research Fund. The programme was introduced by the Ministry of Education and Research and is managed by the RCN. The aim of the fund is to increase the research

level by supporting regional research, innovation and development. Another objective is to increase the cooperation between higher education institutions, business life and the regions. The Norwegian counties have been grouped, on a voluntary basis, into seven regions with regard to the administration of the fund (Regionale Forskningsfond, 2011).

Finland

Institutional structure

A dominant feature of the Finnish higher education system is the dual or binary system of universities and universities of applied science (*yrkeshögskolor*). Universities have traditionally had the role of research institutions, whereas universities of applied science have (since the 1990s) had a role as applied science providers, with a strong regional development function.

The university sector, governed by the Universities Act, 715/2004, effective from 1 August 2005, is characterized by 20 institutions (10 multi-faculty and 10 specialists) with bachelor's, master's, licentiate and doctorate studies. As of 2005, universities have an obligation to interact with society and promote the social impact of their scientific and cultural activities. The university sector has evolved in a number of different phases, marked by an extension of university education to all regions, differentiation of mission and expectations and compatibility with regional agendas (OECD, 2009b).

At the beginning of 2010 a university reform was agreed, which resulted in changes concerning university funding. Basic funding is safeguarded, but financing outside the university – which has already increased – is expected to increase even more in the future. Agreements were made that universities could collect sponsor money until 31 December 2010 and receive co-funding (sponsor funding multiplied by 2.5) from the state.⁵ There has, however, been some criticism of this changed role of the universities, especially concerning research independence. All universities need to report more on their activities. The results of the reform will be reported in 2014. In spite of the reform, the state will be the main financer of universities even in the future.

The sector of applied science has evolved over the last decades until today there are 25 universities of applied science in Finland. Universities of applied science are municipal or private institutions, and educational mission, fields of education, student numbers and locations are authorized by the government. Core funding, based on unit costs per students, project funding and performance-based funding, is provided by the government. Funding from local authorities is based on the number of residents. There may also be external sources of funding. The universities of applied science were established as part of the Finnish higher education system in the middle of the 1990s. Originally, universities of applied science were conceived as a

⁵ The newly established Aalto University has decided to change its base wholly to that of a funded university. Initially it will receive special funding from the state and from private investors.

means of overcoming the functional shortcomings in the system and a means of clearing a vocational and matriculation backlog. They are dedicated to providing profession-oriented higher education and applied research, supporting regional development and adult education principally in engineering, business and health care. During the 1990s, they gained equal status of universities, but with a very specific differentiated character. Today, they offer bachelor's degrees and master's degree programmes.

Regulations made it possible for universities of applied science to practise research and development, but it was not until 2003 that R&D and innovation formally became part of their duties. According to Finnish law, they should have a regional function related to labour life, regional development and creative activities.⁶ The ambition is to broaden their role outside education. Universities of applied science should have close connections to labour life, their education fields should support regional labour markets' needs and they should be able to provide applied research and lifelong learning to their students (Ministry of Education, 2010: 7). During the last few years, overall strategies have been prepared and reformed, based on environmental analyses and resulting in the development of different profiles and selection of focus areas for studies.

In 2009, there was an international revision of the Finnish higher education system and its innovativeness. According to the international panel there were many good things about the Finnish higher education system, but it was considered too incoherent, with overlapping activities provided by different organizations. The tasks of the organizations needed to be clarified and co-operation between different actors in the innovation system to be developed, in order to make more effective use of the resources. Since then, the government of Finland has initiated a reform of universities of applied science. Preparation will begin in 2012 and new regulations concerning funding and authorization are expected in 2014.

Innovation policy

The Research and Innovation Council is responsible for the strategic development and coordination of Finnish science and technology policy as well as of the national innovation system as a whole. It advises the Government and its Ministries concerning research, technology,

⁶ Polytechnics Act of 2003, Ammattikorkeakoululaki, 2003/351.

innovation and their utilization and evaluation (Ministry of Education and Culture, 2011). The Council has introduced the strategy 'Research and Innovation Policy Guidelines for 2011-2015'. Other important institutions concerned with research and innovation policy are the Academy of Finland, which introduced a new strategy in 2010, and the Finnish Funding Agency for Technology and Innovation, TEKES, which introduced a new strategy in 2011 (Melin & Blomkvist, 2011).

The Academy of Finland's mission is to finance high-quality scientific research, act as a science policy expert, and strengthen the position of science and research. Its operation covers the full spectrum of scientific disciplines (Academy of Finland, 2011). While being responsible for financing high-quality research, the Academy of Finland is also responsible for the application of research to support innovation (Melin & Blomkvist, 2011).

TEKES is the main public funding organization for research, development and innovation in Finland (TEKES, 2011a). The strategy of TEKES is to support opportunities for innovation, but it has a wide perspective on research. TEKES provides extensive funding to research, and approximately one-third of the funding is allocated to research and universities and research institutions (Melin & Blomkvist, 2011).

Private and public investments in research, technology and innovation activities have increased considerably since the mid-1990s. Public funding for research and development activities in 1993 was close to the OECD countries' average of 2.2 per cent, but in 2000 it had increased to 3.4 per cent. This funding level was maintained in the following years. In recent years, companies' R&D spending has developed favourably in many sectors in Finland, such as the electronics, mechanical, metal and chemical industries, and the service sector. Finland had the highest private sector R&D expenditure in 2008 compared with all countries in Europe (2.56 per cent of GDP).

Regional development policy

The Ministry of Employment and the Economy is responsible for the preparation of national legislation, objectives and strategies for regional development; it also supervises their implementation and monitoring of results (Regional Development Policy, 2020). The main goals of regional development are to reinforce the national and international competitiveness of regions,

enhance the vitality of regions by reducing regional differences in development and solve special challenges facing regions. The Ministry of Employment and the Economy is tasked with implementing the objectives through industrial, employment and innovation policy. In an increasing number of cases, it must also do so through energy policy. Regional councils take the objectives into account when preparing and implementing their regional development programmes.

The Strategic Centres for Science, Technology and Innovation (SHOKs) established in Finland are new public-private partnerships intended to strengthen innovation processes. Their main goal is to renew industry clusters and to create radical innovations. In the strategic centres, companies and research units work in close cooperation, carrying out research that has been jointly defined in the strategic research agenda of each centre. The research aims to meet the needs of Finnish industry and society within a five- to ten-year period (TEKES, 2011b). The main part of the funding of SHOKs comes from TEKES and the Academy of Finland. The SHOK initiative has been emphasized as integrating several innovative elements in terms of its thematic focus, the function of platforms for participants from universities, research institutions, the business community, and other stakeholders, and finally for its clear strategic ambition to strengthen the links between research and innovation (Melin & Blomkvist, 2011).

The OSKE programme is part of the Centres of Expertise programme that is a fixed-term programme coordinated by the Ministry of Employment and the Economy, in compliance with the Act on Regional Development. The programme supports regional strengths, the specialization of regions and cooperation between Centres of Expertise. A multi-disciplinary committee, that is appointed by the government and includes representatives from different ministries and other interest groups, is coordinating the Centres of Expertise programme at the national level. A secretariat assisting the committee consists of expert representatives from the Ministry of Employment and the Economy, the Ministry of Education and TEKES. OSKE involves 13 Competence Clusters and 21 regionally associated Centres of Expertise, which are established with the purpose of enhancing technological innovation and international competitiveness in different areas (Centres of Expertise, 2011).

Sweden

Institutional structure

The Swedish history of higher education dates back to the fifteenth century. During the eighteenth and nineteenth centuries, the main mission of universities was teaching. Between 1940 and 1975 there was an increased focus on research, and new research organizations and research posts were established. In the latter part of the twentieth century, new higher education institutions were founded throughout Sweden to improve access to higher education and the student population increased rapidly. Today, there are about fifty institutions offering higher education in Sweden; 14 universities, 21 state-owned university colleges, three self-governed higher education institutions entitled to award third-cycle qualifications and a number of independent institutions. The differences between universities and university colleges are limited. Historically, only universities were entitled to award third-cycle qualifications (licentiate and doctoral degrees), but during the last decade university colleges have been permitted to apply for the entitlement to award two-year master's degrees and third-cycle qualifications in specific domains.

The Swedish government has the overriding responsibility for higher education in Sweden, including legislation, funding and granting of degree awarding powers and university status. The Ministry for Education and Research is responsible for a number of agencies involved in the higher education sector. One of them is the Swedish National Agency for Higher Education (Högskoleverket), the public authority that oversees higher education institutions (HEIs). The agency performs this function through a variety of mechanisms, e.g. reviewing the quality of higher education, ensuring HEIs comply with relevant legislation and regulations, monitoring trends, and providing statistics and information about higher education. Another one is the Swedish Research Council (Vetenskapsrådet), promoting the development of basic research at an international standard in Sweden through research funding, research policy issues and information.

The majority of universities and university colleges are public authorities, subject to the same legislation and regulations as other public authorities in Sweden. A number of universities and university colleges, including Chalmers University of Technology, Jönköping University Foundation and the Stockholm School of Economics, are self-governing and independent. They operate on the basis of an agreement with the government. All higher education institutions

are obliged to follow the particular statutes, ordinances and regulations relevant to the higher education sector. It is mainly the Higher Education Act (1992:1434) and the Higher Education Ordinance that govern the operations of higher education institutions in Sweden.

Sweden devotes 1.7 per cent of GDP to higher education and research. In 2009, the revenues of higher education institutions (HEIs) totalled 2.1B SEK. Forty-five per cent of the operations of HEIs comprise first- and second-cycle programmes and the rest third-cycle programmes and research. The government issues public service agreements on an annual basis detailing the obligations of the higher education institutions. Funding for education, first- (undergraduate) and second-cycle (master's) courses and study programmes, is mainly provided by the public sector and based on the number of full-time equivalent students. Tuition at higher education institutions in Sweden is free of charge for Swedish students and students from the European Union (EU), the European Economic Area (EEA) and Switzerland, and most other students are required to pay application and tuition fees. Public research funding consists of a combination of direct government funding and an increasing share from other public actors, such as the research councils. Approximately 50 per cent of the research funding is provided by other actors, such as foundations, local or regional governments, the EU and the private sector.

The demand for higher education institutions to engage in cooperation with the surrounding society has developed over time. This has traditionally been an important mission for many higher education institutions, but in 1977 it was stated by Swedish law that cooperation was important in order to increase interest in higher education and to attract new student groups. In the Higher Education Act of 1996, cooperation with society was described as a 'third mission', but no specific funding was provided for development of incentives, systems or procedures. In 1999, Swedish higher education institutions were required to develop strategies for cooperation and since 2003 they have had to account for cooperative activities concerning education, research and society. In the Higher Education Act of 2009, the expectation was that cooperation between higher education institutions and the surrounding society should lead to increased quality in education and research, as well as the use and commercialization of research results on a broad basis. For many higher education institutions, this resulted in a need to balance

the two demands of providing 'excellence', in terms of measurable results, and participating in regional development and commercialization processes.

Innovation and regional policy

Over the last decades, the demand for higher education institutions to be involved in regional development activities and commercialization of research results has increased. Swedish regional policy has evolved from a regional distributive policy to a regional development policy and lately a regional growth policy. During the 1990s, the necessity of enhanced collaboration between universities and industry was identified as an important instrument in creating a dynamic economic development and growth in Sweden. Over time, a number of different policy initiatives were initiated to develop this role of higher education institutions. In 1994, the Swedish government established holding companies, with the purpose of increasing cooperation between universities and the surrounding society, e.g. by supporting commercialization of business ideas. Three years later, ownership and administration of the holding companies were integrated into the universities' remit.

The Knowledge Foundation (KK-stiftelsen) was established by the government in 1994 and has, since then, invested some SEK seven billion in more than 2,000 projects. The Knowledge Foundation provides research funding for new universities and university colleges in order to strengthen Sweden's competitiveness and value creation. The Foundation supports research, requiring co-funding and active participation from industry. The Knowledge Foundation strives to help institutions of higher education to create internationally competitive research environments, work long-term on strategic profiling and increase cooperation between academia, industry, institutions and society. Examples of programmes supporting increased collaboration between HEIs and business are the HÖG programme, initiated in collaboration with Nutek in 1994, and the establishment of so called "KK environments", that support the development of knowledge and competence.

In 2000, the Swedish Agency for Innovation Systems (VINNOVA) was established. Since then, VINNOVA has run a number of programmes to stimulate need-oriented research through cooperation between academia, business and the public sector (e.g. policy-makers) – the so-called triple-helix cooperation. Many programmes are sector-specific. The national programme Key Actors was launched in 2006 to develop competence, methods, processes and structures to make key actors in the Swedish innovation system more professional in their roles as regards cooperation between research, business and other actors in the

surrounding society, diffusion of knowledge and commercialization of research. There is also the VINN Excellence programme, supporting the development of Centres of Excellence in collaboration between HEIs and business. VINNOVA's VINNVÄXT programme has focused on regional development through triple-helix cooperation, prioritization and need-oriented research in regional innovation systems.

The VINNVÄXT programme has been coordinated with the national programme for innovation systems and clusters, Visanu, which was run between 2003 and 2005 in cooperation between Nutek (Swedish Agency of Economic and Regional Growth), ISA (Invest in Sweden Agency) and VINNOVA. In 2009, Nutek was reorganized into Tillväxtverket, but some programmes, for example the Regional Cluster Programme, are still providing valuable support for many clusters where regional HEIs play an important role.

The Innovation Bridge (Innovationsbron), established by the government in 2005 and reorganized in 2008, was intended to increase the commercialization and use of publicly funded R&D and knowledge development. In order to stimulate growth, Innovationsbron provides support to researchers, innovators and entrepreneurs with innovative ideas with a high growth potential. To this end, Innovationsbron has firmly established cooperation with other organizations providing business support or capital, e.g. universities, holding companies, incubators, investors, VINNOVA, regional actors and venture capital funds.

Another important instrument for regional development is the EU regional structural funds (ERDF). In the latest round of programmes, covering the period 2007 to 2013, one of the five prioritized areas was innovative environments, including cluster or innovation systems, and higher education institutions were often important actors. Prioritizations between projects are made in regional partnerships, including stakeholders from different sectors.

In the latest bill on research and innovation, the Swedish government suggested that Innovation Offices were to be established in seven universities; Karolinska Institute, Uppsala University, Lund University, Umeå University, Linköping University, Royal Institute of Technology (KTH) and Chalmers Institute of Technology (Swedish Ministry of Education, 2008). The universities were commissioned to develop strategies for annual distribution of SEK 75 million. Later, the decision was taken for an eighth Innovation Office to be run in collaboration among four newer universities, i.e. Karlstad, Växjö, Örebro and Mid-Sweden, under the name of the Four Leaf Clover (Swedish Ministry of Education, 2009). Another initiative of the bill was the decision to increase the support of 24 strategic

research areas (SRAs). It was decided to invest an additional MSEK 1800 in Swedish HEIs from 2009 to 2012, mainly in high technology sectors. Early in 2009, a call was announced in collaboration between the Swedish Research Council (Vetenskapsrådet), the Swedish Council for Working Life and Social Research (FAS), the Swedish Research Council on Environment, Agriculture Science and Spatial Planning (Formas), the Swedish Energy Agency (Energimyndigheten) and the Swedish Agency for Innovation Systems (VINNOVA). The bill also encouraged regional actors to develop regional innovation strategies.

Sweden pushed forward the idea of the knowledge triangle during its presidency of the EU in 2009. The concept refers to the interplay between education, research

and innovation (Melin & Blomqvist, 2011). Working groups for developing policies and organizational arrangements supporting the concept have been appointed in ministries as well as governmental agencies and universities (SUHF, 2011). In 2009, the Royal Academy of Engineering (IVA), Nutek and VINNOVA took a joint decision to initiate a process called Innovation for Growth.⁷ The year after, the Swedish government presented a national innovation strategy for the services sector. In February 2011, the government invited 150 people from industry, academia, the public sector and civil society to participate in a process to develop a national strategy for Sweden's innovative capacity in 2020.

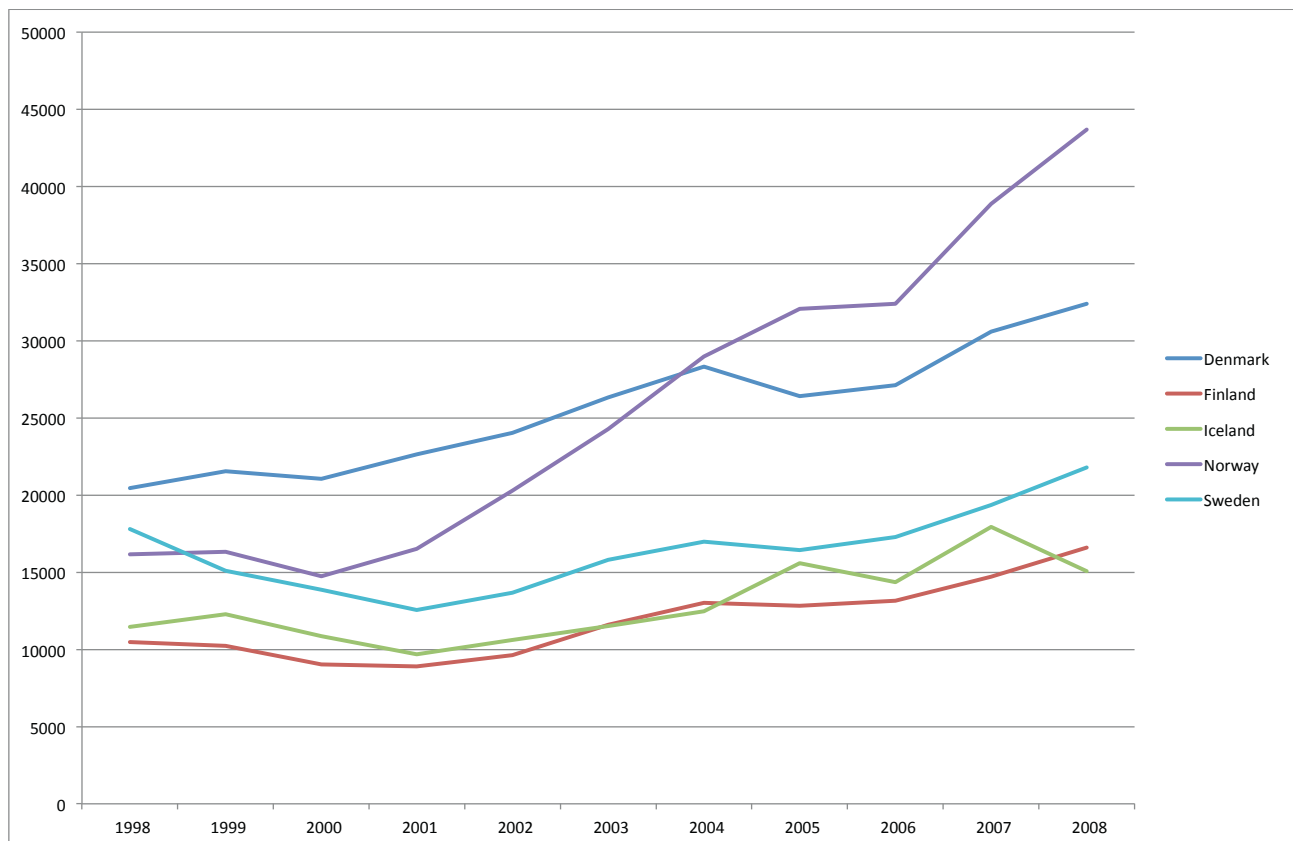
⁷ www.ivas.se/innovation.

Summary of the institutional and policy framework

After looking into the institutional and policy context in which HEIs are operating in each of the Nordic countries, this section seeks to summarize and compare the context in which the five countries are operating, with a focus on how the ‘third mission’ of HEIs is

supported, i.e. the collaboration with their surrounding society. First, however, we can see in the figure below that government expenditure per student on tertiary education increased in all Nordic countries during the 2000s, primarily in Norway, followed by Denmark.

Figure 1. Government expenditures on tertiary education in USD per student



Source: OECD, Nordregio calculations

The table below provides an indication of main institutions and funding programmes we have found to be of relevance to HEIs' collaboration with their localities in the Nordic countries.

Table 1. Overview of main institutions and policy programmes found to support the 'third mission'

| Country | Main institutions | Funding Programmes |
|----------------|--|---|
| Denmark | Danish Council for Technology and Innovation Regional Growth Fora | Regional development funds EU Structural Funds |
| Iceland | Rannis Regional Development Agencies | Regional Growth Agreements |
| Norway | Norwegian Research Council Innovation Norway SIVA Councils for cooperation with the business community | Skattefunn VRI programme ARENA Programme Norwegian Centres of Expertise Regional Research Fund |
| Finland | Academy of Finland TEKES | Strategic Centres for Science, Technology and Innovation (SHOK) OSKE (Centres of Expertise) programme EU Structural Funds |
| Sweden | Knowledge Foundation (KKS) VINNOVA (Agency for Innovation Systems) Tillväxtverket (Agency of Economic and Regional Growth) Innovation Bridge ERDF Partnerships | HÖG and KK-environments VINNVÄXT programme Key Actors Programme Centres of Excellence programme Regional Cluster Programme EU Structural Funds |

Denmark and Iceland seem to have some similarities, although there are also differences in the institutional functions and resources available in the two countries. Respectively, the Danish Council for Technology and Innovation and Rannis are responsible for administering various research funding schemes, which may in some cases involve strengthened cooperation between research and business. In Denmark and Iceland respectively Regional Growth Fora and Regional Development Agencies have been set up, comprising regional partnerships that involve different regional stakeholders that guide regional development. The Growth Fora allocate regional development funds, and the Regional Development Agencies manage Regional Growth Agreements in the regions. HEIs are part of the regional partnerships and to a varying extent also take part in regional projects. In Iceland, knowledge institutions involved in regional growth agreements are the University of Iceland's Regional Research Centres. In Sweden, regional partnerships have been developed to prioritize and take decisions related to European structural funds.

The Norwegian Research Council provides research funding for both basic and applied research. It is responsible for one scheme that specifically supports triple-helix cooperation, which is the VRI programme.

Moreover, the Council administers the Skattefunn initiative, which is unique among the Nordic countries. It is a tax incentive for private firms to invest in R&D activities in cooperation with HEIs. The Academy of Finland, similarly to the Norwegian Research Council, also provides some funding to applied research. In Sweden, basic research funding is provided by several actors, including the Swedish Research Council. TEKES in Finland and VINNOVA in Sweden are similar institutions established to support innovation systems. Both provide funding for applied research, and both have regionally focused clusters and centres of expertise programmes, e.g. OSKE and VINNVÄXT. In Norway, a national cluster programme, the ARENA Programme and the Norwegian Centres of Expertise programme are implemented in regions in collaboration between Innovation Norway, Research Council and SIVA. The VINNVÄXT programme in Sweden and the Centres of Expertise Programmes in Norway and Finland have similar constructions, targeting specific clusters in selected regions and focused on establishing cooperation between actors of the triple helix.

The Strategic Centres for Science, Technology and Innovation (SHOKs) are a recent construction in Finland to support the links between research and innovation through establishing platforms where researchers and

businesses meet. In Sweden, the Knowledge Foundation allocates funding to stimulate the development of collaborative research environments in the new HEIs. Finally, in Norway HEIs are now required to establish councils for cooperation with the business community, which includes regional stakeholders in the development

of collaboration strategies.

Several of the institutions and policy programmes introduced in this section will be touched upon in the case studies, where their actual implementation is explored.

4. Pilot Study on Student Mobility

This is a pilot study, investigating the possibility of using individual data to follow migration and carrier patterns of students after graduation. The Nordic countries are at the forefront of collecting, storing and managing

individual-level data from sources such as civic registers and tax offices and recently these databases have found considerable application in social science studies.

Methodology

As was extensively discussed in the theory part there are inherent difficulties in assessing the effects universities have on their surrounding regions. Given the multiple (often parallel) channels through which HEIs are at least assumed to affect regional economies, and our less than perfect understanding of every single one of those, disentangling the significance of each channel is far from trivial. As mentioned earlier, Drucker and Goldstein (2007) provide an excellent overview of scholarly studies on the regional economic development impacts of universities. All approaches are invariably conditional on feasibility and data availability. The different methodologies applied include: (1) impact of studies of individual institutions (that mostly focus on spending and investment impact of universities), (2) surveys, (3) micro-economic knowledge production function approaches (that mostly equate patenting activity with 'knowledge', with the obvious bias of focusing on HEIs' R&D functions) and (4) cross-sectional and quasi-experimental research designs that apply regression-based statistical approaches on a sample of the full population.

Although the provision of education and the production of human capital remain one of the most important roles of universities, the post-graduation mobility and employment patterns of alumni have received rather limited attention. That is naturally the case because of the limited available information on the post-graduation career paths of the alumni. Some exceptions do exist. Huffman and Quigley (2002) study 950 graduates of two Californian universities, and their propensity to stay in the state after graduation. Blackwell et al. (2002) and Felsenstein (1995) carry out similar studies on a single US university each. The ability of regions to retain the graduates of local universities is a major concern of regional development policies (especially when the studies are significantly subsidized by the region's budget). Groen (2004) considers 30 selective US colleges and universities and finds a rather

poor relation between the state an individual studied in and that in which he or she started working after graduation.

In the pilot study described herein a similar set of questions has been addressed through the use of comprehensive census data instead of a sample of one or even several universities/colleges. Despite their best efforts universities usually manage to maintain contact with just a fraction of their graduates and any post-graduation employment information is usually limited to their very first appointment which can vary from a permanent to a very temporary one. These are two commonly cited weaknesses that the current approach is capable of overcoming. The pilot study was carried out in co-operation with a subcontracting team from the Royal Institute of Technology that had access to individual level data describing the Swedish labour market over a number of years (1985 to 2009).

Following a discussion with the subcontracting research team the suggested pilot study was planned for execution in the following stages:

1. Identify three cohorts of university graduates who are currently (most recent year available) actively participating in the workforce. Cohorts represent people who graduated one, five and ten years before the current year.
2. Compare the region of study with the region of current employment and present summary statistics of retention rates (percentage of graduates currently working in their region of study) for the three cohorts.
3. Repeat (2) for holders of advanced degrees (PhDs and Licentiates).
4. Decompose (2) in aggregate fields of studies (engineering, humanities, etc.)
5. Create graduation-employment matrixes for all Swedish counties to allow monitoring of graduate mobility patterns among the regions and the

identification of best and worst performing regions in terms of retaining and attracting university graduates.

6. Finally, assessment of the local employment effect

of university alumni entrepreneurial efforts.

The results and findings of the pilot study are presented and discussed below, stage by stage.

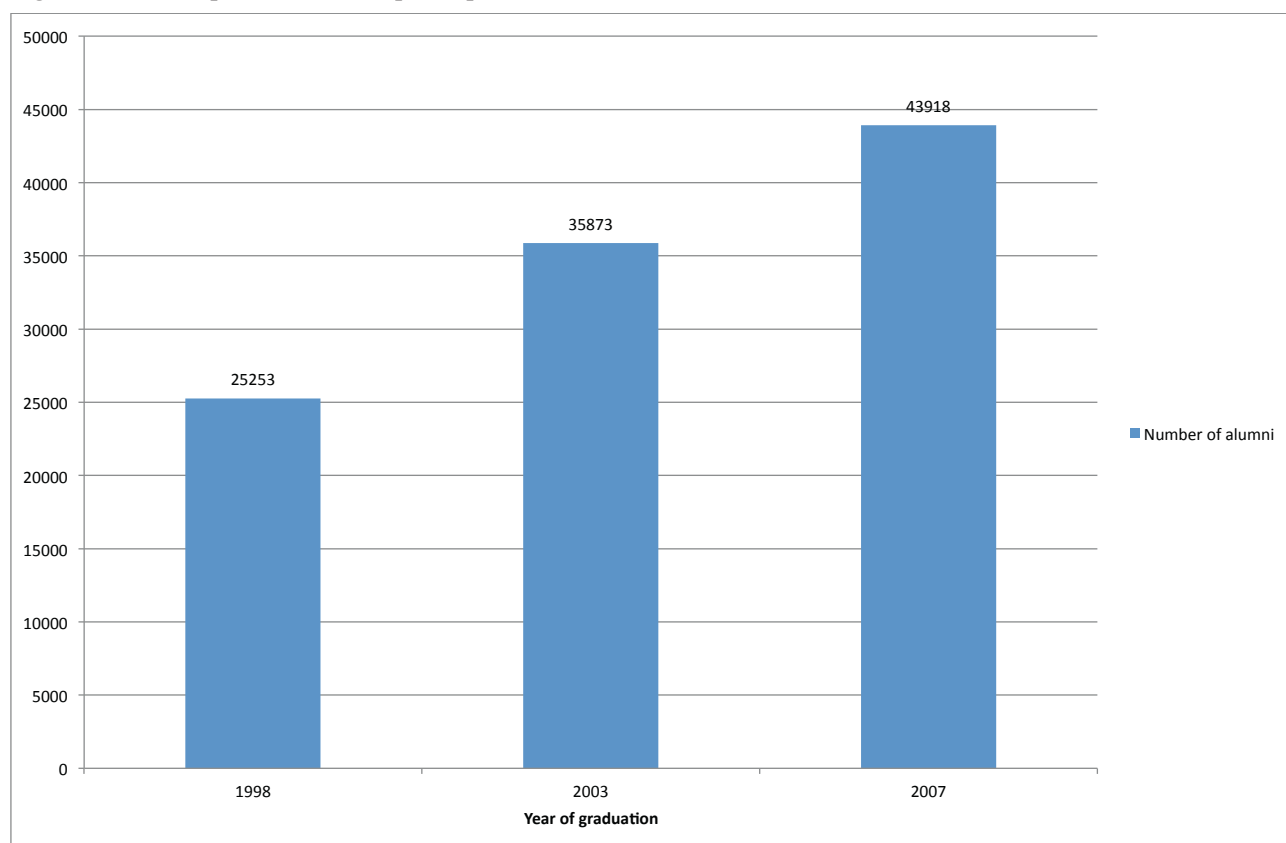
The sample of students

The point of reference for the entire pilot study is the Swedish labour force in the year 2008 (the most recent year for which data were available when the study was carried out in the spring of 2011). That includes all individuals engaged in gainful employment (either as employees or own-firm owners) in both the private and public sectors of the economy. Applying a retrospective approach and examining the education records of these individuals it is possible to identify those who received a university degree as well as the exact year and place of graduation. For the entire study the geographical unit considered is that of a Swedish county (*län*). The decision was made to consider three different cohorts of alumni, i.e. those who graduated one, five and ten years before 2008 (2007, 2003 and 1998 respectively). Throughout the entire pilot study the term alumni is used to refer to those who have completed at least three years of tertiary education.

In this manner a total of 105 044 alumni are

identified and broken down in three cohorts after their respective year of graduation (Figure 2). What is immediately evident is that there has been a significant increase in the number of graduates over time. At this stage it is important to stress a couple of points. First of all, these figures account for the university graduates who passed in these particular years and represent only a fraction of the university graduates active in the workforce in 2008. Second, it is necessary to acknowledge that labour force participation rates might differ between the different alumni cohorts. In order to control for this the numbers in Figure 1 are compared with statistics on the total number of university graduates as published by Statistics Sweden. These are presented in Figure 3 along with the corresponding labour force participation rates for 2008 (number of alumni participating in the labour force over total number of alumni).

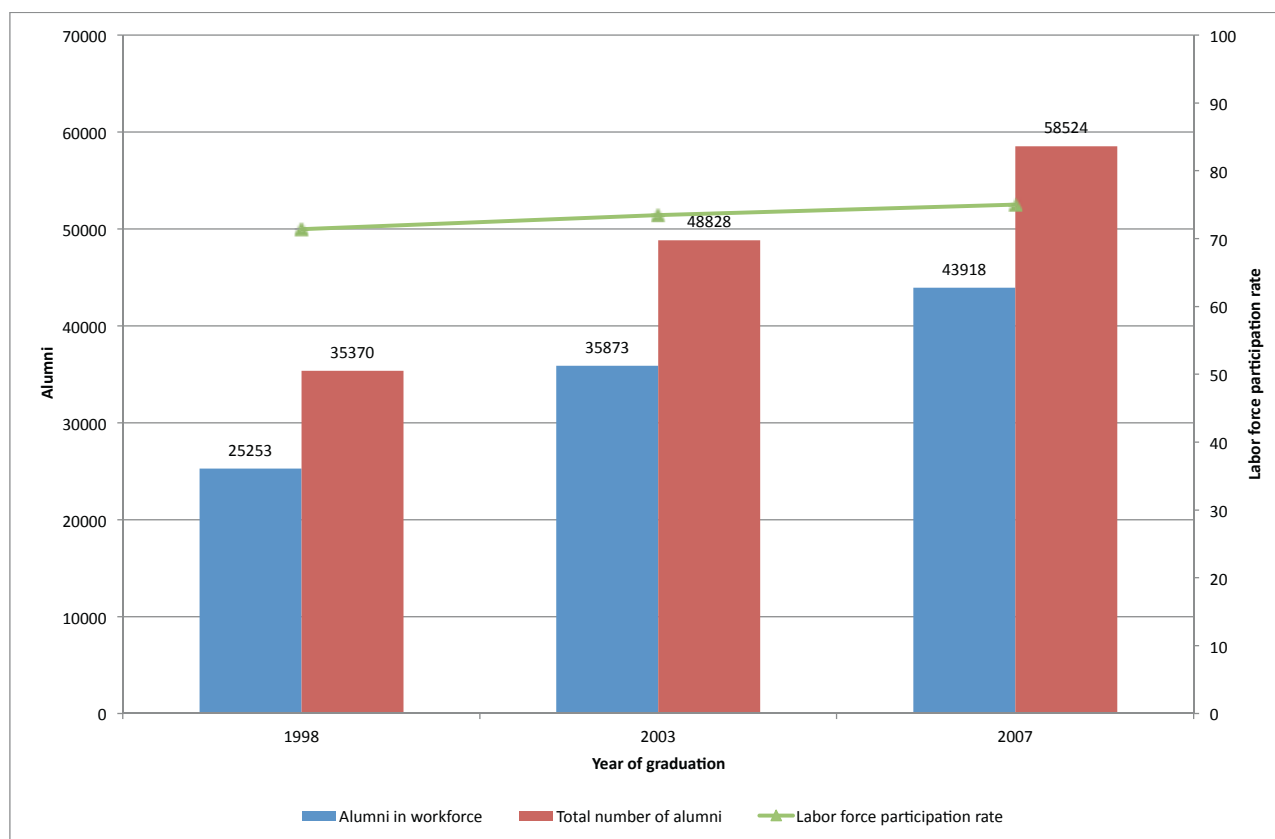
Figure 2. Alumni per cohort who participated in the labour force in 2008



Two important points emerge from Figure 3. First of all, the number of alumni participating in the workforce and the total number of alumni exhibit similar growth rates with an increase of approximately 40 per cent between 1998 and 2003 and approximately 20 per cent between 2003 and 2007. Second, and quite

naturally, this translates into relatively constant labour force participation rates, that do however show an upwards trend from 71 to 74 per cent between the 1998 and 2007 cohorts. In other words, the figures do not seem to suffer from severe selection biases, with the different cohorts exhibiting similar trends.

Figure 3. Alumni per cohort who participated in the labour force in 2008, total alumni per cohort and labour force participation rate



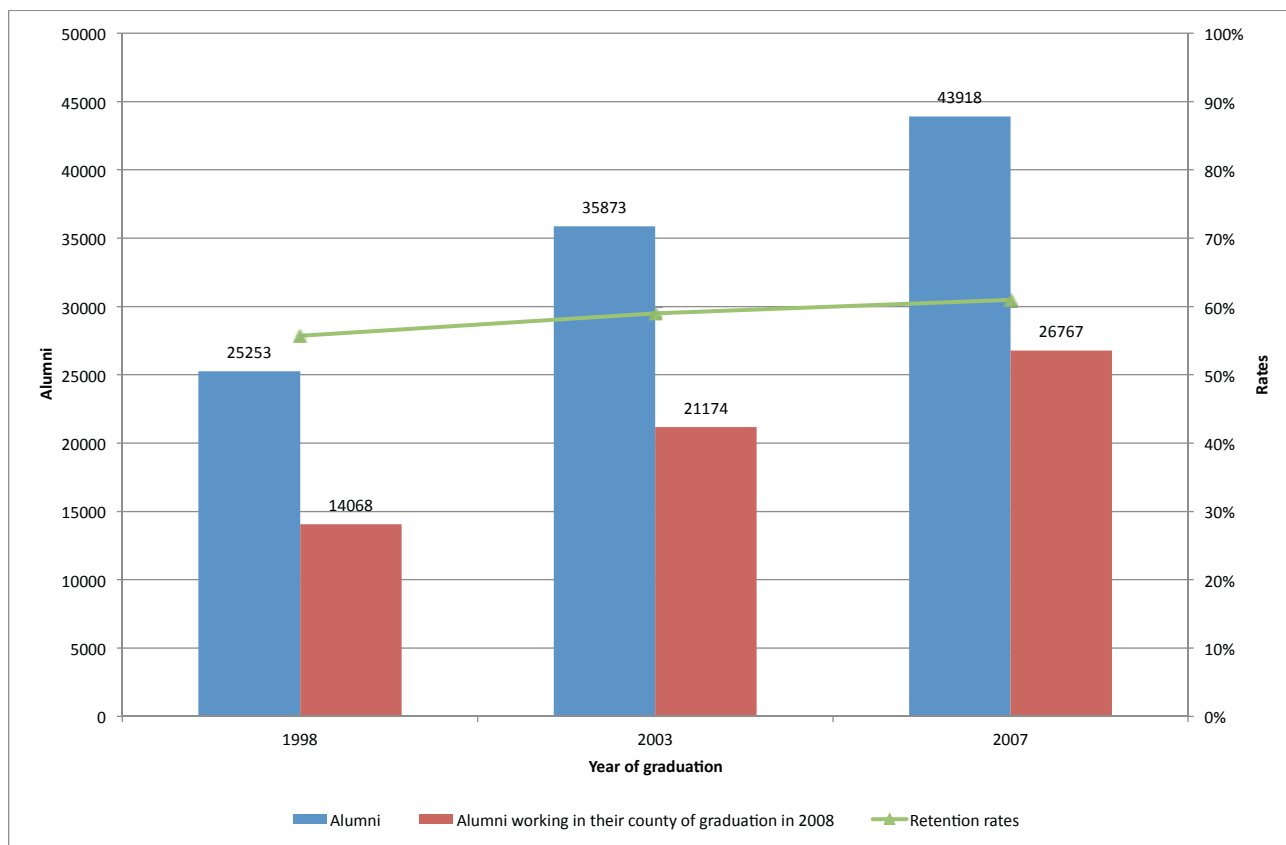
Regional impact of students

Regional retention of students

Having checked the quality of the aggregated census data against the official national statistics we need now to address the issues which arose during the inception of the pilot study. From now on the terms alumni and graduates will be used to describe those who are actively participating in the labour market as described in Figure 2, unless stated otherwise. In this stage the aggregate retention rates were considered. The cost of educating individuals is considerable and

regions would like to enjoy a return on this investment by making sure the alumni remain in the region after they graduate. Comparing the place of graduation with the place of current work it is possible to ascertain the percentage of graduates who have joined the labour market of the region they studied in. The corresponding figures along with the retention rates are presented in Figure 4.

Figure 4. Aggregate retention rates for the three alumni cohorts



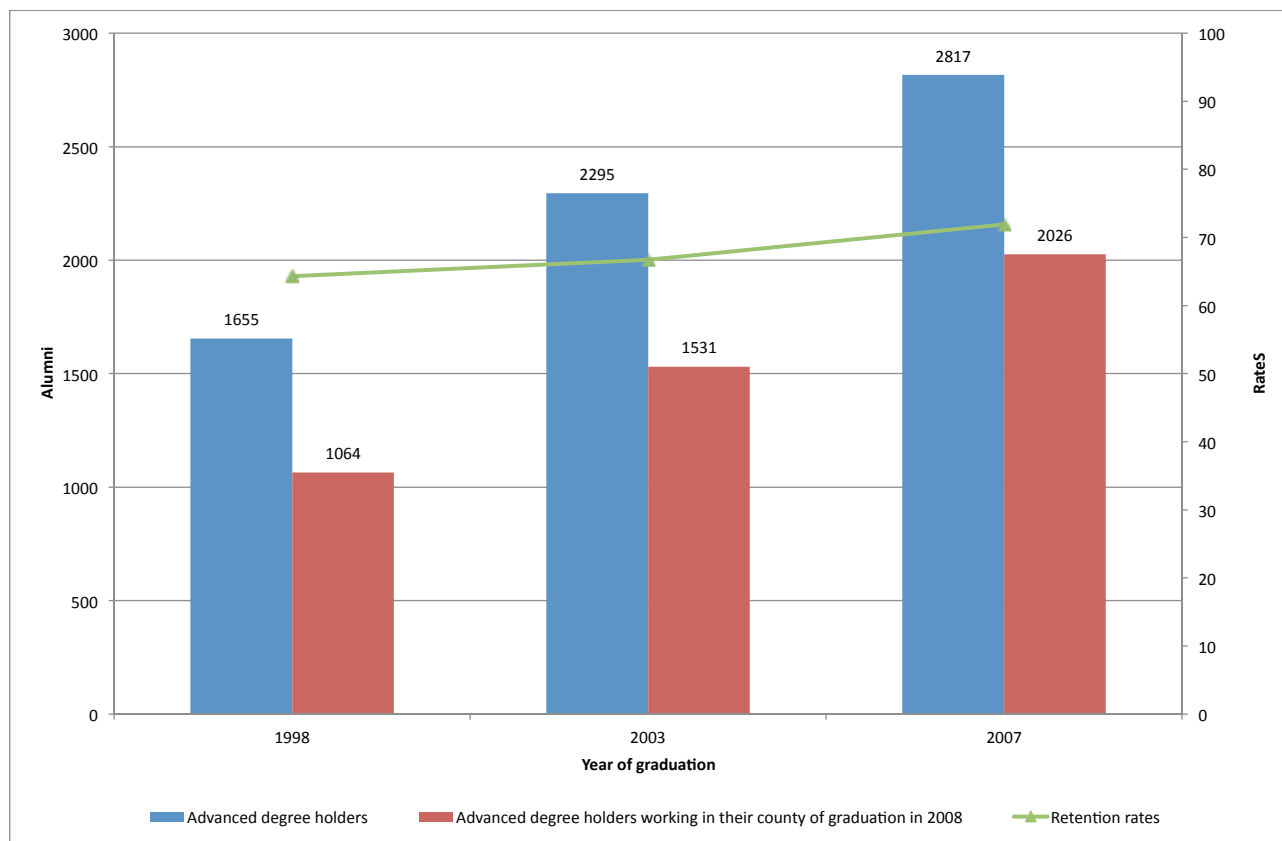
It should be noted that the use of the term retention rate is somewhat unorthodox in this context as it is a place-specific characteristic but is used here to describe the behaviour of a group of individuals. Since the discussion will later focus on specific regions the term is used here as well for the sake of continuity. Turning to Figure 4, retention rates in 2008 are higher the closer the year of graduation is, but the difference is quite small, ranging from 56 per cent for the 1997 cohort to 61 per cent for the 2007 cohort. On average, 59 per cent of all alumni remain in their place of graduation for work and this rate drops by only a small fraction as much as ten years after graduation. This finding has a rather interesting implication. Although roughly 40 per cent of alumni appear to leave their place of study immediately after graduation the 60 per cent who choose to remain will decrease only slightly with the passing of time. The key to retaining university graduates in the region might lie in the ability of the

local labour market to offer appropriate employment soon after graduation.

Regional retention of advanced students

The focus of university-impact studies very often turns towards the holders of advanced degrees (PhDs and Licentiates). These are individuals who choose to make considerable investments in time and effort in specializing in a particular field of scientific studies. They are considered to be highly valuable in the contemporary knowledge-based economy and because of their qualifications they are assumed to be the most mobile individuals since they are rarely tied to a specific place or industry. In this stage the exercise carried out before on aggregate retention rates is repeated for the holders of advanced degrees. The results are presented in Figure 5.

Figure 5. Aggregate retention rates for the three alumni cohorts, advanced degree holders



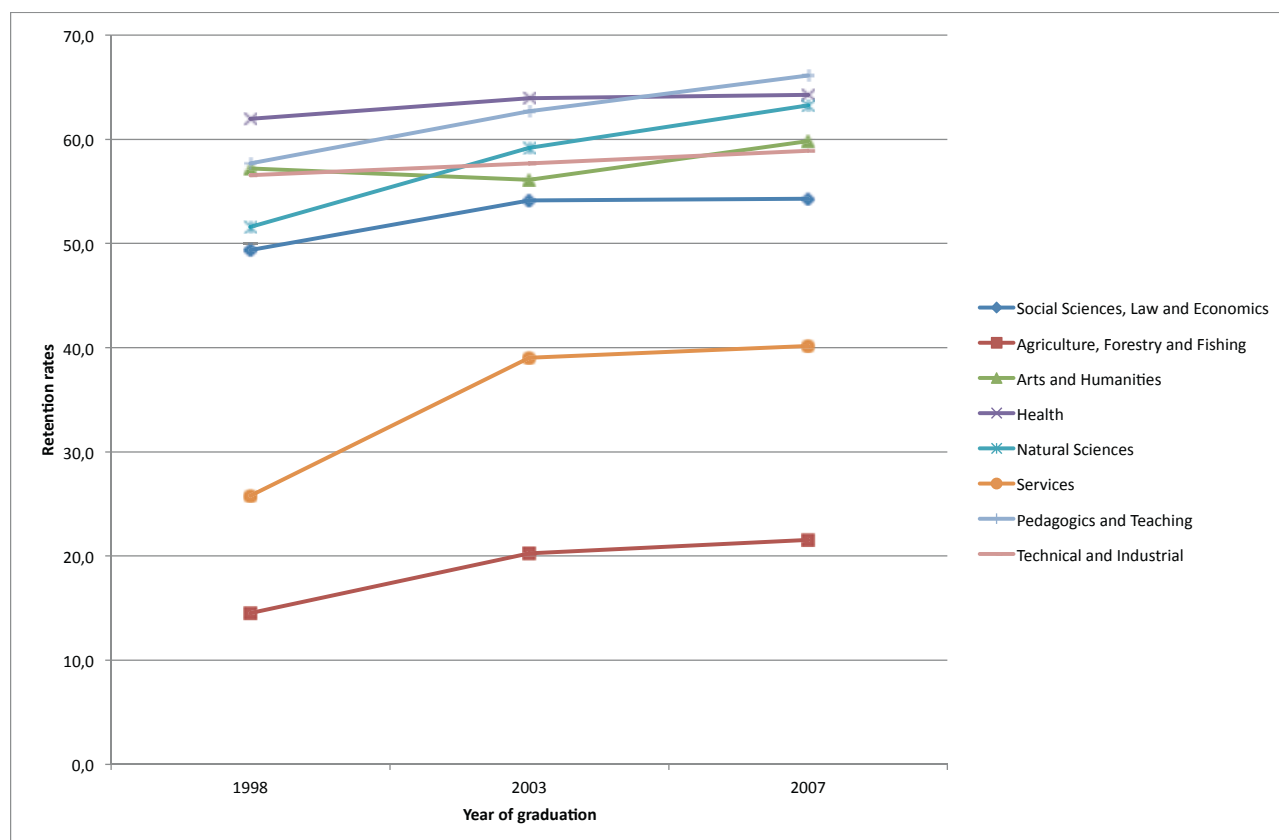
The first point worth noting is that the percentage of advanced degree holders is similar in all three cohorts at just above 7 per cent. What is striking however is that retention rates are somewhat higher among these individuals compared with the total number of alumni considered in stage 3, ranging between roughly 65 and 72 per cent. These figures go against the popular assumption that advanced degree holders are more mobile given their ability to seek out higher paying placements thanks to their specialized skills. One possible explanation for this is the particularity of the Swedish case which has relatively high averages as far as the age of university students is concerned. By the time these students receive a PhD they may have already formed families and developed the sort of ties that keep

them rooted in the region. An alternative explanation is that the largest universities that host more extensive research education tend to be located in the major urban centres where employment opportunities after graduation are also more abundant. Although the first assumption is beyond the scope of the current pilot study the second one is addressed in what follows.

Variations between fields of study

In this stage the previous analysis is decomposed in different fields of studies. It is interesting to consider whether different disciplines seem to be more or less bound to the region of their alma mater. The resulting aggregate retention rates are presented in Figure 6.

Figure 6. Retention rates among different fields of studies



Disciplines connected with primary sectors such as agriculture, forestry and fishing display, unsurprisingly, the lowest retention rates among all fields. These professions are dependent on the geographical dispersion of natural resources and the high degree of relocation post-graduation is perfectly normal. Service-oriented studies have the second lowest retention rates. This is possibly the less specialized field compared with other disciplines and the constant growth of the service industry compared with more traditional industries can perhaps explain the high degree of mobility since these professions probably enjoy the lowest degree of place-specificity.

The rest of the fields are clustered together within the 50 to 70 per cent zone. At the lower bound lie the social sciences, law and economics and at the upper bound lie health-related studies. The upward trend of some of the fields may be connected with the efforts of the Swedish government to decentralize higher

education by supporting the growth of peripheral institutions and thus allowing more individuals to study close to home. The most impressive increase is in the services-related field between 1998 and 2003.

Regional variations in Sweden

The analysis so far has only considered whether the place of graduation and the place of work in 2008 match. In this stage the study goes a step further by looking at the exact place of graduation and place of work. In this manner it is possible to construct detailed matrixes that track the movements of alumni between their student and professional lives. As an example Table 2 presents the geographic dispersion (according to their place of work) of alumni graduating from an institution in Stockholm among the different counties in Sweden for the three different cohorts.

Table 2. Working destination of Stockholm area alumni (in absolute numbers and percentages)

| County | 1998 | 2003 | 2007 | 1998 (%) | 2003 (%) | 2007 (%) |
|-----------------|-------|-------|-------|----------|----------|----------|
| Blekinge | 22 | 48 | 20 | 0.4 | 0.6 | 0.2 |
| Dalarna | 53 | 78 | 103 | 1.0 | 1.0 | 1.1 |
| Gävleborg | 48 | 76 | 105 | 0.9 | 1.0 | 1.1 |
| Gotland | 47 | 66 | 94 | 0.9 | 0.8 | 1.0 |
| Hallands | 25 | 36 | 21 | 0.5 | 0.5 | 0.2 |
| Jämtland | 22 | 37 | 33 | 0.4 | 0.5 | 0.4 |
| Jönköping | 39 | 47 | 41 | 0.7 | 0.6 | 0.4 |
| Kalmar | 23 | 37 | 32 | 0.4 | 0.5 | 0.4 |
| Kronoberg | 14 | 28 | 17 | 0.3 | 0.4 | 0.2 |
| Norrbottns | 16 | 57 | 37 | 0.3 | 0.7 | 0.4 |
| Örebro | 52 | 87 | 66 | 1.0 | 1.1 | 0.7 |
| Östergötland | 76 | 102 | 120 | 1.4 | 1.3 | 1.3 |
| Skåne | 117 | 159 | 125 | 2.2 | 2.0 | 1.4 |
| Södermanland | 120 | 170 | 179 | 2.2 | 2.2 | 2.0 |
| Stockholm | 4 274 | 6 073 | 7 575 | 79.0 | 77.7 | 82.9 |
| Uppsala | 120 | 207 | 184 | 2.2 | 2.6 | 2.0 |
| Värmland | 28 | 58 | 41 | 0.5 | 0.7 | 0.4 |
| Västerbotten | 19 | 24 | 24 | 0.4 | 0.3 | 0.3 |
| Västernorrland | 40 | 52 | 38 | 0.7 | 0.7 | 0.4 |
| Västra Götaland | 158 | 197 | 176 | 2.9 | 2.5 | 1.9 |
| Västmanland | 98 | 174 | 108 | 1.8 | 2.2 | 1.2 |
| Total | 5 411 | 7 813 | 9 139 | 100.0 | 100.0 | 100.0 |

Clearly, the majority of Stockholm graduates remain in the capital region. The satellite regions of Uppsala and Södermanland along with the other two regions that host a major urban centre (Malmö in Skåne and Gothenburg in Västra Götaland) attract significantly more alumni than the rest of the regions. The retention rates for the three cohorts are 79, 77 and 82 per cent respectively. These figures are clearly well above the national aggregates presented in Figure 4, but that is to be expected for the capital region. Similar tables can be constructed for each one of the 21 Swedish counties.

Table 3, for example, repeats the analysis in Table 2 for the region of Värmland that hosts Karlstad University. One point is worth noting. The retention rate for Värmland is well below that of Stockholm at around 55 rather than 80 per cent. Stockholm does attract a considerable percentage of the alumni who take their degrees in Värmland but Västra Götaland, which lies much nearer, attracts a larger percentage than the capital region, suggesting an underlying gravity-like mechanism is at play. In other words, distance does play a significant role.

Table 3. Working destination of Värmland area alumni (in absolute numbers and percentages)

| County | 1998 | 2003 | 2007 | 1998 (%) | 2003 (%) | 2007 (%) |
|-----------------|------|------|-------|----------|----------|----------|
| Blekinge | 4 | 1 | 1 | 0,6 | 0,1 | 0,1 |
| Dalarna | 15 | 12 | 25 | 2,2 | 1,2 | 2,0 |
| Gävleborg | 4 | 3 | 5 | 0,6 | 0,3 | 0,4 |
| Gotland | 0 | 4 | 3 | 0,0 | 0,4 | 0,2 |
| Hallands | 11 | 12 | 15 | 1,6 | 1,2 | 1,2 |
| Jämtland | 2 | 4 | 5 | 0,3 | 0,4 | 0,4 |
| Jönköping | 9 | 7 | 13 | 1,3 | 0,7 | 1,0 |
| Kalmar | 4 | 5 | 3 | 0,6 | 0,5 | 0,2 |
| Kronoberg | 0 | 2 | 3 | 0,0 | 0,2 | 0,2 |
| Norrbottnens | 1 | 1 | 3 | 0,1 | 0,1 | 0,2 |
| Örebro | 45 | 65 | 110 | 6,6 | 6,5 | 8,7 |
| Östergötland | 11 | 11 | 27 | 1,6 | 1,1 | 2,1 |
| Skåne | 19 | 23 | 17 | 2,8 | 2,3 | 1,3 |
| Södermanland | 4 | 13 | 9 | 0,6 | 1,3 | 0,7 |
| Stockholm | 94 | 79 | 110 | 13,9 | 7,9 | 8,7 |
| Uppsala | 6 | 5 | 11 | 0,9 | 0,5 | 0,9 |
| Värmland | 297 | 573 | 700 | 43,8 | 57,5 | 55,1 |
| Västerbotten | 1 | 4 | 3 | 0,1 | 0,4 | 0,2 |
| Västernorrland | 2 | 3 | 3 | 0,3 | 0,3 | 0,2 |
| Västra Götaland | 141 | 161 | 192 | 20,8 | 16,1 | 15,1 |
| Västmanland | 8 | 9 | 12 | 1,2 | 0,9 | 0,9 |
| Total | 678 | 997 | 1 270 | 100 | 100 | 100 |

Of course, one could also consider the other dimension as well and construct a table similar to Table 2 describing the counties in which university graduates currently working in Stockholm received their degrees.

On this note, an important question is whether the retention rates⁸ of peripheral regions are comparable to those of regions with major urban centres or the balance is heavily skewed towards one or the other type

of region. To address this issue a simplifying dichotomy was used naming the counties hosting the three urban centres of Stockholm, Malmö and Gothenburg as Core and the rest of the regions as Periphery. The resulting 2x2 matrixes where the place of study lies in the one dimension and the place of work in the other are presented in Table 4 for each of the three graduation cohorts.

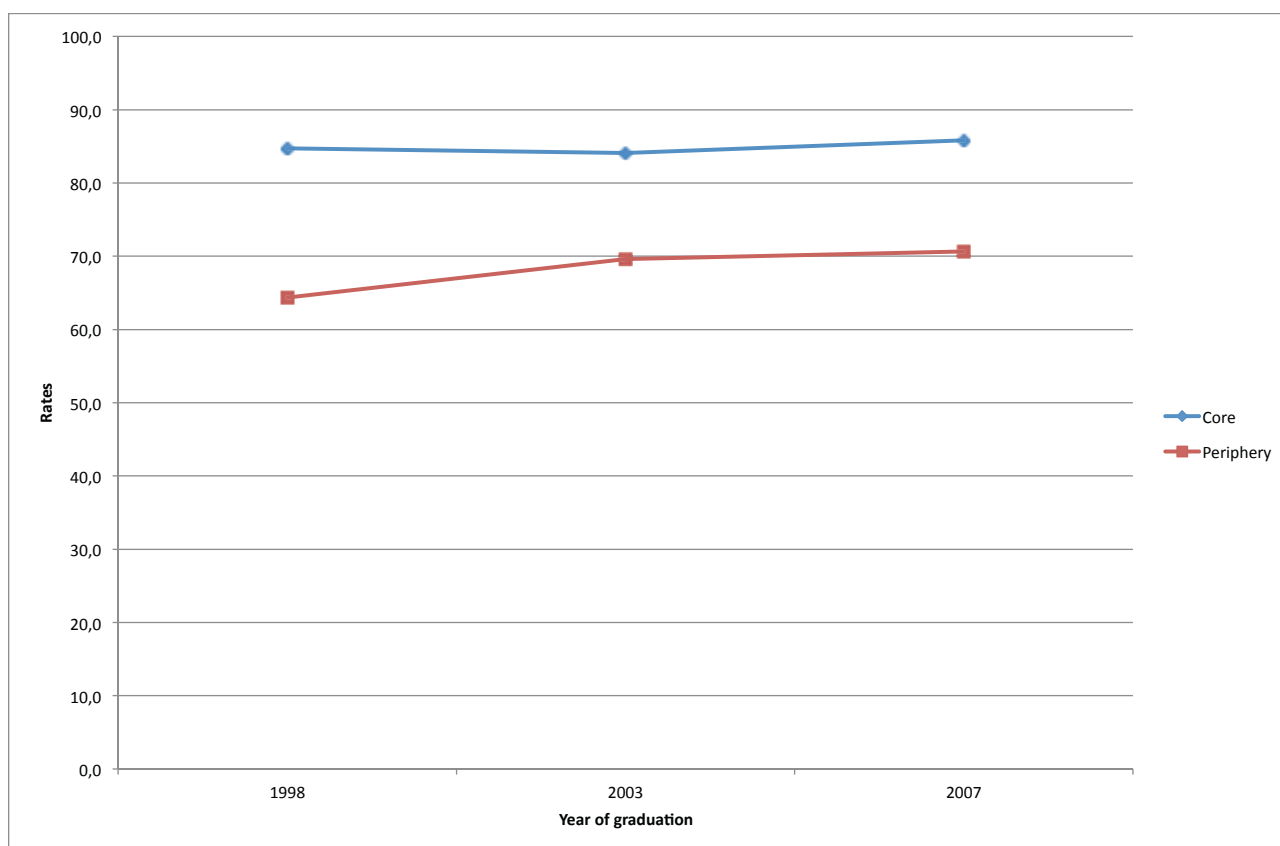
⁸ Now that the discussion has become place-specific the term retention rate is used in a more orthodox manner.

Table 4. Mobility between Core and Periphery after graduation

| Place of study | Place of work | | |
|----------------|---------------|-----------|--------|
| | Core | Periphery | Total |
| 1998 cohort | | | |
| Core | 11 272 | 2 033 | 13 305 |
| Periphery | 4 260 | 7 688 | 11 948 |
| Total | 15 532 | 9 721 | 25 253 |
| 2003 cohort | | | |
| Core | 15 460 | 2 929 | 18 389 |
| Periphery | 5 312 | 12 172 | 17 484 |
| Total | 20 772 | 15 101 | 35 873 |
| 2007 cohort | | | |
| Core | 19 225 | 3 173 | 22 398 |
| Periphery | 6 316 | 15 204 | 21 520 |
| Total | 25 541 | 18 377 | 43 918 |

It follows that one can calculate separate retention rates for the Core and the Periphery, as in Figure 7.

Figure 7. Retention rates for Core and Periphery



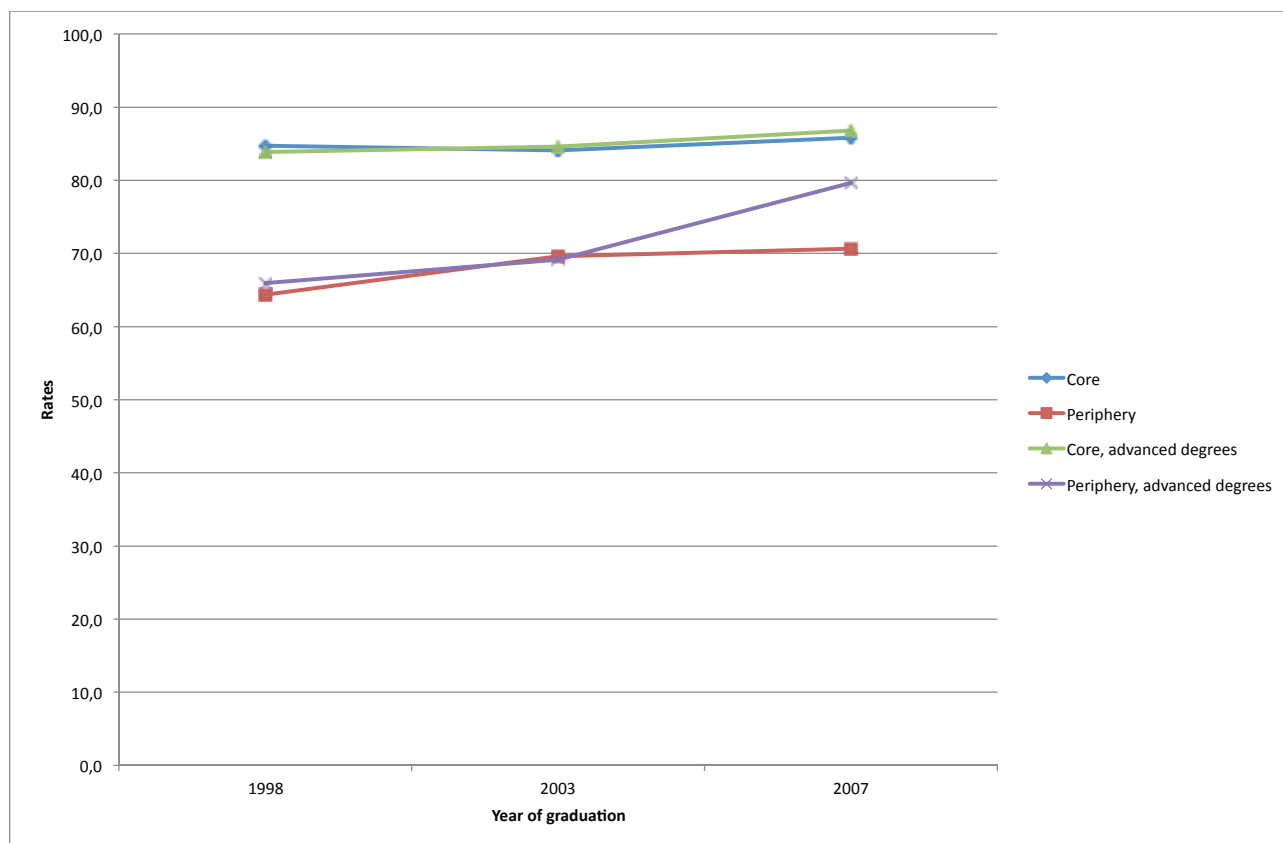
Note first of all that the retention rates in Figure 7 are considerably higher than the aggregated ones presented in Figure 4. The reason is that when such a binary dichotomy is used moving between peripheral counties would still count as not relocating away from the periphery and contribute to increasing the periphery's retention rate. As the size of the regional unit diminishes, the likelihood of leaving the region increases, which leads to correspondingly lower retention rates. Turning

back to Figure 7, the Core appears to be performing considerably better than the periphery in terms of retaining its graduates within the region. This difference can be attributed, however, to the superior performance of the Core (rates around 85 per cent) rather than a strikingly poor performance of the Periphery. What is also noteworthy is that retention rates for the Core appear almost constant among the different cohorts whereas the Periphery seems to manage to maintain a

higher percentage of recent rather than older graduates. The analysis in Figure 7 is repeated for advanced degree holders as well. All four lines are presented in Figure 8. The results are almost identical with one exception. The Periphery appears to manage to maintain recent

graduates with advanced degrees at a higher percentage than alumni in general. One possible explanation for this trend is the connection of advanced degree holders with research programmes that often extend beyond the date of their graduation.

Figure 8. Retention rates for Core and Periphery, all alumni compared with advanced degree holders



Finally, this stage of the pilot study looks at which regions perform best and which worse in terms of retaining but also attracting university graduates. The ranking is based on all alumni for the most recent cohort (2007) in terms of retention and attraction rates. The attraction

rate is a relative score that measures what percentage of university graduates working in the region have received their degrees from outside the region. The scores and rankings are presented in Figures 9 and 10.

Figure 9. Regional ranking based on retention rates, 2007-2008

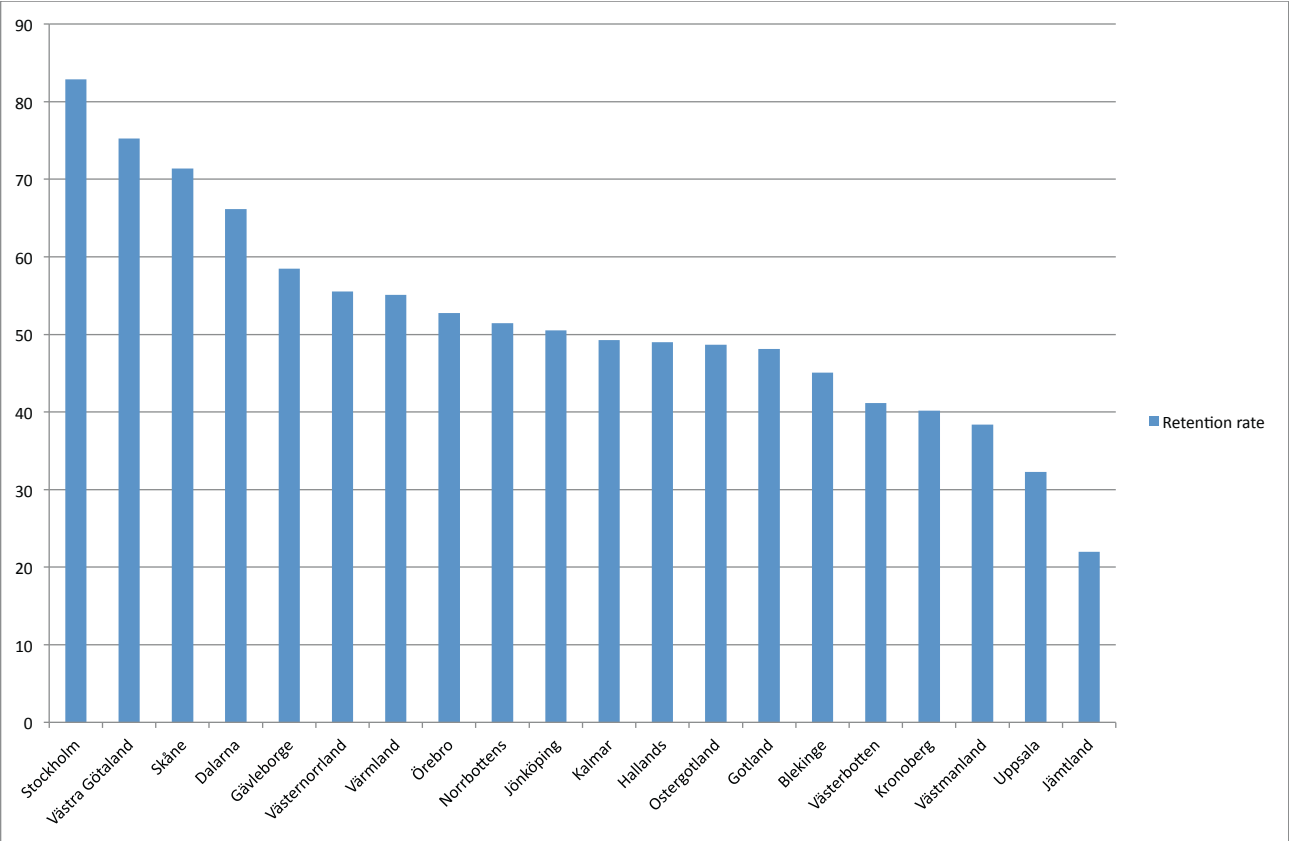
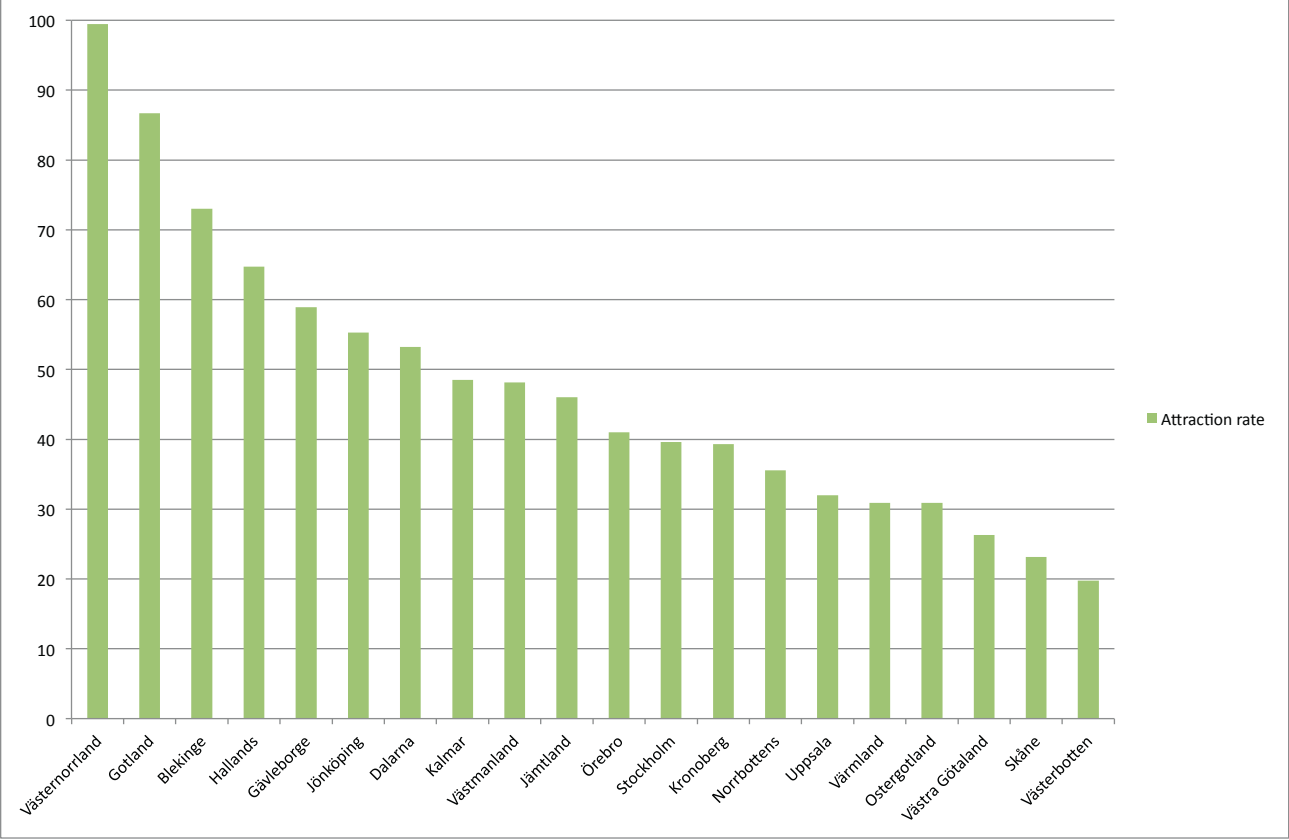


Figure 10. Regional ranking based on attraction rates, 2007-2008



Not surprisingly, the best performing regions when we consider retention rates are the ones that host the three major urban centres (the ones earlier referred to as the Core). At the bottom of the ranking lie Uppsala (understandably, considering its close proximity to the capital) and Jämtland. Turning next to (relative) attraction rates the picture is quite different. The regions that lead the ranking are those that have a very small output of local graduates and depend on the alumni of other regions for recruitment of highly educated labour. Skåne and Västra Götaland lie at the bottom of the ranking since they attract relatively few graduates compared with the number of those who receive their degrees in those regions. Stockholm lies near the middle, managing to attract a lot of graduates despite the large number of people receiving their education there; 40 per cent of all university graduates employed in Stockholm received their degree in some other region. The numbers for Stockholm are admittedly inflated by the fact that Uppsala graduates (roughly 11 per cent of the total) count as coming from outside the region despite the close distance.

It goes without saying that the rankings in Figure 10 would be almost reversed if one were to consider an

absolute rather than a relative measure of attraction (for example total number of alumni moving to the region for work after graduation) but an important limitation of the data is also laid bare. Västernorrland Region appears to be almost completely dependent on other regions for employing university graduates. This is not because of massive numbers of students moving into the region from elsewhere in Sweden but because the number of local graduates appears to be close to zero despite the presence of two out of the three campuses of Mittuniversitetet (Mid-Sweden University). The reason is that all credits and degrees are registered at Östersund where the third campus is situated in the neighbouring region of Jämtland. This is one of the downsides of using census data. The figures could be corrected in order to carry out a more detailed study by comparing which programmes are offered at which campus and compare those with the degrees issued or apply a simple method of extrapolation based on the total number of students and the relative size of each campus. Such corrections are not possible, however, without direct access to the data and so fall outside the resources of the current project.

Impact on regional entrepreneurship

One of the assumed benefits of higher education is that it provides individuals with the right set of skills for embarking on an entrepreneurial career and thus becoming job creators with a significantly positive impact on regional economies. In this last stage of the pilot study the goal is to quantify and capture the employment creation effect of alumni entrepreneurial efforts for a limited number of HEIs.

The following three tables show the employment in the year 2008 in firms founded between 2003 and 2005. To avoid distortions, firms with 30 or more employees in their first year of existence have been removed from the analysis. In Tables 5 and 6, these firms are associated with the entrepreneur's recent alumni experience. We define an alumnus as a person born after 1966 (qualifying the information about 'recent' alumni) with a longer (at least three years long) tertiary education. The concept of the entrepreneur is defined differently in Tables 5 and 6. In Table 5, an entrepreneur is a firm founder (the person listed as owner and manager in the firm's first year of existence). In Table 6 an entrepreneur is a person listed as owner/

manager in 2008. The total number of people fitting the above criteria is displayed by the region where they are active, and by the university to which at least one of the entrepreneurs can be tracked. Since Stockholm County hosts a number of small university colleges, a total figure for entrepreneurs from any higher education institution in the county is also included. Table 7 shows, for reference, the total number of employees in 2008, by region, in firms founded between 2003 and 2005. Finally, we must acknowledge that Statistics Sweden is not able to track entrepreneurs perfectly. People whose ownership is indirect (e.g. who own a firm through another firm) may not be registered as entrepreneurs. Table 8 reports employment in firms for which no entrepreneur is tracked. By comparing Tables 6 and 7, we find that 40-50 per cent of all 2008 employment created in firms founded in 2003 to 2005 cannot be attributed to any one entrepreneur. If we assume that this relationship is not systematically different between firms founded or led by alumni and other firms, the employment numbers of Tables 5 and 6 can be expected to be 40-50 per cent lower than the true numbers.

Table 5. Employment in alumni-founded firms

| | Employees (2008), by region | | | |
|------------------------------|------------------------------------|---|---------------------|------------------|
| | Sweden | Stockholm, Uppsala, Västmanland, Södermanland, Örebro County | Stockholm County | Värmlands County |
| Entrepreneur from: | | | | |
| Stockholm University | 371 | 350 | 336 | 0 |
| KTH | 999 | 938 | 923 | 0 |
| Handelshögskolan i Stockholm | 214 | 210 | 209 | 0 |
| Karolinska institutet | 108 | 95 | 87 | 0 |
| Södertörns högskola | 15 | 13 | 13 | 0 |
| Mälardalens högskola | 76 | 58 | 25 | 0 |
| Örebro universitet | 98 | 55 | 27 | 0 |
| Uppsala universitet | 477 | 433 | 339 | 4 |
| Karlstad University | 114 | 80 | 78 | 18 |
| Stockholm County (total) | 1 853 | 1 731 | 1 688 | 0 |

Table 6. Employment in alumni-led firms

| | Employees (2008), by region | | | |
|------------------------------|------------------------------------|---|---------------------|------------------|
| | Sweden | Stockholm, Uppsala, Västmanland, Södermanland, Örebro County | Stockholm County | Värmlands County |
| Entrepreneur from: | | | | |
| Stockholm University | 554 | 526 | 475 | 0 |
| KTH | 1 282 | 1 154 | 1 128 | 0 |
| Handelshögskolan i Stockholm | 139 | 128 | 127 | 0 |
| Karolinska institutet | 186 | 153 | 134 | 0 |
| Södertörns högskola | 18 | 16 | 16 | 0 |
| Mälardalens högskola | 179 | 161 | 101 | 0 |
| Örebro universitet | 156 | 90 | 29 | 0 |
| Uppsala universitet | 777 | 670 | 475 | 5 |
| Karlstad University | 139 | 38 | 36 | 38 |
| Stockholm County (total) | 2 424 | 2 180 | 2 067 | 0 |

Table 7. Employment in all firms

| | Employees (2008), by region | | | |
|---------------------------|------------------------------------|---|---------------------|------------------|
| | Sweden | Stockholm, Uppsala, Västmanland, Södermanland, Örebro County | Stockholm County | Värmlands County |
| Entrepreneur from: | | | | |
| Anywhere | 230 442 | 84 907 | 61 122 | 6 354 |

Table 8. Employment in firms without established entrepreneurs

| | Employees (2008), by region | | | |
|---------------------------|-----------------------------|---|---------------------|------------------|
| | Sweden | Stockholm, Uppsala, Västmanland, Södermanland, Örebro County | Stockholm County | Värmlands County |
| Entrepreneur from: | | | | |
| Stockholm in general | 102 121 | 39 981 | 29 903 | 2 703 |

Taken together Tables 5 to 8 suggest some interesting implications. The total employment impact of alumni entrepreneurship does not seem very impressive. Among firms whose entrepreneurs it is possible to track, Stockholm alumni entrepreneurs are for example responsible for less than 2 per cent of employment. Advocates of entrepreneurship in academic curricula may in this sense find support in the above data. It must, however, be kept in mind that the definition of alumni is relatively strict (in particular, it only includes longer university education).

It should further be noted that three out of four alumni-founded firms began in the business service sector. For firms started by non-alumni, the corresponding figure is one out of four. This illustrates how alumni-founded firms contribute to the renewal of the regional industry structure.

Comparing Tables 5 and 6, we see that alumni-

led firms in general contribute about a third more to employment than alumni-founded firms. The notable exception to this pattern is alumni from Handelshögskolan in Stockholm, who leave a greater footprint as firm founders rather than as owner/managers in the later stages. Among the universities included above, KTH stands out with a higher employment impact. Entrepreneurial KTH alumni create greater impact on employment than alumni from the other large universities of Stockholm and Uppsala together. Alumni-induced employment seems to be strongly local for Stockholm-based universities, and less so for universities in less urban settings (Västerås, Eskilstuna, Örebro, Karlstad). Interestingly, this pattern is even stronger than the tendencies found earlier in the data concerning alumni mobility. A brief comparison is presented in Table 9.

Table 9. Comparison of alumni mobility with alumni job creation effect

| | What proportion of alumni from the 1998 cohort work in their county of graduation? | What proportion of jobs in alumni-founded firms are found in the entrepreneur's county of graduation? |
|-----------|--|---|
| Stockholm | 79% | 91% |
| Värmland | 44% | 16% |
| Örebro | 39% | 23% |

Summary and conclusions

The main idea of the pilot study was to test the potential of census data to identify and track the post-graduation experiences of HEI alumni. To that end it has lived up to expectations and produced a series of interesting results, summarized in the following bullet points:

- the number of HEI graduates in Sweden grew almost steadily between 1998 and 2007 whereas the labour force participation rate of these graduates remained relatively stable at around 70 per cent.
- on average the alumni retention rate in a region (number of local graduates who enter the local or regional labour market) is roughly 60 per cent

with recent graduates exhibiting slightly higher percentages than older graduates.

- on average the retention rate for advanced degree holders (PhDs and Licentiate) is higher than that of all graduates at roughly 70 per cent. This belies a common belief that higher education attainment facilitates labour market mobility.
- on average, retention rates vary considerably among different fields of studies. The lowest values are found for 'Agriculture, Forestry and Fishing' and 'Services' whereas graduates in 'Health' show the greatest inertia.
- considering specific regions separately one finds

significant differences in retention rates compared with national averages. Stockholm is an obvious example of a best performer with rates close to 80 per cent. When we use a binary dichotomy between core (major urban centres) and peripheral regions the core clearly outperforms the periphery in retaining local graduates.

- several points surround the employment effect of the entrepreneurial behaviour of alumni:
- In absolute numbers the job creation effect of firms attributed to alumni is not impressive. It is however distinctive in that it mostly happens in the service industry, contributing to the renewal of local business landscape.
- Among a selection of several universities the

employment effect appears stronger for businesses attributed to KTH alumni, underpinning the importance of science and engineering graduates.

The majority of these points are of prime significance when we consider the role of HEIs in regional development. What is worth noting is that the above analysis is the result of looking mostly at aggregated measures of individuals' mobility patterns; depending on the availability of time and resources, much more detailed analyses are possible through the use of census data. Similar research at a Nordic level would be of interest. Collection and analysis of transnational data is, however, demanding in terms of both costs and logistics. A discussion on methodological problems is presented in Appendix 1.

5. Case study analysis

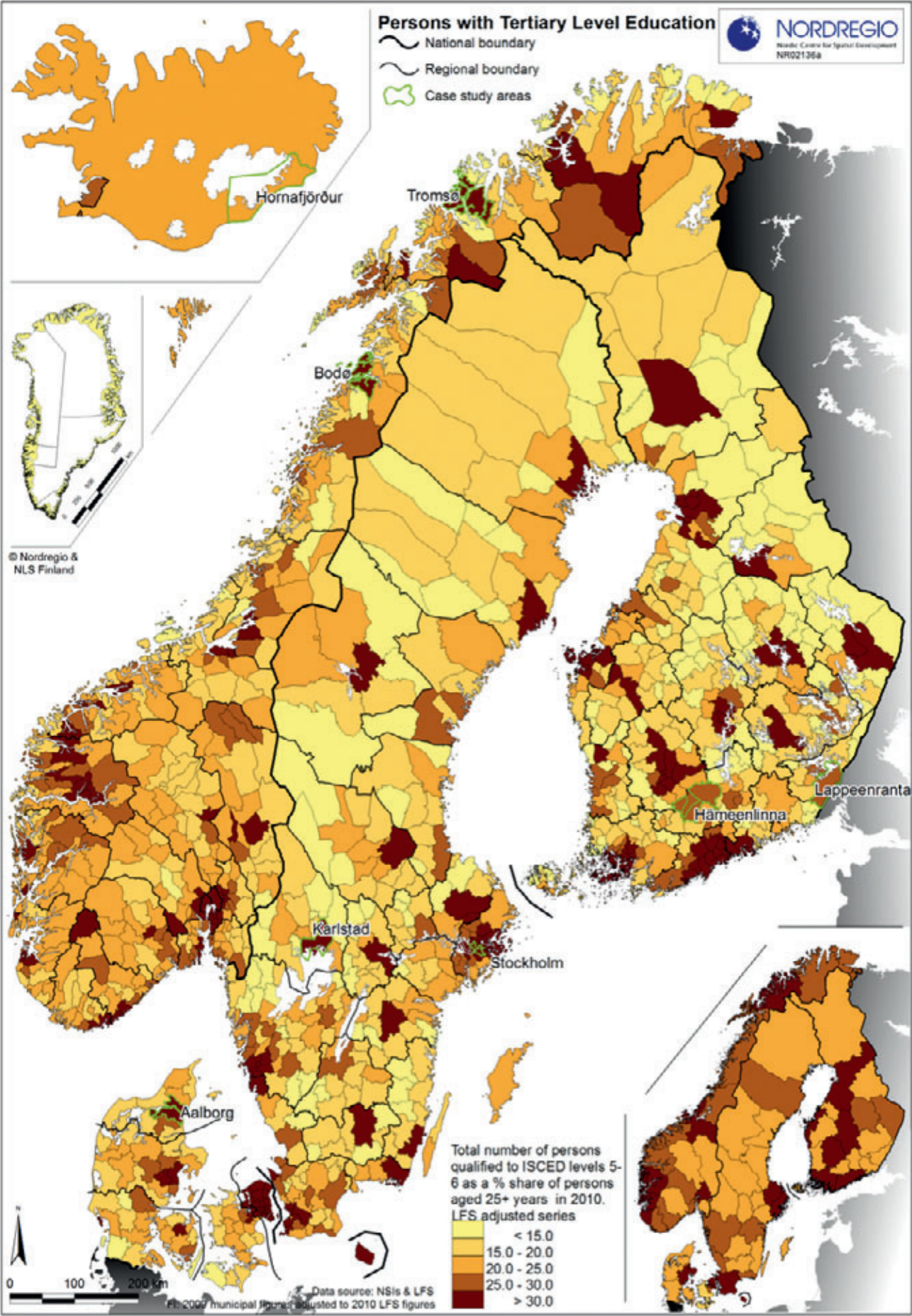
Presentation of the case studies

This part of the report offers a short presentation of eight case studies of HEIs from the five Nordic countries and a comparison of different strategies and roles in regional development. For a full presentation of the case studies, see separate working paper⁹. The case studies have been selected to represent interesting examples of the role of HEIs in regional development. The choice of specific case studies was made after discussions with reference group members, the Nordic expert group of Nordregio and regional actors. We sought variation in terms of types of HEIs and regional contexts, ranging from small sparsely populated to large urban regions. Case studies were performed in the following Nordic

regions; the North Jutland region, the municipality of Hornafjörður in Iceland, Nordland County and the region of Northern Norway, the counties of Värmland and Stockholm in Sweden, and the regions of Häme and Lappeenranta in Finland. As indicated in Figure 11 below, the level of higher education is, in general, high or relatively high in regions with an HEI. The case studies do not claim to be representative and the examples of regional collaborations are selected to illustrate a variation of activities rather than to identify best practice. To improve access to information, contacts and input from other research projects have been integrated into the project.

⁹ Lindqvist, M., L. Smed Olsen, P. Arbo, V. Lehto and H. Hintsala (2012) Strategies for Interaction and the Role of Higher Education Institution in Regional Development in the Nordic Countries – Case Studies, Stockholm: Nordregio Working Paper 2012:3.

Figure 11. Distribution of case study HEIs



Aalborg University (AAU)

Aalborg University Centre was established in 1974, at a time when the region of North Jutland was undergoing comprehensive structural changes. This led to a mutual interest on the part of stakeholders in the region and Aalborg University Centre in facilitating the process and it was decided that the university's research and education activities should be based on inter-disciplinary integration, problem orientation and group work. In 1994 the university centre became Aalborg University (AAU). From the very beginning, the education at Aalborg University was characterized by problem-based learning (PBL), also known as the Aalborg model, and by collaboration with the surrounding society. In 2010, the university had about 15 800 students and a staff of almost 2 900 in three campus areas. The total turnover was about 250M €, of which approximately 73 per cent was state funding.

Research and development have played a significant role in the interaction between the region and the university, as technology has been perceived as an important driving force in the renewal of the industrial structure of the region. In particular, the development of an international and competitive cluster in the field of ICT has proved pivotal to how regional stakeholders themselves perceive research and development as the driving force for development in the region.

The importance of strong collaboration with the surrounding society is stressed in AAU's strategy for the period 2010-15. In the strategy, it is stated that AAU has a specific mission with regard to three interrelated issues: problem-based learning, inter-disciplinarily and innovation. AAU has a unique arrangement with the Growth Forum of North Jutland, called the 'knowledge dissemination agreement'. This is a framework agreement for the 2010-12 period, comprising 12 sub-activities. The main purpose is to ensure knowledge transfer from the university to firms in the region. The Growth Forum provides up to 50 per cent of co-financing for activities carried out within the focus areas of the agreement.

The University of Iceland (UI)

UI was established in the capital, Reykjavik in 1911, as the first university in the country, through the merger of three faculties (theology, medicine and law). In 2008 the university merged with Iceland University of Education. In 2010, there were about 14,000 students.

As the first and largest state-run university, UI takes an active role in the development of the entire country. In 2006, the university was allocated additional funding from the Ministry of Education, Science and Culture to support development in the rural areas, on which a crisis in cod fisheries had a great impact at the

time. The Institute of the University of Iceland's Study Centres was set up to support the rural areas. The Institute is the focal point for the university's cooperation with local authorities, institutions, businesses, associations and individuals in rural areas through a total of nine Regional Research Centres which have been set up as independent organizational units in rural areas of Iceland. The objectives of the Institute are to provide facilities for research in rural areas; increase the access of the general public to education; and strengthen the relationship between the University of Iceland and the business community.

As UI underwent severe budget cuts of approximately 25 per cent owing to the financial crisis, attempts were made centrally to cut the budget of the regional research centres entirely, as they were not a fixed cost on the university budget. Meanwhile, strong objections from the municipalities involved and representatives in Parliament led to the rescue of the centres, which ended up undergoing the same budget cuts as other institutions of UI. The main strategic support for collaboration with the surrounding society is offered by the regional research centres. In its current strategy UI focuses on strengthening its collaboration with leading international research universities.

UI has developed an evaluation system which is now being used by all of the public HEIs in the country. Most points are awarded for publishing peer-reviewed articles, book chapters and for conference presentations. The earlier ambition of developing a reward system for collaboration was not included in the 2011-16 UI policy. The amount of external competitive funds has increased during recent years, however, as a consequence of the financial crisis.

University of Nordland (UiN)

Bodø University College was established in 1994, after a merger between the Regional College of Nordland, Bodø Teachers' College, and the Nursing College of Nordland. In January 2011 the university college received university status and became the University of Nordland, after a process supported by regional stakeholders. In total, there were about 5,700 students and a staff of 600 in 2010.

A main purpose of the university is to offer education programmes which are needed in the county. A benefit of its newly achieved university status is increased independence in terms of implementing new education programmes. An important forum for discussions on education programmes is Partnership Nordland, which has regular meetings and discussions concerning the development of strategies. Regional stakeholders also provide donations, e.g. to provide funding for fellowships and post-doctorates. The University of

Nordland aims to increase its share of external funding for research, especially focusing on funding from EU programmes and the Norwegian Research Council. An important element as regards achieving a greater degree of external financing is the recently established study and research administration office. The University of Nordland does not have a formal written strategy for cooperation with the surrounding society in the county, but a strategy is currently being developed. It has a Strategy for Internationalization 2009-2012, which gives high priority to cooperating with Russian universities. Moreover, the wider circumpolar region is a strategic focus area of the University of Nordland, which is evident through the university's active participation in the University of the Arctic.

The university carries out some projects in cooperation with private firms based in the county, e.g. supported by the incentives provided by Innovation Norway and the tax incentive *SkatteFUNN*. In such constellations firms often seek assistance from Knowledge Park Bodø AS, established by the business community, Nordland County and SIVA. The knowledge park provides advisory services and assists with the development of applications of private firms for R&D projects. A national funding programme by the Norwegian Research Council which has been especially important in terms of strengthening triple helix cooperation during recent years is the VRI programme. The University of Nordland also has close collaborations with Nordland Research Institute, established in 1979 and owned by Nordland County and other stakeholders. Since January 2010, the Nordland Research Institute has been registered as a limited company of which 51 per cent is owned by the University of Nordland.

University of Tromsø (UiT)

The university was founded in 1968. The main aim was to provide equal access to higher education and to help build the welfare state, as there was a lack of doctors, teachers and other groups of professionals in Northern Norway. It was also expected to specialize in academic fields reflecting the characteristics of the region, such as fisheries, northern lights research and Sami studies. The university started out with the ambition of creating a new and different university, with an interdisciplinary, regionally relevant and problem-oriented study programme and a democratic governance structure, including students and non-academic staff in all decision-making bodies. Since then, UiT has been reorganized to resemble the traditional universities more. Today, UiT has approximately 9,000 students and a staff of 2,500. The annual budget is about 297 M€, of which nearly 80 per cent is funded by the government.

After the international economic downturn in the 1970s innovation and industrial renewal became key government priorities and universities stood out as potential engines for knowledge-based economic growth. In Tromsø this led to the establishment of Northern Research Institute (NORUT), a research institute for contract research, and a science park. There is, however, no special unit for regional collaboration. Over the years, however, the interfaces between UiT and the region have been deepened and extended. According to UiT's strategy document for the period 2009-13, the vision is to create 'a national and international powerhouse for expertise, growth and innovation in the High North'. Both the strategy document and the accompanying action plan state that UiT should provide candidates with good and relevant qualifications, perform research and development that can foster innovation and industrial development, and become a more prominent regional actor and collaborative partner in public and private working life.

Karlstad University (KaU)

Karlstad University College was established in 1977 as one of several new university colleges in Sweden. About a decade later, the university college received university status and became one of the youngest state universities of Sweden. Karlstad University has approximately 12,500 students and a staff of 1,200 (70 per cent faculty). In 2010, the total revenues of Karlstad University amounted to 100 M€, with state-funding representing almost 95 per cent.

In the Research and Education Strategy 2009-2012, the university is described as a modern, outreaching university. One of its ambitions is to be an active and important link in the Swedish system of higher education and, at the same time, maintain a strong regional basis and international outlook. In the Vision 2015, it is stated that Karlstad University is meant to contribute to regional attractiveness and growth. All education and research are underpinned by close dialogue with private companies and public organizations. To reach the goals concerning quality and collaboration, a proportion of the budget for research and education is allocated according to performance in these areas. In 2011, this amounted to 15 per cent of the budget, but the intention was to increase it further. To support external collaboration, the university has also developed a structure with several different organizations, e.g. for professional services, grants and innovation support. There is also close collaboration with INOVA, the open incubator of Värmland.

Most research is multi-disciplinary and carried out in conjunction with industry and the public sector at the regional, national and international level. During

the last decade, cluster organizations have been invited to participate in the regional development process in the County of Värmland. Today, Karlstad University, Region Värmland and the cluster organizations have taken the lead in the regional development process. An agreement on research collaboration has been signed, whereby Värmland Region provides funding for ten professorships at Karlstad University for the period 2010-14, if the university provides a matching amount.

Royal Institute of Technology (KTH)

KTH in Stockholm is the largest, oldest and most international technical university in Sweden, dating back to the establishment of the polytechnic Teknologiska Institutet in 1827. Albeit the initial focus was to provide education on applied technology, basic research and practical engineering often cross-fertilize each other. Over time, the name was changed to KTH and in 1927 KTH received university status. In 2010, KTH had a total of just over 14,000 full-year equivalent undergraduate students, close to 1,700 active research students and almost 3,200 full-time equivalent employees. Total turnover amounted to 337 M€, of which state funding constituted about 54 per cent.

In Vision 2017, there is scope for Stockholm and the larger Lake Mälaren region to become one of Europe's most innovative environments, and for KTH to have an active role in regional development in collaboration with other regional HEI. The vision was developed in an inclusive process involving a large number of internal and external stakeholders from different geographical levels. In the Strategic Plan 2009-2012, it is stated that collaboration with external actors is of great importance and, to an increasing extent, a precondition for the future competitive edge of KTH. This is manifested by development of KTH Business Liaison, the recently established KTH Innovation Office and participation in different networks and collaborative research centres and platforms, nationally as well as internationally. KTH hosts two Knowledge and Innovation Centres within the prestigious EU collaboration, European Institute of Innovation and Technology (EIT) and InnoEnergy and EIT ICT Labs. KTH is also involved in several regional cluster development projects in the greater Stockholm region, e.g. Life Science (Hagastaden/Flemingsberg), ICT (Kista) and Creative Stockholm (Botkyrka).

An important part of the future development relates to attitudes, competences and incentives of KTH management, staff and researchers. For several years, the Entrepreneurial Faculty project has provided leading faculty members with opportunities for exchanging experience and benchmarking in successful activities for innovation and collaboration through workshops

and study visits to leading universities. A later initiative is the KTH Future Faculty project.

HAMK University of Applied Sciences (HAMK)

HAMK is a multidisciplinary polytechnic institute, established in 1995 and based on eight separate education institutions. Objectives concerning the key operations and finance are determined by Häme Municipal Federation for Professional Higher Education (HAKKY), formed by six member municipalities. There are 8,196 students and a staff of 777. HAMK's total revenues are about 67 M€, with basic funding from the state and municipalities amounting to 73 per cent.

In the HAMK Strategy 2015, the vision for 2015 is to be profiled as an international higher education institution and promoter of entrepreneurship, to raise the population's competence level. There are several supplementary strategies for education, R&D, internationalization and regional development. HAMK's strategies and the regional strategies of Häme region complement each other. HAMK is involved in several different activities to support the region with development of relevant education and competence development, ranging from vocational training to joint research. There are for example incubator cooperative and several new regional Education & Research centres, e.g. InnoForss (in Forssa) and AutoMaint (in Valkeakoski). Business services are provided by HAMK and commercialization of ideas is handled in the AMK-TULI ('Research into Business') programme funded by The Finnish Funding Agency for Technology and Innovation (TEKES). HAMK has also been actively involved in building a regional higher education community (the Häme Open Campus, HOC) and in FUAS (Federation of Universities of Applied Sciences). The Häme Region Centre of Expertise is part of the national Centre of Expertise Programme (OSKE) and develops competencies through three national competence clusters, Living Business, Digibusiness and Intelligent Machines.

HAMK has a strong influence on the County of Häme, socially as well as economically, and was named as a Centre of Excellence in Regional Development in 2001 and 2003 and as a Centre of Excellence in Education in 2002 by the Ministry of Education. According to an audit by the Finnish Higher Education Evaluation Council (FINHEEC) in 2011, HAMK's quality assurance system was the best ever of a Finnish higher education institution. HAMK has also been awarded a Diploma Supplement Label for 2010-13 by the European Commission.

Lappeenranta University of Technology (LUT)

The university, established in 1969, combines two fields of science that complement each other – technology and business studies. The history of the School of Business dates back to regional ambitions in the early 1900s to develop a Finnish-speaking higher education institution close to the border in this the most international centre of commerce in Finland. On top of the 5,264 degree-level students, there are students in further education (about 1,700) and in the Open University (about 1,500 students). In 2009, total revenue amounted to about 73 M€, approximately 57 per cent of it being basic state funding and supplementary funding mainly from the Academy of Finland, the Finnish Funding Agency for Technology and Innovation (TEKES) and EU funding. About three-quarters of external funding is for research.

The main ambition of Lappeenranta University as described in its Strategy 2013 is to be an independent actor, but with a high level of collaboration with other actors. The Strategy 2013 includes faculty strategies and six reform programmes, i.e. high-quality research, best education in Finland, interaction with

society, internationalization, human resources and management, and distinction and appeal. LUT has developed a strategy that is less based on cluster and more focused on methodology. Being located near the eastern boundary of Finland, the university also offers comprehensive know-how related to Russia. There is a department of research and innovation services, partly funded by the national TULI programme, assisting researchers with research project agreements, financing and administration, inter alia.

The university has a close co-operation with industry. Over the years, contacts have expanded from the forest industry to cover a range of different industries, including electricity and metals. Today, there are about 400 research projects in which companies are involved and most students (95 per cent) are doing their thesis work in collaboration with firms. There are collaborations in forms of partnerships with regional actors (e.g. Lappeenranta Innovations Ltd, Teknopolis, and Lappeenranta municipality), patent collaborations and innovation target groups. Lappeenranta Innovation Ltd is also the coordinator of the Forest Industry Future Cluster Programme and Southeast Finland Centre of Expertise.

Variations in HEI characteristics

To explore various strategies and activities to support regional development, HEIs of different types, ages and sizes have been included in the study. As indicated in the table below, there are two universities, established during the early nineteenth century, University of Iceland and KTH. In the late 1960s, the universities of Tromsø and Lappeenranta were established. Although most of the HEIs in the study have university status today, many of them were established as university colleges or polytechnics. KTH was initially a polytechnic institute, providing professional education, and the LUT was formed through the merger of a technical

institution and a business school. Similarly, Aalborg University Centre and Karlstad University College were established during a period of national investment in new HEIs during the 1970s, but in the 1990s, they both received university status. During the same period, HAMK University of Applied Science and the University College of Bodø were established. In 2011, the latter received university status and changed its name to the University of Nordland. This illustrates well the on-going discussion in several Nordic countries concerning the increasingly blurred differences between university colleges/polytechnics and universities.

Table 10: Age and size of case study HEIs (2010)

| HEI | Year of establishment | Number of staff/ students 2010 | Revenues (% state funding) 2010 |
|--|-----------------------------------|-----------------------------------|------------------------------------|
| Aalborg University | 1994 (1974 University Centre) | 2 864/ 15 800 (0.18) | 250 M€ (73%) |
| University of Iceland | 1911 | N.A./14 000 | |
| University of Nordland | 2011 (1994 University college) | 600/ 5 700 (0.10) | |
| University of Tromsø | 1968 | 2 500/ 9 000 (0.27) | 297 M€ (80%) |
| Karlstad University | 1999 (1977 University college) | 1 200/ 12 500 (0.10) | 100 M€ (95%) |
| Royal Institute of Technology (KTH) | 1927 (1877 Polytechnic) | 3 200/ 15 700 (0.20) | 367 M€ (54%) |
| HAMK University of Applied Science | 1995 | 777/ 8 196 (0.09) | 67 M€ (73%) |
| University of Lappeenranta | 1969 (1919 School of Business) | 930/ 5 264/ (0.18) | 71 M€ (57%) |

Size varies from about 5,000 students in HEIs in the more peripheral regions of Nordland and Lappeenranta to over 15,000 in the more urban regions of Aalborg and Stockholm. The University of Iceland has a high number of students. The number of students is to some extent also visible in the level of revenue but there are some variations that can partly be explained by the amount of external research funding. This is also

illustrated in the relation between staff and students, whereby the more research-intensive HEIs, e.g. UiT, KTH, AAU and LUT, have a higher ratio of staff to students. There are some relations, however, that are more difficult to explain, e.g. the low number of staff in HAMK in spite of a relatively high proportion of external funding.

Different regional contexts

The HEIs have also been selected as case studies in order to explore the challenges in different types of regions. As indicated in the table below, the case study regions provide variety in terms of size, population density and annual population growth. The regions range from sparsely populated regions, like Iceland and Northern Norway (including Nordland), to large urban regions, such as Stockholm and Aalborg. HAMK University of Applied Science is located in the Kanta Häme County,

but is also part of the greater Helsinki region. In some regions with a low level of annual population growth, there are large variations between municipalities. HEI are often located in regional centres, characterized by a population increase: e.g. in Aalborg in North Denmark, Karlstad in Värmland County and Bodö in Nordland County. Similarly, in Iceland there are large variations in population growth between the capital area and the rest of the country.

Table 11: Regional characteristics of case study regions

| HEI | Region | Size of region (density) 2010 | Annual population growth 2005-2010 |
|--|--|---|------------------------------------|
| Aalborg University | North Denmark region | 579 628 persons (73 pers/km ²) | 0.8 (per mille) |
| University of Iceland | Iceland | 317 630/ persons (3 pers/km ²)/ | 15.7 |
| University of Nordland | Nordland County (<i>fylke</i>) | 236 271 persons (7 pers/km ²) | -0,5 |
| University of Tromsø | Troms County (<i>fylke</i>)/ Northern Norway region | 156 494 persons (6 pers/km ²)/ 465 621 persons (4 pers/km ²) | 4.9 |
| Karlstad University | Värmland County (<i>län</i>) | 278 000 persons (16 pers/km ²) | -0.2 |
| Royal Institute of Technology (KTH) | Stockholm County (<i>län</i>) | 1.9 million persons (311 pers/km ²) | 15 |
| HAMK University of Applied Science | Kanta Hämeen County (<i>maakunta</i>) | 173 828 persons (33 pers/km ²) | 7.3 |
| University of Lappeenranta | South Karelia County (<i>maakunta</i>) | 134 019 persons (24 pers/km ²) | -2.6 |

Källa: Compiled from Lindqvist, M , ed (2010), Regional Development in the Nordic Countries 2010, Nordregio report 2010:2

A simple way to assess the economic importance of HEIs in a specific region is to calculate the number of students and staff in relation to the total number of regional inhabitants, disregarding multiplier effects owed to economic activities and investments. Even if this does not give a full picture, it does illustrate the potential for greater economic impact of HEIs in small

regions, e.g. HAMK and the Universities of Karlstad, Lappeenranta and Iceland. In the large Stockholm County, KTH seems to have limited direct economic impact. KTH, however, is only one of several HEIs in the region, which together represent an important group of Swedish HEIs.

Table 12: HEI students and staff as proportion of regional population (2010)

| HEI | Students | Staff | Students + staff | Population | % |
|----------------------------|----------|-------|------------------|------------|-----|
| HAMK | 8 196 | 777 | 8 973 | 173 828 | 5.2 |
| Karlstad University | 12 500 | 1 200 | 13 700 | 278 000 | 4.9 |
| University of Lappeenranta | 5 264 | 930 | 6 194 | 134 019 | 4.6 |
| University of Iceland | 14 000 | 0 | 14 000 | 317 630 | 4.4 |
| University of Aalborg | 15 800 | 2 864 | 18 664 | 579 628 | 3.2 |
| University of Nordland | 5 700 | 600 | 6 300 | 236 271 | 2.7 |
| University of Tromsö | 9 000 | 2 500 | 11 500 | 465 621 | 2.5 |
| KTH | 15 700 | 3 200 | 18 900 | 1 900 000 | 1.0 |

Comparative analysis

In this sector, a comparative analysis of the case study HEIs is presented. Initially, we look at the historical background and missions of the HEIs and the existence of different strategies and support structures related to collaboration and regional development. We then argue that most HEIs have an active role in regional development and represent different types of interesting examples.

History matters

In many of the HEIs, particularly the ones established as university colleges, the initial focus has been on providing education and professional training. Partly as a consequence of national policy development, focus has shifted towards research and external collaboration over the years. In some cases, the mission from the start has been to support regional actors. In other cases, the national mission has been more pronounced. This indicates that, depending on the historical background of the HEIs, their role in regional development has been more or less explicit over the years.

UI, for example, was established as a national university whose mission was to take an active role in development of the entire country. There has not been a strong tradition of regional collaboration, even if

activities have been adapted according to regional needs, mainly through the establishment of regional research centres. At KTH, the mission has changed over the years, from an initial focus on professional education to more academic and research-oriented activities of importance to the Swedish manufacturing industry. KTH has traditionally not had an explicit ambition to participate in regional development, albeit many collaborative partners were located in the Stockholm region. During the last few years, however, KTH has become increasingly involved in regional development activities.

In other cases, there has been an evident regional mission from the start. During the establishment of UiT, for example, the ambition was to provide higher education to support the development of public services and regionally important sectors. Over the years, UiT has become increasingly anchored in the region. In North Denmark, there was a mutual interest on the part of regional stakeholders and AAU to facilitate the ongoing structural change in the region and to establish strong collaboration with the surrounding society. As a polytechnic and the only HEI in the County of Häme, HAMK has from the start had an important role in regional strategy development and involvement on the

municipality level is strong. The development of LUT is the result of a long process. Regional business had for many years supported the establishment of a business school, as the region was a centre of international trade. Over the years, business and technology were integrated in LUT, but there is still a strong focus on regional business sectors, e.g. forestry, and cross-border collaboration with Russia.

In two cases, regional stakeholders had an important role in the transformation of a university college to a university. External collaboration was a major mission for the former University College of Karlstad, providing education in response to regional demand. Traditionally, business collaboration was dominated by a few large companies in specific sectors, but over time the university has become increasingly involved in a broad range of regional development activities. In the late 1980s, regional business had an important role in the university transformation, aiming to increase regional research competence in specific areas, e.g. steel and forestry. The University of Nordland (the former University College of Bodø) has also had an important role in providing education programmes of relevance to the regions. Regional stakeholders were very active during the process of the college becoming a university in 2011, e.g. providing donations. As a result, UiN has become more independent in terms of the potential to introduce new education programmes.

Few specific strategies on regional development

As indicated already in the above presentation of the case studies, there are many different types of strategies supporting collaboration and regional development. An attempt to summarize HEI strategy documents and prioritized focus areas is presented in the table below. The study does not claim, however, to offer a complete inventory of HEI strategies.

In most cases, there is one overall HEI strategy: AAU Strategy 2010-2015, UI Policy 2011-2016, UiT Strategy 2009-2013, KaU Education and Research Strategy 2009-2012, KTH Strategic plan 2009-2012, HAMK Strategy 2015 and LUT Strategy 2013. In these strategy documents the most important missions or focus areas are defined, including strategies for collaborating with the surrounding society. Since UiN was recently established, no overall strategy document is currently publicly available but a strategy on internationalization has been developed and a strategy for collaboration is under construction. In HAMK, the overall strategy documents are supplemented with a large number of strategies, focusing specifically on education, research, internationalization and regional activities. In the Swedish case studies, the strategies are supplemented with documents describing more long-term vision. In KTH, Vision 2027 was developed in an inclusive process involving a large number of stakeholders from the regional and national level.

Table 13: Summary of HEI strategies, strategic focus and collaboration support structure

| HEI | Strategies | Focus | Collaboration support structure |
|-------------------------------------|---|--|---|
| Aalborg University | AAU Strategy 2010-2015 | Problem-based learning (PBL – Aalborg Model) Inter-disciplinary Innovation | AAU Innovation, including knowledge-based networks (e.g. BrainsBusiness), commercialization unit, entrepreneurship support (e.g. incubators, regional task force, solution camps) and matchmaking |
| University of Iceland | UI Policy 2011-2016 | International competitiveness | 9 Regional Research Centres |
| University of Nordland | Strategy for Internationalization Strategy for collaboration (under construction) | Regionally relevant education Cooperation with Russian HEIs | Majority owner of Nordland Research Institute |
| University of Tromsø | UiT Strategy 2009-2013 Action Plan | Relevant education R&D fostering innovation and industrial development Regional actor and collaborative partner in private and public working life | Majority owner of Northern Research Institute (NORUT), including innovation and commercialization unit Norinna (e.g. business incubator, seed capital fund and technology transfer) Research Centres |
| Karlstad University | Research and Education Strategy 2009-2012 Vision 2015 | Multidisciplinary Mixed funding International collaboration Networking Societal involvement of employees Gender equality | Karlstad University Professional Services Grants & Innovation Office (including commercialization and exploitation, e.g., Fyrklöver Innovation Office) Research Centres Competence Centres |
| Royal Institute of Technology (KTH) | Strategic Plan 2009-2012 Vision 2027 | Excellence in research and education Collaboration with society | KTH Business Liaison, supporting access to professional competence, research and innovation collaboration, recruitment and networking. KTH Innovation Office Competence Centres National Research Centres and SRA EIT |
| HAMK University of Applied Science | HAMK Strategy 2015 Education Strategy 2010-2015 R&D Strategy 2015 Development Plan for Internationalization 2015 Regional strategies (2002 and 2006-09) | Competence development Profiling Development of operations Regional cooperation | Education and Research Centres Centre of Expertise HAMI (vocational training) HOC (Häme Open Campus) |

| | | | |
|----------------------------|-------------------|---|--|
| University of Lappeenranta | LUT Strategy 2013 | High-quality research Best education in Finland Interaction with society Internationalization (with focus on Russia) Human resources and management Distinction and appeal | Research and Innovation Services, supporting technology transfer, commercialization and innovative start-ups Research Centres Centre of Expertise Open University (e.g. continued professional education) Alumni Association |
|----------------------------|-------------------|---|--|

In most strategy documents, collaboration is presented as an important strategic activity. In some cases, for example at UI, focus is on international collaboration with other HEIs, to increase the knowledge inflow and raise the quality of research. Collaboration with the surrounding society, broadly defined, is mentioned as a strategic mission in all Swedish, Danish, and Finnish case studies, either in the strategies or in the visions. In some cases, e.g. KaU, UiT, UiN and HAMK, their role as a regional actor is more explicit. Today, there are no separate strategy documents related to regional collaboration, but HAMK has previously developed such strategies and UiN is presently developing one.

An active role in regional development

Although there are few strategy documents on regional collaboration, several HEIs are actively involved in regional development processes. For example, the Rector of AAU is a member of the Regional Growth Forum of North Denmark, with responsibility for the regional development strategy, monitoring of regional development and allocation of regional development funds, including EU structural funds. The forum has made a unique framework agreement with AAU for the period 2010-12 to ensure knowledge transfer to firms in the region by offering a 50 per cent co-financing agreement.

In Norway, UiN is part of the Nordland Partnership, responsible for the County's overall planning strategy and development programme. The partnership is of particular importance for discussions on education programmes. UiN intends to utilize the partnership to formalize a future Council for Cooperation with the business community, in accordance with national guidelines. In the Häme region, the strategies of HAMK and the regional strategies of Häme complement each other and HAMK has been involved in developing the county strategies, e.g. identifying new business development needs.

In the Swedish County of Värmland, KaU has become increasingly involved in regional development, but on a less formal basis. Over time, the university has developed a regular dialogue with regional authorities

and cluster organizations, e.g. on how to invest funding from the national defence restructuring programme in the mid-2000s, in the prioritization of research areas and as part of the on-going process of developing a new regional cluster strategy. KaU had an important role in the implementation of these decisions.

Apart from participating in the regional development processes, HEIs have an important role in terms of collaboration support structures, functions and services provided. As indicated in the table above, a wide variety is provided by the different HEIs in the study, ranging from the development of relevant education programmes and vocational training to commercialization and collaborative research. In many cases, these functions are provided by different units or organizations within the HEIs, e.g. the Danish and Swedish Liaison or Innovation Offices, in other cases by collaborative Research Centres or Centres of Expertise, or by majority-owned external organizations, such as the Norwegian Research Institutes of Nordland and NORUT.

Several universities have been actively involved in the restructuring of the regional industry, e.g. the ICT sector in North Denmark through the activities of AAU Innovation and the BrainBusiness networks. An interesting example is the establishment of a regional task force providing competence development, business development support and an incubator for spin-off firms, to cushion the effect of the closure of the two largest ICT companies in the latest economic crisis. UI had an important role in supporting the structural change in rural areas of Iceland, when the fishing industry was hit by economic crisis. A specific example is the municipality of Hornafjörður, where the establishment of a regional research centre had an important impact and contributed to innovation and development of the tourism sector. In Karlstad, there has been increased collaboration between the municipality, regional actors, KaU and the business sector, the latter often represented by the regionally prioritised cluster initiatives. LUT is another HEI that has contributed to the restructuring of an old industry structure dominated by steel and forestry by attracting big company research and supporting the development

of new companies, e.g. in the field of electrical and energy engineering.

From a regional perspective, the most important role of HEIs is often said to be the provision of knowledge and competence. This explains why many HEIs have initially had a focus on education and professional training. It is not only a question of higher education (e.g. at bachelor's or master's level), however. In many regions, HEIs also have an important role in supporting lifelong learning. Examples are Karlstad University Professional Services, a wholly owned organization supporting lifelong learning among employees of companies and public organizations, and the close collaboration between researchers at KaU and Karlstad Technology Centre, run by the municipality of Karlstad. Another example is the Open University of LUT, which offers university-level knowledge to meet the need in working life, e.g. continued professional education, degree programmes and undergraduate courses. A further example is the Häme Vocational Institute (HAMI), an independent institute working in close collaboration with HAMK.

In most regions, the location of an HEI has an important impact on regional attractiveness. In Stockholm, a strategic alliance between HEIs and collaboration with regional public actors on strategic questions is expected to increase the attractiveness of the greater Stockholm-Mälardalen Region. Helsinki Education and Research Area (HERA) is a consortium of 15 HEIs, including HAMK, in the Helsinki Metropolitan Area. Their mission is to develop the Helsinki region into an attractive place to live, learn, work and do business. Similarly, the UiT is expected to have had an important impact on Northern Norway by enriching cultural life and highlighting the region.

Integrating education, research and collaboration

There are several initiatives integrating collaboration with the surrounding society into education and research. Important reasons for collaborating on education are to provide more relevant education programmes, closer contact between students and the surrounding society and improved opportunity for private and public employers to recruit students after graduation. One example of this is the nationally and internationally recognized PBL-Aalborg Model (problem-based learning) of AAU. The model gives students the chance to work with the business community and to solve real-life problems, which in turn makes them appreciated in the labour market.

In several cases, there have been attempts to integrate the requirements of the labour market into the development of new education programmes. In

the University of Nordland, for example, a significant forum for discussions on education programmes with regional stakeholders is Partnership Nordland. Donations are received to finance fellowships and post-doctorates. It is stressed, however, that it is important to balance the expectations of regional stakeholders and the development of academia.

In Karlstad University, all education and research are underpinned by a close dialogue with private companies and public organizations, e.g. through advisory boards, reference groups and steering committees. There have also been joint actions to increase the interest in higher education among potential students. For example, Cooperation Business and ICT Students (SNITS) was established in collaboration between the Department of Computer Science at Karlstad University and the regional ICT cluster "Compare" in order to increase the interest in ICT after the ICT crises in early 2000s. SNITS arranges seminars and various social events, and provides students with study visits and mentorships; and several companies are active as lecturers or provide advisory services. In terms of research collaboration, it is acknowledged that collaboration can improve the relevance of research and also facilitate research funding from national and European research programmes.

In most of the HEIs, research collaboration is organized in different types of organizations, e.g. Research Centres, Centres of Expertise, Competence Centres, Strategic Research Areas (SRA) and the European Institute of Technology and Innovation (EIT). These centres are often based on close collaboration with other organizations, including other HEIs as well as public or private actors. Some centres have a more pronounced focus on regional development, e.g. the Regional Research Centres of UI, which have an important role in the development of rural areas of Iceland. Others have a national focus, e.g. the Centres of Expertise in Finland and the Strategic Research Platforms in Sweden. In some cases, there are even international centres, e.g. the KIC run by KTH as part of the EIT programme. In Lappeenranta, the ambition of LUT is to develop collaborations at all levels, not just at the regional level. In terms of innovation, collaborations can take many forms, e.g. partnerships with other regional support organizations, patent collaborations and innovation target groups.

Many of the case studies also imply the importance of collaboration with regional cluster organizations. AAU has an important role in regional development through the knowledge-based networks established by AAU Innovation, for example with the ICT sector (BrainBusiness). In Stockholm, KTH is involved in the development of the ICT, life science and creative sectors. In Värmland, there is also established

collaboration between KaU and the established cluster organizations in the pulp and paper, steel and ICT sectors. KaU is also involved, however, in the development of new competence areas in the intersection between old and new sectors, e.g. energy efficiency, consumer packaging and services sectors. LUT, on the other hand, has tried to develop a strategy that is less based on clusters and more on methodology, albeit there is still close collaboration with dominant industries, e.g. in the Southeast Finland Centre of Expertise, focusing on national clusters in forestry, intelligent machines and the maritime sector.

According to the HAMK strategy, there is an explicit goal to integrate research and education. One way of doing this has been to develop Education and Research Centres. These centres have been formed according to the regional context in which they are located, e.g. Automaint, eLearningCentre, InnoForss, Innosteel and Steel Metal Centre. The ambition is to bring together researchers, teachers and students to work on joint research and product development projects, creating structures for continuous interaction with the labour market and fostering the growth of students as experts in their professions.

Many activities to stimulate entrepreneurship and innovation

It is clear that many of the collaborative activities and services provided by the HEIs aim at stimulating entrepreneurship and innovation, often at the regional level. To take advantage of the ideas and knowledge developed, several HEIs have established support organizations and incubators, to support commercialization and innovation. Sometimes these activities are organized as separate organizations. In North Denmark, for example, AAU Innovation is responsible for supporting networking between the university, the business community and public authorities, and for commercialization and entrepreneurship support of employees at AAU, including the management of incubators in different departments. AAU Innovation has base funding from AAU, but most funding is provided in project form. In the region of North Norway, the innovation and commercialization unit Norinna has the main responsibility for providing a business incubator, seed capital fund and technology transfer activities. Norinna is part of Northern Research Institute (NORUT). This used to be an independent, to some extent competing, actor, but since January 2010 NORUT has been a limited company of which UiT owns the majority.

In Sweden, several national initiatives have been taken to support university entrepreneurship and innovation. These have been integrated with

regional activities. At KTH, the KTH Business Liaison supports competence matching, research collaboration, innovation support, recruitment and networking. In 2009, KTH was commissioned to develop an innovation office, to support research commercialization. KTH Innovation is run in partnership with other HEIs and research institutes in the greater Stockholm/Mälars region. In Värmland County, a close collaboration between regional entrepreneurship and innovation support actors has developed over the last few years. At KaU, the Grants and Innovation Office (GIO) has the main role in supporting commercialization and innovation. A close link with the university has been developed through the innovation coordinators appointed to different faculties. The management of GIO is also responsible for the new innovation office, run in collaboration with three other HEIs in central Sweden. There is also close collaboration with INOVA, an open incubator providing support for business development. INOVA is partly funded by the national Innovation Bridge Programme, but also receives regional co-funding, e.g. from KaU.

In Finland, the Finnish Agency for Technology and Innovation (TEKES) has taken national initiatives to support technology transfer, commercialization and innovative start-ups by students, staff and researchers from HEI. In HAMK, commercialization activities are supported by TEKES's AMK-TULI programme (Research to business). Entrepreneurship is also encouraged during education, e.g. through interactive learning, extensive links to enterprise, alumni activities and student counselling. In LUT, Research and Innovation Services assists researchers with commercialization, as part of the TULI programme. LUT is also part of the Southern Finland InnoTuli consortia, supporting university spin-offs.

Another type of activity is matchmaking, to provide public or private actors with different types of competence. One example is the matchmaking project run by AAU. The project is funded by the Regional Growth Forum of North Denmark, as part of the knowledge dissemination agreement. Each department of AAU has appointed an internal matchmaker to help industrial partners to find relevant researchers. External matchmakers are located at business promotion offices around the region.

In Stockholm, a matchmaking project (Kunskapslotsen) has been initiated in collaboration between Stockholm Academic Forum, an association of 21 HEIs in Stockholm, and the Innovation Offices of KTH and the Karolinska Institutet (KI). The first phase of the project started in 2008 and focused on knowledge transfer to small and medium-sized companies in the healthcare sector. In the second phase, running between 2011 and 2013, companies in

the environmental sector have also been included. The project involves researchers as well as students from participating HEIs.

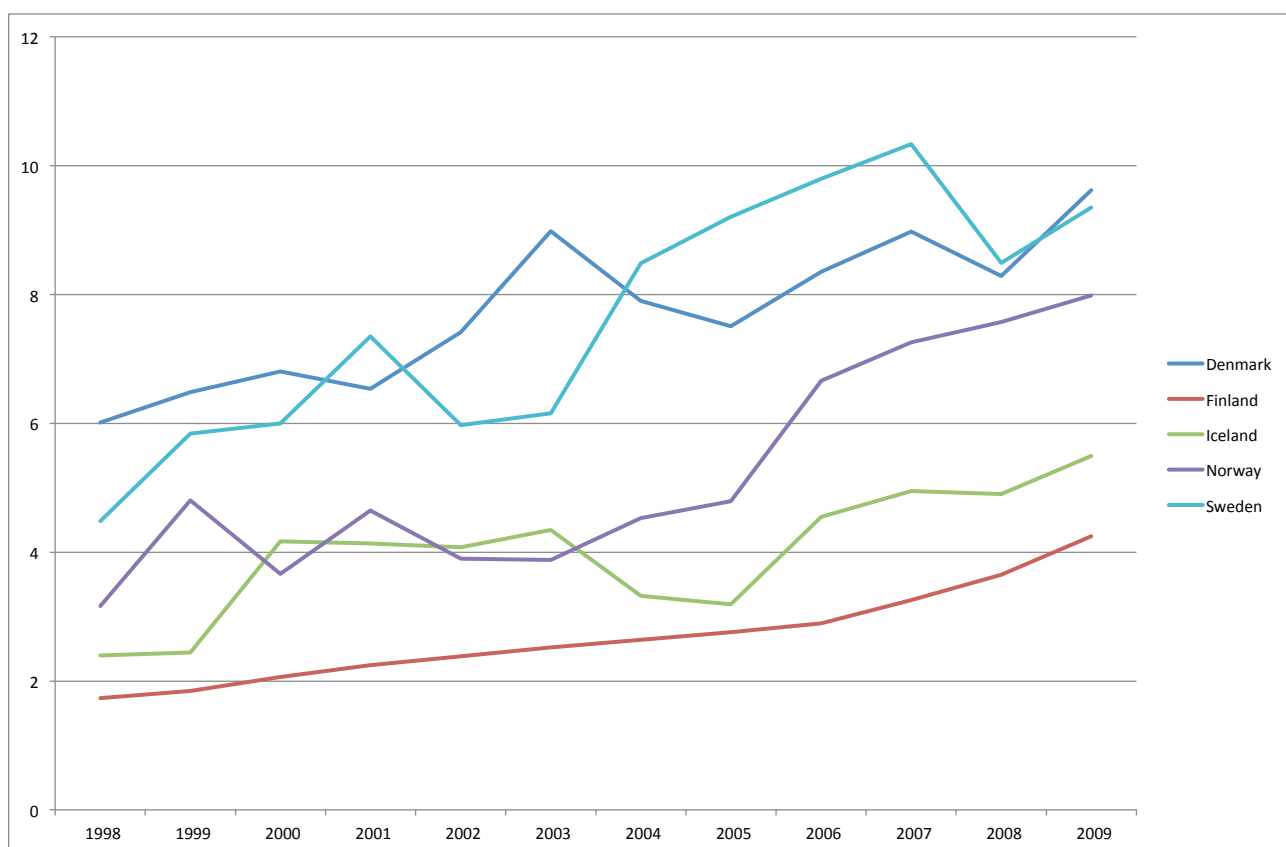
In some regions, there are ambitions to concentrate the location of various support actors in order to facilitate access to different services. In Häme region, HAMK has been active in building a regional higher education community, the Häme Open Campus (HOC), bringing HEIs, research institutions and citizens in the region closer together. In Stockholm, there is ongoing discussion about gathering all regional innovation support actors in an open laboratory at KTH.

Different perspectives on internationalization

In the light of the case studies, there seems to be a strong focus on internationalization among most HEIs. There are, however, different perspectives on internationalization.

First, there is the question of increased competition for students. Most HEIs have introduced education programmes in English, to be able to attract more foreign students. In some HEIs, the increased number of students over the last years can be explained by an increase in foreign students, although regional attraction has been relatively constant. As a result, the number of foreign students has increased over the last decade in all Nordic countries, as indicated in the figure below. Many HEIs are, however, concerned about future development.

Figure 12. Number of students with foreign citizenship as a percentage of total number of students



Source: OECD, Nordregio calculations

KaU is one of the HEIs which want to combine a strong regional basis with an international outlook. It was the first university in Sweden to receive the EU ECTS label (2006-2009), an accreditation simplifying the evaluation of education programmes between nations. The Swedish government introduced tuition fees for non-EU citizens studying at HEIs in January 2011, however. As a result, the number of non-EU students has decreased radically and it may become even more

important to receive a high ranking in international HEI comparisons in order to attract foreign students in the future.

Second, there is the question of international collaboration with foreign HEIs. Most HEIs in the case studies indicate that this is important for securing high-quality research and education. The strategies adopted by UiN and LUT focus on cooperating with Russian universities, something which may be explained

by geographic proximity. This has been encouraged by regional authorities, for example as part of an increased political focus in Northern Norway. Today, there is an agreement between UiN and four Russian universities involving education programmes in business and energy management. Another example is KTH, which has extensive research and education exchange programmes with HEIs in Europe, the USA, Australia and Asia. HAMK is another HEI with a network of collaborations with more than 120 HEIs in Europe, Asia, the USA, Russia and Africa. As it is one of the least internationalized regions in Finland, this is important for the County of Häme.

A third perspective on internationalization relates to research funding. In Sweden, KTH has been one of the most successful HEIs in terms of attracting funding from European research programmes. Today, KTH participates in a large number of international research projects and in two of the three collaborative networks within the prestigious EIT programme. Several other HEIs are also participating in different international research collaborations.

Stimulating a culture of collaboration

Collaboration between HEIs and external actors is well developed in all case studies, even if it has different objectives and takes many forms. Collaboration with the surrounding society in general and with regional actors specifically cannot, however, be taken for granted. There are still substantial differences in attitudes towards collaboration, within as well as between different HEIs. In order to develop an entrepreneurial spirit and more positive attitudes towards external collaboration, KTH has for several years run the Entrepreneurial Faculty project. The project has provided faculty management with an opportunity to make study visits and exchange experiences with entrepreneurial universities in other parts of the world. The project has been followed by other initiatives to develop attitudes and competence among teachers and researchers, e.g. KTH Future Faculty, including the development of a tenure track system for young researchers and a Faculty of Innovative Engineering.

Incentives for individual researchers to engage in external collaboration are in many cases limited. There is usually no national funding and the internal incentive systems of HEIs are more inclined to favour traditional areas, such as scientific publications and citations, over collaboration activities. To reach the goals of quality and collaboration, the management of KaU decided to allocate part of the research and education budget according to performance in these areas. In 2011, the proportion was 15 per cent of the total budget, but the ambition was to increase it in the future. In its attempt

to become a modern outreaching university KaU also uses a process-oriented approach, based on annual monitoring of the main priorities.

Although external funding has become a criterion for performance evaluation at KTH, scientific citations still have a dominant influence on academic merits and career development. In order to assess the internal quality of research and education, KTH has performed international research assessment exercises (RAE) and education assessment exercises (EAE) based on self-assessment and peer reviews. The faculty board has also initiated a process to develop a new policy for quality assurance based on continuous development in four areas; education, research, collaboration and competence development. LUT has also been involved in international university accreditation and received feedback which has been relevant and helpful for improving education.

UI has developed an evaluation system, used by all public HEIs in Iceland. This sprang from a rather traditional system, giving high priority in salary discussion to academic performance (e.g. peer-reviewed articles, book chapters and conference presentations), whereas collaboration with the surrounding society was only credited to a minor extent. In the former policy, there was an ambition to increase the reward for research and consultancy in collaboration with business and society, but this was abandoned in the new policy for 2011 to 2016.

In an audit by the Finnish Higher Education Evaluation Council (FINHEEC), HAMK was named the best HEI in 2011.

AAU is an HEI well known for collaborating with the surrounding society. It has, however, been noted that the lack of incentive for researchers to participate in collaboration is not a national but an international issue. Related to this is the question of the international ranking systems. AAU is involved in various activities to make international ranking systems more comprehensive and able to capture more indicators. Since 1997, AAU has been a member of the European Consortium of Innovative Universities (ECIU), a network established to strengthen member universities' strategic cooperation in research, education and regional development. Some activities include lobbying to influence EU programmes.

Challenges to HEI

Finally, during the interviews, a number of challenges to Nordic HEIs were raised, some of them closely related to their potential for taking an active role in collaboration and regional development, others of a more general nature:

- national budget cuts have severe impacts on collaboration activities
- negative attitudes towards external collaboration
- need for incentive systems including collaboration activities
- develop criteria to assess quality in collaboration
- tension between internal and external support structures
- coordination of several campuses
- the pressure from society on HEIs to serve many different needs
- threat of structural changes in the HEI sector owing to on-going debates
- national requirements for collaboration and division of labour
- increased competition for students in the future
- difficulties in attracting foreign students if they have to pay tuition fees

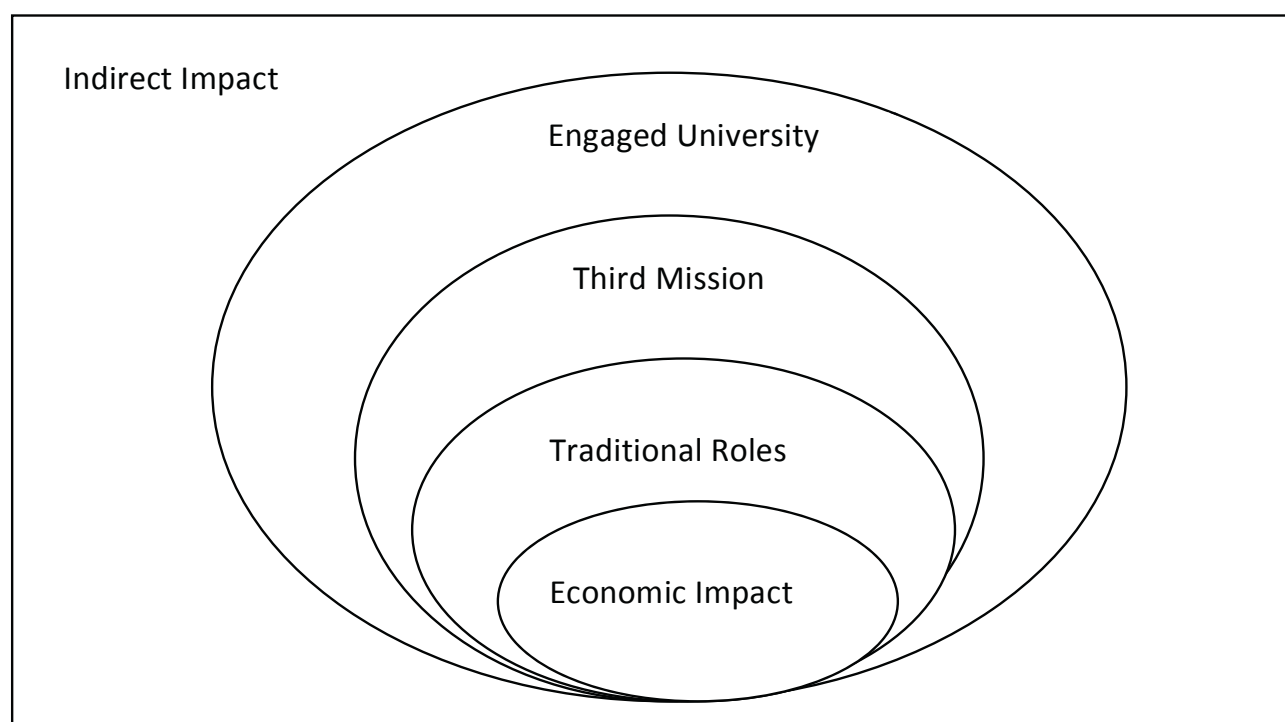
6. Concluding discussion

The roles of HEIs in regional development

One objective of this project has been to develop a deeper understanding of the roles of higher education institutions and their impact on regional development. The role of HEIs in regional development is not a new issue. The different functions and roles of HEIs in

regional development, as identified in previous research, are summarized below. Although the focus has been on regional collaboration, it is clear that collaboration with the surrounding society may also have an important impact at local, national or even international level.

Figure 13: The roles of HEIs in regional development



Source: Adapted from Goldstein et al. (1995), Drucker and Goldstein (2007) and Stahlecker and Kroll (2011)

So we could explore differences in strategies and roles, eight HEIs, ranging from small university colleges to large national universities, were selected for case studies. They are located in different types of region in the Nordic countries, e.g. regions differing in terms of population size and growth, unemployment rates and level of GDP. The definition of regions has been pragmatic, i.e. based on the most relevant geography from the perspective of a specific HEI. As a result, there are considerable differences between the case studies: for example, the case of the University of Iceland (UI) covering the whole country, but focusing on the small

municipality of Höfn, the Universities of Tromsø and Aalborg addressing larger geographic regions and most of the other HEIs having a main focus on one specific county.

Overall, we can conclude that HEIs do have an impact on regional development in all types of regions, although the roles and specific measures have to be adapted according to regional conditions. There is no 'one-size-fits-all' in terms of strategies or policy measures, but the case studies provide possible inspiration and examples of different types of measures and activities. In the following, the different roles

presented in Figure 13 are discussed. An attempt has been made to understand variations owed to differences in type of HEI and regional characteristics.

Economic impact

Several studies have focused on the economic impact of HEIs, in terms of direct effects created by economic activities, e.g. *investments and employment*, as well as indirect so-called *multiplier effects* on other sectors. Owing to methodological difficulties, many research approaches have been guided by access to data, for example on university spending and investments. Some of the more extensive research projects on the economic impact of HEIs have been carried out by the University of Strathclyde. The results suggest a substantial impact in terms of output and employment, but the most important effects are related to *productivity spill-over* from various R&D projects. In an analysis of the economic impact of KTH on the Greater Stockholm region, the results indicated that 70 per cent of the total income was spent in the region and that every job at KTH generated an additional 0.4 jobs in the region.

Similar studies, however, are complicated and expensive to perform at an international level, owing to variations in access to data between nations. As a result, this project has focused on other roles and functions of HEIs in regional development, rather than on economic impact. It is clear, however, that the economic role of an HEI vary between different types of regions. A medium-sized HEI may, because of its sheer size, have an important role as employer and economic actor in a small region, whereas a large HEI in a metropolitan area may have a less visible economic impact.

Traditional roles

The traditional roles of HEIs are to provide education and research, in order to create knowledge and develop human capital. Polytechnics, university colleges and universities of applied science have usually had a strong focus on education, often directed towards regional need for competence (e.g. in the business sector or in the public sector), whereas research has traditionally been an important activity of universities. As indicated in the case studies, the difference between university colleges and universities has become increasingly blurred. During the last decade, several university colleges have received university status, often strongly supported by regional stakeholders.

Developing human capital through the education of degree students and researchers is still the main function of most HEIs. In this project, a pilot project was undertaken to investigate more closely the regional impact of HEIs on the regional labour market in Sweden. The results indicate that approximately 60 per

cent of all degree students remain in their study region after graduation. Among researchers the number is higher, at approximately 70 per cent, which is slightly surprising, since it is often assumed that people with specialized skills are more likely to move to advanced jobs in other regions. There are variations between different fields of study, and disciplines connected to primary sectors or services have the lowest retention rates (about 20 and 40 per cent, respectively).

There are also large variations in retention rates between different types of region. In the pilot study, a more in-depth analysis of the two Swedish case study regions, i.e. the metropolitan County of Stockholm and the more peripheral County of Värmland, was performed. The results showed that the majority of Stockholm students (almost 83 per cent) remain in the region after graduation. In Värmland, only about 55 per cent of graduates stay in the region. A similar situation has been identified among other metropolitan and more peripheral regions. When it comes to attracting university graduates from other regions, however, the difference is not as great. In Stockholm, for example, about 40 per cent of all university graduates employed received their degree in another region. In Värmland, the percentage is slightly above 30 per cent.

A second important function of HEIs, strengthening the development of human capital, is to support *knowledge creation*. This can take different forms, ranging from basic research with a scientific perspective to applied research and collaborative projects with a more operational perspective. Most universities have traditionally had close collaboration with large industrial companies on research in specific disciplines. The importance of regional development has been less clear, however. In some cases, these companies have been located in the same region as the HEIs, contributing to regional competence development and potential for growth; in other cases, collaboration has taken place with companies or research institutions producing state-of-the-art research, independent of location.

Third mission

Over the last few decades, the expectations of HEI in terms of collaboration with the surrounding society – the third mission – have increased in the Nordic countries. Today, this role is often regulated by law or by contracts between the state and the HEIs. In Finland and Sweden, for example, the amount and quality of collaboration is followed up on a regular basis, which has increased the interest in collaboration among HEIs. The third mission of HEIs can include many different functions, ranging from one-way transfer of knowledge and technology to providing relevant competence, actively supporting entrepreneurship and participating

in innovation activities.

Transfer of knowledge and technology can take many different forms, from arranging seminars for the public to writing public articles or participating in general debate. These activities may take place without a specific strategy and often without any follow-up regarding the type and amount of resources allocated. They may also have a more or less regional focus. They perform an important function, however, by contributing to a more positive attitude towards higher education and research, facilitating the recruitment of potential students, staff and researchers.

For many employers, access to *relevant competence* is the main barrier to development and economic growth. As the majority of students remain in their region of study after graduation, this is of importance from a regional perspective. Ensuring the education of students with specific skills has traditionally been an important motive for regional stakeholders to become involved in the development of HEIs. As a result, different initiatives have been taken to increase the collaboration between HEIs and regional stakeholders on the development and implementation of higher education programmes, e.g. through participation in education boards, problem-based learning and associate professorships. Competence, however, refers not only to higher education or research. Some of the HEIs in the case studies are engaged in broader processes to develop regional knowledge infrastructure even from the secondary school stage. Examples of this are the sharing of regional laboratories or machinery, and the invitation of teachers and potential students to different events. Other HEIs are actively supporting lifelong learning in the region, e.g. providing different types of vocational training or contact education for external actors.

In terms of *entrepreneurship*, HEIs are expected to play a supporting role, e.g. by developing an entrepreneurial culture among students, researchers and staff, providing support for commercialization and stimulating spin-offs. When we look at the case studies, most HEIs are keen to support entrepreneurship. As the activities are often supported by regional authorities, they tend to have a regional rather than a national perspective.

To investigate the employment impact of HEIs on regional entrepreneurship, the project made a pilot study of the entrepreneurial activity of graduates in the two Swedish case study counties; Stockholm and Värmland. In total, the impact of alumni-funded firms on employment in newly established firms in 2008 does not seem very impressive. In Stockholm County, alumni-founded firms represented approximately 6 per cent of all employment in newly founded firms. Approximately 923 people were employed by firms

founded by KTH alumni. This means that 91 per cent of all employees in KTH alumni-funded companies work in Stockholm County. In firms founded by alumni from Karlstad University, only 18 people (16 per cent) were employed in Värmland, whereas four times as many (78 people) were employed in Stockholm County. This indicates that the employment impact of graduate alumni-founded firms in Värmland was much lower than in Stockholm. One explanation may be that general growth opportunities were better in Stockholm, e.g. in terms of access to capital and qualified labour. An interesting observation is that three out of four alumni-founded firms began in the business services sectors, which still dominate the larger metropolitan areas. Since 2008, however, the University of Karlstad has become increasingly involved in stimulating entrepreneurship and innovation in the services sector, including health care.

The increased interest shown by national actors in supporting collaboration between HEIs and small and medium-sized enterprises (SME) is likely to have increased the regional focus of HEIs in the Nordic countries. Also, theories on knowledge spill-over, tacit knowledge and the importance of trust in development processes support the hypotheses of an important role of HEIs in *regional innovation and development processes*. In most case studies, research and innovation activities are undertaken in close collaboration with regional business, e.g. specific clusters or industry sectors. In most case study regions, research/competence centres, test laboratories or cluster initiatives have been developed to coordinate the collaboration between HEIs and other stakeholders. Focus is usually on regionally prioritized sectors, e.g. tourism, pulp and paper, or forestry. At the same time, there is an on-going discussion on balancing external expectations concerning education and research with academic freedom and the need for basic research.

Engaged and entrepreneurial universities

For the last 30 years, there has been research on the transition of traditional universities into so-called entrepreneurial universities. Much focus has been on understanding the role of university research in regional development and the outcome in terms of patents and research-based start-up companies. Over time, perspectives have broadened to include the impact of HEI education and collaboration in other areas than research. Most HEIs have developed different structures and measures for supporting entrepreneurship and innovation, often in a regional context. Organizational forms have varied, from externalized incubators and science parks to internalized liaison or innovation offices. Today, we can talk about engaged HEIs, which

collaborate with the surrounding society in various ways.

In several case studies, HEIs have had a strong role in regional development even from the beginning, with regional stakeholders taking an active role in the establishment process. During the last few years, even in the large metropolitan region of Stockholm, KTH has become increasingly involved in regional development. An internal process of competence development and close collaboration with authorities and other HEIs in the regions is expected to be of importance for future international competitiveness, both for KTH and for the Stockholm region. In Aalborg University, an elaborative collaboration structure has been developed, providing activities covering service to society (outreach) and purely commercial services (outcome). These are interesting examples of how an HEI can become increasingly engaged as a stakeholder in regional development processes.

It is, however, important to balance activities for regional development with support of collaboration at a national or international level. This can add to the regional knowledge base and reduce the risk of regional over-specialization and lock-in effects. Today, the EU Commission, in its strategy Europe 2020, has put the focus on smart, sustainable and inclusive growth. The concept of smart specialization could be interpreted as a new type of regional specialization in combination with diversification into related areas, regional collaboration and global outreach. In this process, HEIs may have an important role in the development of smart specialization strategies by providing regions with an inflow of knowledge from research and through national and international linkages.

Indirect impact

Apart from the functions of HEIs previously mentioned,

there can also be considerable indirect effects. Many are the outcome of a location effect, contributing to the *image and attractiveness* of a region for potential students, employers or investors. Access to relevant education or a concentration of competence is often an important motive for selecting a specific location. In such cases, an HEI, or at the local level a research centre, may have a strong impact on the image of a location.

One question that has been raised during the study concerns the *positive spill-over* of HEIs to more distant regions. The relevant region of an HEI may vary, depending on research topics and functions provided. As indicated earlier, Karlstad University exports students to the Stockholm region. In the short run, this may be negative for Karlstad, but positive for Stockholm. If, on the other hand, one of them moves back to Karlstad, he or she may bring new contacts and competences back to the region, which may be positive for both regions. It is also possible that an HEI will have an important impact on another region which lacks the specific education or research competence provided by the HEI.

There is also reason, however, to consider the possible *negative effects* of HEIs attracting students and graduates from other regions. In more peripheral regions, the percentage of young people entering higher education tends to be lower than in metropolitan areas. Instead, they enter the regional labour market at a younger age. This may, on the one hand, result in a low level of education and make it difficult for employers to find the relevant competence. On the other hand, it may mean that more young people will remain in the more peripheral regions. If they were to move to an HEI in the central municipality or in a larger city region there is a risk that they would not return. Today, this is partly a gender problem, with more females than males leaving rural areas for higher education in other regions.

How can HEIs support regional development?

In the previous study by Hedin (2009), a number of examples of how HEIs collaborate with the surrounding society were presented. In this study, focus has been on strategies, incentives and activities implemented by eight case study HEIs to stimulate collaboration and actively support regional development in different types of region. On the basis of the case studies, we have identified three possible mechanisms for increasing the potential of HEIs to support regional development; developing university strategies, taking an active part in regional partnerships and developing culture, attitudes and incentives.

Strategy development

In the Nordic countries, HEIs are expected to collaborate with the surrounding society and most HEIs have integrated strategies for collaboration into their overall strategy documents. Although the study does not claim to have made a complete inventory of strategy documents, there appear to be few specific strategies for regional collaboration and development. In most cases, collaboration is expected to take place at various levels, ranging from local to regional, national and international levels. The relevant level is highly dependent on the topics and functions provided by a

specific HEI.

Today, the ambition of supporting regional development is stated in several strategy documents or visions. There is still room, however, for clarification of the goals, strategies and visions of the role of HEIs in regional development. Introducing ambitions for regional collaboration and development in strategic documents gives an indication of the importance of these issues to HEI management. To ensure that the strategic plans of HEIs are supported by regional development strategies and business needs, these strategies should preferably be developed in dialogue with relevant stakeholders. There is also a need to develop internal systems for quality assessment and follow-up of strategic goals, to assess the impact of strategies on the regional activities of HEI and develop a basis for an on-going learning and development process.

Taking an active part in regional partnerships

Over the years, the process of knowledge creation and dissemination has received increased attention as an important driver of economic growth and innovation. The expectations of HEIs have shifted from production and dissemination of academic knowledge to being part of multidisciplinary knowledge creation in collaboration with other actors. New models for collaboration have been developed, including the concepts of clusters, innovation systems and triple helix. Successively, these models have evolved to include different types of actors in a complex process of knowledge creation and diffusion.

In most regions, HEIs have an important role in economic development, image and attraction of population (e.g. students, researchers and company employees). The case studies vary in terms of types of history, year of establishment and size between different HEIs. According to a previous overview of the historical development of HEIs in the Nordic countries by Hedin (2009), there is a distinction between HEIs founded before and after 1960, as the former are often located in metropolitan areas, while the latter are usually established outside of these areas. In this study, two HEIs were established in metropolitan areas pre-1960: the Royal Institute of Technology (KTH) in Stockholm and the University of Iceland in Reykjavik. At that time, neither of them had an explicit role in regional development, but rather a national mission to provide education and research. Most other HEIs in the case study were established post-1960 as part of national ambitions to support regional development and improve access to education nationwide. Many of them developed as university colleges or universities

of applied science and had a clearer role in regional development.

In the case studies, the levels of integration in regional development processes vary between different HEIs and over time. In several regions, forums for discussing regional development issues have developed. In Aalborg in Denmark and Nordland in Norway, representatives of HEI management participate in formal partnerships, i.e. the Regional Growth Forum of North Denmark and the Nordland Partnership. In the latter case, there are plans to extend the partnership to a *council for cooperation with the business community*, in accordance with national guidelines. In other cases, the collaboration is on a more informal basis, e.g. the support of HAMK for the development of regional strategies by Häme County and the on-going dialogue between Karlstad University, the public authority Region Värmland and the regional cluster organizations in Värmland County. Even in the large metropolitan region of Stockholm, collaboration between KTH and other regional actors has increased, e.g. their participation in several large EU structural fund projects in collaboration with public authorities and other HEIs in the region.

Developed culture, attitudes and incentives

An important factor influencing the propensity for external collaboration and participation in regional development is the internal culture, attitudes and incentives of HEI researchers and staff. Traditionally, the academic qualification system has been based on indicators such as citations and scientific publications, often from a disciplinary perspective. Participation in collaboration and regional development processes has often been relatively ad hoc, based on the personal interest and involvement of individuals rather than strategic considerations. There is also an on-going discussion on the lack of state funding for the 'third mission' of HEIs over the last decade. In the Nordic countries, basic HEI funding is provided for education and research, whereas funding for collaboration with external society is mainly funded by short-term projects with external actors.

Despite the lack of state funding being a barrier to collaboration, there are a number of positive effects of collaboration and regional development for HEIs and individual researchers and staff, e.g. a higher propensity to attract funding for applied research by collaborating with private companies, an extended contact network through partnership, and increased opportunities to attract students and researchers by providing problem-based learning and business contacts. Knowledge about these effects is sometimes limited, however. To stimulate

researchers and staff to engage in collaboration and regional development, HEI management has an important role. If the management clearly states that these are important activities, and they are supported by different measures and incentives, the general attitude of researchers and staff is likely to improve. Within the case studies, a number of different support measures applied by HEI management have been identified:

- increased mobility between academia and the private sector, e.g. industrial PhDs and associate professors
- tenure track systems for young professionals
- budget allocation according to collaboration performance
- development of new indicators for quality assessment
- support of applications for applied research in collaboration
- peer reviews and internal assessment exercises

It is important to note, however, that the academic qualification system and quality assessment indicators cannot be influenced by single actors at regional or national level. In some cases, HEIs have engaged in international collaboration to influence the development of these systems.

Implementing the knowledge triangle

The concept of the knowledge triangle has, so far, mainly been used by policy-makers in Sweden to address the need to integrate three important functions of HEIs; education, research and innovation. Previous studies of the entrepreneurial university and its role in regional development have often focused on patents and the establishment of new firms. The bulk of activities

provided by HEIs, however, are related to the provision of competence and future employees. As a result, it has been suggested that the potential role of students in collaborating with the surrounding society is not always fully utilized by HEIs.

In several of the case studies it was evident that students cooperate with private and public entities. Students therefore to some extent ensure knowledge transfer from the university to the surrounding society, and in turn they bring knowledge from their surroundings into the HEI. Examples of collaborative activities provided for firms and other organizations include:

- exam projects
- problem-based learning projects
- internships with firms and organizations

In Aalborg University and KTH, for example, matching activities have been integrated into HEI strategies in order to facilitate contacts and the transfer of knowledge between students/researchers and the surrounding society. Systems for keeping an overview of the firms and organizations which students have worked with, however, and the topics which have been studied there, are rarely in place. This type of collaboration with private and public actors has been found to strengthen the interaction between two elements of the knowledge triangle, education and research, but also potentially the third part of the triangle, that concerns innovation. Ensuring more synergies between the work of students and researchers at the HEIs, and focusing on strengthening cooperation with private and public organizations, may prove useful in terms of integrating research, education, and innovation even more in the future.

Implications for regional and national level policy measures

The case studies suggest that regional and national policy measures have had an impact on the development of various activities for collaboration and regional development of HEIs. It should be noted, however, that evaluations of the effectiveness of national and regional policy measures have not been studied or carried out within the framework of this project.

Regional partnerships

At a regional level, there are examples of how HEIs may be influenced by or participate in regional partnerships,

e.g. the ERDF partnerships in Sweden, Growth Fora in Denmark and the Nordland Partnership in Nordland County. In such partnerships, HEIs are involved to varying extents in the strategy development of regional authorities. Examples of policy measures which represent rather unique examples of regional support of HEIs have been developed through regional partnerships:

- the knowledge dissemination agreement between the Growth Forum of North Denmark and AAU,

which sets guidelines for how cooperation with the university should take place in relation to projects funded by the Growth Forum. The main purpose of the agreement is to ensure knowledge transfer from the university to firms in the region.

- the agreement on research collaboration, where ten professorships in regionally prioritized applied research areas, identified in a dialogue between KaU and regional cluster representatives, is co-funded by Region Värmland.

Creating an attractive region

Regional policy makers have an important role to play in developing an attractive region for students, faculty members and businesses. Availability and quality of housing and public services are some conditions influencing the overall quality of life in a region. Business support structures and a functioning labour market are important factors influencing regional business potentials. Overall, regional conditions may influence the ability of a region to attract students, researchers and skilled people in general, but also to retain students and researchers after graduation. Policy measures aimed at creating an attractive region may be of particular importance in more rural regions, which face a higher risk of losing young well-educated people.

Cluster strategies

As is evident in several of the case studies, HEIs are often involved in cluster initiatives that support regionally prioritized sectors, e.g. ICT, pulp and paper, or tourism. Such initiatives are in some cases funded by regional development funds, EU Structural Funds, or national level cluster programmes. Case studies indicate that cluster initiatives have facilitated collaboration between university researchers, firms and regional/local authorities. As part of such initiatives cluster

organizations or other types of mediating actors are often utilized as contact points through which connections between firms and relevant research environments can be established.

Public support towards cluster initiatives may take various forms, ranging from cluster branding and funding of regionally prioritised education and research areas, to investments in soft support structures and physical infrastructure, e.g. research laboratories and demonstration facilities. In many cases, public support may also increase cluster legitimacy and improve access to external funding.

Supporting cluster initiatives often requires a multi-sector policy perspective, integrating for example education and research policy with labour market, regional development and business development policies. Such strategies are often implemented at a regional level, but stimulating HEIs to perform the various roles defined above and become more engaged in regional development may require a similar coordination of different policy areas at a national level. It has, for example, been suggested that basic state funding for education and research by one ministry could be supplemented by funding of other functions by other ministries.

National programmes and measures matter

While keeping in mind that this project has not aimed at evaluating national programmes and measures, the case studies have provided indication that national level programmes, when they are in place, have had an influence on the opportunities of HEIs to strengthen collaboration with their surrounding society. The table below provides an overview of national programmes, measures, and co-funded institutions which have been utilized in the case studies within each of the Nordic countries.

Table 14: Examples of HEI participation in national measures or programmes

| Country | Measure or programme | Case study example |
|---------|---|---|
| Denmark | Regional Growth Forum (Government) Danish Agency for Science, Technology and Innovation | Growth Forum North Jutland The IT Innovation network INFINIT, coordinated by AAU |
| Iceland | Ministry of Education, Science and Culture | UI Regional Research Centres |
| Norway | Councils for cooperation with the business community 2011 (Ministry of Education and Research in Norway) ARENA and Norwegian Centres of Expertise Program (Innovation Norway, SIVA and Norwegian Research Council) VRI programme (Norwegian Research Council) SkatteFUNN (Norwegian Research Council) Centres for Research-Based Innovation, SFI (Research Council of Norway) | Project ARENA – Innovative Experiences in Nordland VRI tourism project run by Nordland Research Institute Knowledge Park Bodø (business community, Nordland County and SIVA) Tromsø Telemedicine Laboratory and MabCenter, hosted by UiT |
| Sweden | Regional ERDF-partnerships (Government) Innovation Offices (Government) VINN Excellence Centres and Key Actor Program (VINNOVA) Linné centres (Swedish Research Council) Other national competence centres (KKS, Swedish Energy Agency and Mistra) 24 Strategic Research Areas, SRA (Government/ Strategic Research Council) | ERDF partnerships in North Central Sweden and Stockholm KTH Innovation Offices and Fyrklövern Innovation Office 15 national Research Centres and Competence Centres at KTH KTH participating in 11 SRA |
| Finland | Centres of Excellence (Ministry of Education) AMK-TULI (Research to Business) and TULI programmes to stimulate commercialization and innovative start-ups (TEKES) Centre of Expertise Programme, OSKE (TEKES) | HAMK was named a Centre of Excellence in Regional Development and Centre of Excellence in Education. LUT was named a Centre of Excellence in Education Häme has a Regional Centre of Expertise |

Various national cluster programmes and programmes for ‘excellence’ environments are in place, for example, in Norway, Sweden and Finland. Such programmes - as well as regional level initiatives - are usually project-based, which is an issue that has been brought up in several of the case studies. It is difficult to establish longer-term strategies for triple-helix collaboration initiatives, since the funding opportunities are usually for a limited period after which the further development of project initiatives is uncertain.

The SkatteFUNN initiative which has existed in Norway since 2002 has not been introduced in a similar form in any of the other Nordic countries. SkatteFUNN is a tax scheme that allows firms to apply for tax reductions of up to 20 per cent to cover the costs of R&D activities. The potential of such tax incentives may be worth exploring further. In connection with this and more generally, the Nordic countries may benefit from a

more systematic exchange of experiences on the areas of education, research and innovation policy.

Other examples of interesting activities in support of collaborations between HEIs and other sectors are various types of human mobility and work placement projects. Such initiatives have also been stimulated at a European level, e.g. through the Marie Curie (People) programme.

Clarifying the two-tier system

In Norway, Sweden and Finland, there is a two-tiered system, with universities and university colleges. In Norway and Sweden, the different roles and characteristics have become increasingly blurred. During the last decade, many university colleges have applied for and received university status, e.g. Karlstad University and the University of Nordland (formerly Bodø

University College). During the process of applying for university status, focus tends to shift towards traditional academic qualifications and broadening the scientific research base. As a consequence of these discussions, regional collaboration and development may have become less explicit among some HEIs.

There is an on-going debate as to whether the number of university colleges should be reduced in order to increase specialization, create a critical mass in education and research and improve the quality of the functions performed. As a result, many HEIs have initiated different types of collaboration with other HEIs, nationally and internationally. In some cases, this has even resulted in formal mergers. In Denmark, a national consolidation process was initiated in 2007, when 12 universities and 13 governmental research institutions were merged into eight universities and four research institutes. On the basis of this study, however, there is reason to believe that there is a need for different types of HEI, with different roles and providing different functions depending on the type of region, and that collaboration between HEIs should be supported.

Nordic collaboration on quality assessment and international ranking

In most Nordic countries, systems for assessing quality of education and research have been implemented. Quality assessment of the third mission and follow-ups of activities indicating an increased engagement in collaboration and regional development have started

to evolve, but to a lesser extent. Some indicators for measuring collaboration are available in national statistics, whereas others have to be compiled by the HEIs. The Swedish Agency for Higher Education, for example, has presented potential indicators for follow-up of collaboration supporting democracy (e.g. information about research to the broader society), knowledge development and growth (including participation in innovation systems) and better education (e.g. business dialogues on education programmes and student collaborations).

With the present quality assessment systems, there is a risk of over-emphasizing traditional scientific indicators in favour of traditional universities while neglecting the importance of collaboration and regional development. There may be reason to consider a two-tier quality assessment system, giving higher priority to collaboration and regional development. This could stimulate an increased balance between excellence and collaboration among traditional universities without neglecting new universities and university colleges with a regional mission.

Overall, there appears to be ample room for development of new indicators to be used as a basis for resource distribution and academic qualifications. It is, however, difficult for a single HEI or nation to influence systems of academic evaluation and qualification. Through collaboration on the development of indicators and participating in the international debate, Nordic countries may have better opportunities to do so, however.

Future research

Despite the limited scope of the project compared with the far-reaching theme of the research question addressed, several important conclusions can be drawn that merit further scrutiny. There should be little doubt that HEIs have a role to play in regional development but the roles assumed not only differ between institutions but are also partly determined by local or regional conditions. The variety of programmes documented in this report for eight case studies alone is rather telling. Although HEIs may, in theory, pursue their two main roles (education and scientific research) practically independently, acting upon the third one, that of collaborating with the surrounding society, places the HEIs in a multi-actor system. Several constructs have been put forward to describe these systems (e.g. the triple helix and the knowledge triangle) but one thing that is clear is that our understanding of these systems is still immature.

For one thing, it is important to understand that HEIs are moving away from the 'ivory tower' archetype and as part of regional innovation systems they not only affect their environment in new ways but are simultaneously opening up to more external influence from the other actors in the systems. This adds a significant degree of complexity as it is no longer enough to base evaluations of HEIs on fundamental indicators such as the number of students, staff size and scientific publications. Further research is needed for better understanding, documentation, measurement and evaluation of the efficiency, quality and success rate concerning the new roles which HEIs are assuming, e.g. the inter-relations between the different actors in regional innovation systems and the local or regional conditions' impact on such relationships.

The Nordic regions are at the forefront in terms of collecting socio-economic indicators yet

little information exists on the issues brought up in this report that would allow cross-national and cross-regional comparisons. We believe these are important avenues that need to be explored further.

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Appendix 1. Methodology discussion

In Sweden all higher education credits and degrees earned are catalogued in a national electronic system named LADOK. Matching the information in LADOK to individual level socioeconomic micro-data allows comparison of the migration and employment patterns of the entire Swedish labour force with their education history. Such innovations in the management and commercialization of census data open up the possibility of novel in-depth studies but a series of shortcomings need to be mentioned.

first and foremost secrecy issues impose strict accessibility limitations. It is only researchers affiliated with a Swedish institution who have the right to purchase access to the data (at very high cost). Similar requirements are in place in the rest of the Nordic countries that gather and commercialize comparable data, making any effort at transnational comparison extremely demanding in terms of both costs and logistics.

securing data access is only the first milestone. Census data contain several million observations per year and carrying out meaningful analyses requires a certain degree of familiarity with the material and with database management tools, which is very time consuming. In this case the expertise was provided for by the subcontracting team.

furthermore, perfect information of the type found in census data makes it possible to examine

virtually all aspects of certain phenomena and careful research design is required in order to construct and address meaningful and manageable tasks.

Apart from these, mainly technical, issues, the data themselves have several limitations that are relevant for the analysis carried out in this pilot study. First of all, merging data from LADOK with employment data requires the participation of the individuals in the labour market. Graduates who are either unemployed or choose not to participate in the labour market are not included in the particular dataset. Three more groups of university graduates, each of particular interest in their own right, are under-represented either because of missing variables or because they are not part of the database. These are Swedish nationals who have studied abroad before coming back to Sweden to work, Swedish nationals who have studied in Sweden but then moved abroad for work, and non-Swedish nationals who have attended a Swedish HEI and then either stayed in or left the country. The first two of these groups can mostly be considered as exceptions to the rule. The third group, that of internationally mobile students, is becoming increasingly important, however, but delays and/or difficulties that international students face in acquiring Swedish social security numbers mean that they are not perfectly captured in census data and a more targeted data-gathering process is required for properly addressing the behaviour of these graduates.



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