

Tura, Tomi; Uotila, Tuomo

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Rethinking the Roles of Universities and Polytechnics in a Regional Innovation Environment

Tomi Tura ¹ and Tuomo Uotila ²

Abstract

The paper discusses the case of Finnish higher education organisations (HEO's) – universities and polytechnics – in re-defining their roles in regional development and especially in the regional innovation environment. The third task of universities, together with the regional relevance of polytechnics, has been a central topic in current regional and educational policies. The Finnish system of higher education and research is highly decentralised, including more than 50 non-independent regional university units, most of them founded in order to enhance the regional effectiveness of universities. In the paper, it is argued that the roles of these units as actors in a regional innovation environment differ significantly from the “official” understanding of the HEO's regional role.

In order to understand the changing relationship between HEO's and regions, four theoretical dimensions defining the HEO's relationship to the regional innovation environment are developed. As a case study, three innovation-supporting units within polytechnics and universities located in a non-university region will be analysed with these dimensions. The paper presents some preliminary remarks on the case study.

Key words

Universities, Polytechnics, Non-university regions, Regional effectiveness, Regional innovation environment

¹ University of Helsinki, Department of Social Policy; tomi.tura@helsinki.fi

² Helsinki University of Technology, Lahti Center; tuomo.uotila@hut.fi

Introduction

In Finland, as elsewhere in Europe, the universities are expected to play a more active role in the societal, and especially in the regional, development. The expectations towards the third task of universities are focused on their roles in developing economic life and innovative activity. At the same time, the regional development policy is increasingly built around the idea of universities being the central factor in building the competitive advantage in the regions of success in the present post-industrial society, based on knowledge and expertise. The maintenance and strengthening of innovativeness and innovative capability has become a central precondition for the success and competitive advantage of the regions.

The notion of the critical role of the higher education organisations (HEO's) in the development of regions and their innovative capabilities has strengthened the need to increase the higher-level education and research also in the regions with no university (non-university region). Typically, the discourse related to the innovation environment and the relationships between the university and the region has focused on the regions where the university naturally has a central role as the source of knowledge and innovations. However, promoting the innovative capability of the non-university regions presents a remarkable challenge to the development of competitive advantage in Europe.

In about the last two decades the system of the higher education in Finland has expanded remarkably to those regions outside the primary university network, by establishing the non-independent regional university units; the branch units. This third decentralisation forms an interesting special case about the formation and change of the regional role of the universities. It is interesting not only because of the role of the branch offices "between" the universities and regions performing the third task, but also because of their locations in the regions where the field of higher education is constructed very differently from the university regions. This applies, in particular, to the relationship between the universities and the polytechnics, which is the second pillar of the Finnish system of higher education. Thus, the relationship between the universities and the polytechnics is one of the most central issues in building the innovation environment in these regions.

The aim of this paper is to understand how the role of the HEO's, as part of the regional innovation environment, is formed in a situation where the region is lacking a university of its own. In the paper, the regional effect mechanisms of the HEO's are studied through four central perspectives or dimensions. The study is based on the discussion on the changing role of the HEO's in society, on the one hand, and on the research of the regional innovation environments and industrial districts, on the other.

In the paper, two Finnish non-university regions, Lahti and Hämeenlinna, are examined through the four dimensions. Illustrating the nature of these regions, three higher education units, operating in these regions and focusing on the development of innovation activities in the region, are briefly presented. With the preliminary analysis of the data, the special characteristics dealing with the role of the HEO's in the non-university regions are outlined. In the paper, it is argued that there are remarkable differences between the university and non-university regions in the nature of interaction between an HEO and a region, in the functional time span of the HEO's and in the division of labour between the universities and polytechnics.

Finnish system of higher education and its changes

The Finnish system of higher education consists of 21 universities, and can be considered rather decentralised in relation to the population (about 5.2 million) in the international context. If the 29 polytechnics are taken into account, no fewer than 50 educational institutions provide education leading to higher-level degree. The university system was formed almost in its entirety during the twentieth century. At the beginning of the century the University of Helsinki had been the only one for over 250 years; at the end of the century, the system was in its current most extended form.

In the formation of the university system, two central phases of change can be distinguished. They can be called *the first* and *the second decentralisation* of the university system, also reflecting the change of the relationships between the universities and the regions surrounding them. The first decentralisation, contributing to the establishment of the first new universities and the “professional” HEO’s – the universities of technology and commerce in their present form – took place at the first third of the century, mainly in the 1910s and 1920s. It was formed strongly as a part of the building of a new nation just becoming independent, and had its background in the factors relating to the national identity and language policy. (Ahola 1995, 60.) The higher education policy was mainly an internal issue of the HEO’s, and expanding the system was a result of various separate development paths rather than a coherent direction of the state (Kivinen *et al.* 1993). The second decentralisation started at the turn of the 1950s and 1960s and was concluded by 1980. Because of this decentralisation, the provincial universities were formed, and the system was expanded to its present form. The reasoning behind the process highlighted the strong role of the universities as supporters of the cultural life and equal opportunities of education (Ahola 1995, 70). Thus, the second decentralisation was essentially a part of the development of regional policy. Higher education got a more evident social role as a provider of the highest professional training and as a regional actor. In the second decentralisation, higher education became part of the coherent national planning system and the public educational system.

The phenomenon here called *the third decentralisation of the university system* has almost been neglected in research and in the public discourse of the Finnish higher education. This series of events took place mainly in the 1980s and 1990s when approximately 50 non-independent regional university units were established. The non-independent regional university units are the branch units of the existing independent universities, differing significantly from each other as regards to their operating and administrative status. Most of the branch units were founded to execute the continuing education of the universities, the Open University education and the various regional research and development projects. The background of the establishment of the branch units lies in the aims of the non-university regions – and especially the larger cities without university – to access the benefits brought by the universities. For the universities, the main issue, especially in the initial stage, was above all to expand their recruitment area and their scope of regional effectiveness. The third decentralisation was a regional process where the aims and forms were strongly defined based on the needs and industrial structure of the regions. Although the general role of the universities as the cultural dynamo of the region was recognised, the branch units were above all the promoters of the competitiveness of the regions and the developers of the firms and public organisations.

This task was performed through various regionally defined services of education, research and development.

The development of the regional university functions has not gone through unchallenged. In particular, there has been discussion of the expediency of the decentralisation of the basic functions of the university because of regional policy reasons. Establishing new units or relocating activities has been constructed in an interesting way in the interaction with the regional hopes and needs, the existing knowledge structure and the interests of the university. (See eg. Kautonen & Sotarauta 1999; Sotarauta & Kautonen 2003; Clark 1998.) The branch units form an interesting case about building the regional role of the university, and it can be argued that the change in the relationships between the universities and regions is hard to understand if the branch units are ignored. This is related not only to their special task between the universities and the regions, but also to their location in the regions, where the field of higher education is structured remarkably differently from the university regions. In particular, this relates to the relationship between the universities and the second pillar of the higher education system: the polytechnics.

Higher education in Finland is carried out by a dual model, where the first pillar consists of the universities and the second of the polytechnics. The starting point of the reform of the polytechnics was the increasing need for highly educated experts in working life. This task was given particularly to the polytechnics, whereas the universities were assumed to concentrate on scientific research and education. The aim is that both sectors could focus on their strong areas of expertise, but they are also expected to look for such forms of co-operation that facilitate the individual tasks of the sectors. One starting point for the reform was the objective of the Finnish Ministry of Education according to which two thirds of each age group should take a high level degree. The restructuring process was started in the 1980s in Finland, but was primarily implemented in the 1990s. During the reform process foreign experiences, especially Germany and the Netherlands have also been benchmarked. (Raivola *et al* 2001).

There have been great expectations for the polytechnics, and especially outside the university regions the polytechnics are required to function as powerful engines of regional development. An expression of this is the stronger research and development function alongside the previous education function, given in the 2003 law enacted for the polytechnics (Marttila *et al* 2004). According to Kinnunen (2002, 44) the research done in the polytechnics can be seen as research and development work that is applied and practical in nature and supports the educational task of the polytechnics. The research and development tasks mean applied research or other development work of the professional field mainly carried out in the workplace.

Because of the above-described development processes, regions with quite peculiar characteristics as regards the development of the system of higher education have been developed in Finland. In these regions, there are polytechnics with the regional task as their central role, as well as branch units of the universities that have been developed particularly to perform the regional task of the universities. In this situation, it is justified to ask how the division of duties between the universities and the polytechnics is arranged in reality.

The changing role of the HEO's in a regional innovation environment

Though the societal service function has been included in the history of higher education as closely as teaching and research, the discussion about the interaction between the HEO's and the rest of society in recent decades reflects something interesting about the changes in the roles of the HEO's. The discussion is connected to the idea that this interaction is worthy of and demands special attention and an active contribution from the HEO's. The mere fact that the HEO's are educating "civil servants for the crown and church", that they produce relevant knowledge for societal purposes or that the researchers and teachers of HEO's are acting as active members of society seems not to fulfil the expectations placed on the HEO's as the servants of society. Overall, the HEO's are expected to carry out such structural and operational changes, which aid in strengthening their role as developers of economic life and innovation activities. One still has to bear in mind that though the concept of the third task of the HEO's with its many extensions was already a matter of public discussion some years ago, the process of creating procedures and cultures to carry out this mission is just starting (Koskenlinna 2004, 4).

This development has been especially interesting when considering the regional role of the higher education organisations: how the HEO's are acting as developers of the individual regions. The regional development policy during the last fifteen or twenty years has been built on the idea that the HEO's are a crucial factor in building a competitive advantage for successful regions in the present post-industrial society, where success is based on knowledge and expertise. At the same time, the maintenance and strengthening of innovativeness and innovative capability has become a central element in creating a regional competitive advantage, which is also considered to underline the importance of the presence of strong research institutions – universities, polytechnics, etc – in the region. This changing nature of the regional competitive advantage and the role of the HEO's in it has been analysed in the framework of concepts such as regional innovation system, learning regions and innovative milieus. (For discussion, see e.g. Dosi 1988; Camagni 1991; Florida 1995; de la Mothe & Paquet 1998; Edquist & McKElvey 2000; Cooke *et al.* 2004; Harmaakorpi 2004.)

At the same time, the HEO's have been pushed, both for financial and strategic reasons, and more or less willingly, towards paying more attention to the societal and regional effects of their activities. There has already been a long discussion whether this change is of a fundamental nature, changing the whole structures of the system of higher education, or is it only a minor diversification for the new areas of higher education activities (see Etzkowitz *et al.* 1998; Etzkowitz & Leydesdorff 1995; Nowotny *et al.* 2001). In Finland, this discourse is of current interest just now, when both in legislation and in evaluation of the HEO activities the interaction of regions and the HEO's is brought up (Dahllöf *et al.* 1998; Goddard *et al.* 2000; Kinnunen 2001). One major intention behind the new legislation concerning universities is the idea of universities playing a growing role in the development of a national and international innovation system, as well as in developing regional innovation activities (Nieminen 2004, 15-16; Lemola 2004, 115). According to Virtanen (2002, 21, 75) it is not a coincidence and not just a Finnish phenomenon that the HEO's societal role, and especially the regional component of it, has strengthened considerably during the 1990s. The regional commitment is no longer an alternative, less important strategic option in a way to national and international success and fame.

Finnish polytechnics are also defined to have three central tasks: education, research and development and regional development. These tasks are to some degree overlapping and complementary, since the task of regional development is mainly realised through education, research and development. The importance of research and development in polytechnics has grown in recent years; the new law concerning polytechnics, established in 2003, emphasises the importance of R&D activities, whilst earlier they were rather considered optional, non-obligatory duties of polytechnics. Research in polytechnics is mostly applied in nature, aiming to provide solutions to the practical problems in everyday work life. The development work carried out in polytechnics aims to lead to new products and services, methods, processes and competencies.

However, one cannot explain the success of some regions over others just by the presence of the HEO's. It seems that the regional success depends on neither the size of the HEO's nor on their scientific quality alone. There are many examples of the small HEO's that have been able to contribute remarkably to the wellbeing of their environment, and vice versa (see Maskell 2001; Varga 2000; Andersson et al. 2004.) The regional effectiveness of the HEO's seems to depend as much on the mediation and transfer mechanisms between a HEO and its surrounding region as on the presence of the HEO and how it carries out its basic activities. This observation has raised the question of the role of the HEO as part of the regional innovation environment.

Innovations seldom take place in a one-dimensional process, leading systematically from the basic research towards an end user of innovation. Rather, they are typically brought up because of multi-actor and multidimensional processes, being incremental social, organisational and institutional improvements in operational procedures rather than radical leaps in technical products and processes. Along with scientific research, the generation of innovations crucially depends on the ability of actors to collaborate, to learn collectively and to create a trustful and creative atmosphere amongst the actors participating in the innovation process.

The social and non-linear nature of innovations emphasises the importance of institutional structures and procedures as a central element in regional innovative capability. The concept of a regional innovation environment is intended to characterise these structures and procedures. Regional innovative capability can be defined as the ability of a regional innovation environment to exploit and renew regional resource configurations to create a sustainable competitive advantage by innovation activities (Harmaakorpi 2004; cf. Teece & Pisano 1998).

The concept of a regional innovation environment stresses the importance, not only of the strong scientific base, but also of creating a regionally and inter-regionally networked environment promoting the structures of technology and knowledge transfer. This is even more important in the regions lacking major research resources. The characteristics of the regions greatly affect the model of innovation policy applied. The meaning of the concept of "good innovation environment" can differ remarkably depending on whether the region has a strong research base (e.g. its own university or polytechnic), whether it is connected or networked with research institutions situating elsewhere (e.g. through regional university branch units), or whether it has to build its innovative capability without these.

Kautonen *et al.* (2002, 196-198) have categorised regional innovation policies in two classes, one called the Technopolis model and the other called the Learning Economy model. The Technopolis model refers to an innovation policy mainly concentrating on certain high tech and knowledge intensive industries, on the scientific specialisation on chosen research areas, and on the commercialisation of the technology developed in order to maintain international competitiveness. The Technopolis model assumes that there is a strong scientific and technology base in a region and that the aim is to create technological breakthroughs at an international level. Understandably, universities play a major role as sources of innovation activity in the Technopolis model. (Kolehmainen *et al.* 2002, 5-6; see also Gibson & Stiles 2000.)

In the Learning Economy model, innovation activities are approached from a wider perspective, where innovation policy aims to build up a basis for regional competitiveness by taking care of learning between regions and different industries. The targets of innovation policy are not only high technology companies or companies in knowledge intensive industries, but also the companies in the more traditional industries and the service sector (see Foray & Lundvall 1996; Lundvall 1999). The innovation policy based on the Learning Economy model tends to reach as many companies in the region as possible. The model is based on the idea of continuous learning and development as the basis for innovation activities and it stresses the interactive and multi-directional nature of the innovation processes. In the Learning Economy model the role of the universities is less critical than in the Technopolis model. Their role is also more focused on creating conditions for sustainable competitive advantage than just on the commercialisation of the results of the research activity. (Kolehmainen *et al.* 2002, 6.)

Regional branch units as third task units

The intensifying connection between the universities and regional development has also implied institutional arrangements in order to transmit university-level research and education to the regions. Although the universities increasingly underline that the active involvement in societal and regional development belongs to the whole university, not just to its individual parts, in practice they have founded several units specialised to carry out this function. Typical examples of these are the centres of continuing education, the institutes for applied research and different technology transfer and innovation support actors, either inside universities or, in the case of science parks and technology centres, outside them. These institutional arrangements can be called *the third task units (TTU's)*. They are organisations or parts of the organisations, whose primary function is to strengthen the societal effectiveness of universities and execute its service activities.

The TTU's have been studied quite variably. For example, science parks and technology centres have attracted rather extensive attention. (See e.g. Castells & Hall 1994; Saxenian 1994; in Finland e.g. Pelkonen 2003; Lautanen & Saukkonen 2003; Jauhiainen *et al.* 2004). On the other hand, research on the TTU's inside universities is limited and partly outdated in general and almost non-existent when it comes to their regional role.

The TTU's can be placed within a wider group of organisations acting between producers and utilisers of knowledge, called *mediating organisations* by Koskenlinna (2004, 8-36). According to Koskenlinna's definition, "mediating organisations support innovation processes by offering and transmitting expertise to the performance of the innovation processes. They make activities of the innovation environment more efficient and affect the functioning and productivity of the innovation processes". They fix market and systemic failures of an innovation process, and thus play an important role in innovation-based growth of productivity. Koskenlinna includes several different types of organisations in the concept of a mediating organisation. According to Koskenlinna (2004, 6-7), the evaluative information on mediating organisations is rare and there is no comprehensive understanding of their results and effects.

The regional branch units founded during the third decentralisation of the Finnish university system can be interpreted, with a few exceptions, as TTU's. As described above, their background is deeply in executing universities' regional development function and in answering to the needs of a region. Adult education and applied R&D projects play a central part in their activities. Even when carrying out the basic functions of university, their activities are typically strongly affected by regional emphases and expectations. They are also often largely dependent on regional funding, and local actors may play a substantial role in their guidance and decision-making. It can be argued that the regions are typically "closer" to the universities than they are in the regions with their own, independent universities. Moreover, the regional role of the branch units is shaped by their relatively small size: they are not such large, employing and investing actors in the regional economy as the universities. Due to this lack of "automatic" regional effectiveness, they have to build their effect mechanisms by some other means.

The operational preconditions of the branch units are also affected by the fact that while they are in many ways tied to the regional purposes and needs, they are also integral parts of their own parent universities. These universities, for one, differ in their attitudes towards regional service activities. Every university has its own kind of strategy or portfolio of regional effectiveness.

There are at least four defining features of the regional branch units as TTU's. First, an important part of their activities has been such consultative regional development that lies outside the primary basic functions of a university. Second, they have always been strongly integrated with their surrounding regions in their substantial focus, ways of action and finance. Third, there has been a strong emphasis on the development of local business and enterprise activity. This has meant that the wider cultural and societal functions of universities have not been particularly important in these branch units.

Fourth, during the last decade they have had to re-define their place in a regional development environment. One reason for this has been the rise of the so-called new regional policy that outstandingly emphasised the role of universities in regional development. The other is that the EU's structural funds offered a new instrument for funding, which caused a major shift from the privately funded service activity to project funding, as well as a radical growth of R&D activities. The third important change affecting this need for re-definition was the birth of the system of polytechnics. Polytechnics were built at least partly to fill that same hole between the producers and users of knowledge that was a principal reason for founding the university branch units. This functional parallelism was emphasised in the beginning of the 2000s, when the field of

action of the polytechnics started to expand from basic education to the regional R&D activity. Inevitably, universities and polytechnics have met each other in this field, and been forced to solve the question of their co-operation and division of labour.

According to Koskenlinna (2004, 5), there are some good experiences on co-operation and division of labour between universities and polytechnics in local technology transfer, but this cannot be generalised to the whole system of higher education. With the developments described above, the questions of co-operation and division of labour should be locally clarified. It seems that there is competition for scarce resources especially in small university regions, which might weaken both parties as well as the efficiency of the local innovation system. (Koskenlinna 2004, 44-45).

The role of the branch units in the regional innovation environment and innovation policy differs interestingly from that of the parent universities. From the point of view of the latter, the targets and roles of the universities in innovation activities are primarily connected to the production of new, high-level knowledge. Accordingly, their own inputs to the promotion of innovations mainly concern the supporting activities of the commercialisation of research. The universities' innovation services are usually meant to support their own personnel, for example, in patenting and in new start-up business.

The innovation policy of non-university regions is typically closer to the Learning Economy policy model described above than to the Technopolis model firmly tied to the basic research. The role of strong research organisations and the scientific community in the innovation activities of such regions is basically less critical than in the university regions based on the Technopolis model. It is possible, in principle at least, to build up an innovation environment entirely without a contribution from the universities; for example, with a polytechnic investing in extensive and high level R&D-activity. The research-intensive parts of innovation activities often have to find the knowledge and expertise outside the region, anyway.

Thus, while the regional branch units are in their mission and ways of action closely connected to the regional innovation activities, they lack such an automatic place in the innovation environment usually "reserved" for the universities. They have to construct their role by taking into account this characteristic. Paradoxically, the lack of this automatic role precisely emphasises the importance of the physical and cultural closeness of the university units to the region. Their role in a local innovation environment depends greatly on their ability to play a central role in enhancing regional innovation processes and opening doors to the wider scientific community. This implies that their innovation supporting activities are more targeted towards the development of the surrounding innovation environment than towards enhancing the commercialisation of the university-based innovations.

Relation of HEO's and regions: four perspectives

The institutional environment of the HEO's in the non-university regions is thus based on a quite different model than in the university regions. This environment, for one, affects the way the HEO's place themselves

as regional actors and developers of the local innovation environment. These effects can be approached from at least four perspectives or dimensions:

- from the perspective of the nature and level of the interaction processes between a HEO and a region;
- from the perspective of the temporal orientation of the HEO's towards their role in regional development;
- from the perspective of the HEO's self-understanding of their primary regional effect mechanisms; and
- from the perspective of the internal structure of the regional system of higher education.

In the following sections, we will approach the higher education organisations in the non-university regions through these four dimensions. We will develop a preliminary theoretical analysis on the possibilities achievable for the HEO's in their relation with regional innovation environment. We will also make some preliminary remarks based on the examination of two non-university regions, illustrated by three case studies, on the ways the regional effectiveness of the HEO's is built in the non-university regions.

1. Nature of interaction processes

One of the most influential discussions concerning the changing role of the HEO's has aimed to understand how the HEO's and their environment act in increasingly integrated and combined ways. There are several interesting, and partly overlapping, analyses of this development. The basic idea behind these is that the ways of action of both the HEO's and their environment are changing towards closer substantial and practical connections with each other. Perhaps the best-known analysis of this process is the triple helix hypothesis (e.g. Etzkowitz & Leydesdorff 1995; Etzkowitz *et al.* 1998) and the discussion on two modes of knowledge production (Gibbons *et al.* 1994). There are also interesting analyses of the ways the HEO's adopt such entrepreneurial models that affect both the internal organisation of the HEO's and their relationships with their environment (e.g. Clark 1998; Marginson & Considine 2000).

It is questionable whether these developments can be generalised to the whole system of higher education; rather it seems that there are crucial differences between disciplines and scientific cultures, and even between the research groups (see e.g. Tuunainen 2004). Thus, it is reasonable to ask whether such a change can be identified when looking specifically at the non-university regions and the HEO-region relationships within them.

In order to answer this question we will approach the integration of the HEO's and their surrounding regions by developing a conceptual distinction of the nature of interaction processes between an HEO and a region. We will apply here a pair of concepts familiar from the discussion on innovations. We will call the different types of interaction between the HEO's and the regions *linear* and *non-linear* relations. This distinction concerns the way the practical relationship between an HEO and a region is understood and organised: what kind of interactions are considered primary and natural for this relationship. The crucial difference between the linear and non-linear models lies thus not in the internal organisation of the HEO's (as in some other accounts like Gibbons *et al.* 1994 or Clark 1998), but in the way they interact with their regional environment.

In the linear model, the direction of the information flows and other contributions is, from the HEO's viewpoint, *primarily* from the HEO to the region. This does not mean that they are *unidirectional*, that is, there

were no information flows to the opposite direction. Rather, the linear model emphasises the conceptual and practical *separation* of these different flows: there are flows from the region to the HEO, but they are only indirectly connected to the flows from the HEO to the region. In the end, the HEO defines, based on its own purposes and ways of action, how it responds to the former flows. This model can be illustrated by the following sentence: “[the] university listens and takes into account the needs and expectations of the region”. Thus, the HEO and the region form two fundamentally separate “worlds” with their own purposes and needs. Interaction between them is, accordingly, a reconciliation process of these separate interests.

The non-linear model refers to the type of interaction between an HEO and a region where the separate worlds of the linear model collapse. The flows of information are *multidirectional* in the strong sense of the word, that is, there are not just flows going in both directions but also flows that are multidirectional *at the same time*. The crucial difference of the non-linear model compared to the linear model is that in the former, separate interaction processes of the latter turn into processes where an HEO and a region are understood as more or less integrated frameworks with at least some level of conjoining in their purposes and ways of action. The definitions of the needs of the region and of the purposes of the HEO are not two separate events.

The conception of an HEO and a region as separate or integrated worlds comes close to the idea of Etzkowitz & Leydesdorff (2000) on three kinds of triple helices, differing on the level of integration between universities, industry and government. The Triple Helix model III is closest to what we call here the non-linear type of interaction. However, we stress again that our analysis is not an empirical description about the state of the whole system of higher education, nor is it a prescriptive statement about the desirable future of it. It is a conceptual distinction to be applied in the analysis of certain concrete forms of the HEO-region relationship.

2. *Temporal orientation*

Closely connected to the former distinction is another one that focuses on the *temporal* dimension of the HEO-region interaction. When the focus and purposes of the HEO's have increasingly come closer to the entrepreneurial models, the demands for short-term results and achievements and rapidly achievable services have increased significantly. This is quite a familiar topic in political discussion on the changing role of the HEO's, and often connected to the serious concerns about the faith of the long-term basic research and education. On the other hand, it has also been stressed that the HEO's have to be able to react to the rapidly changing problems and challenges of modern society. These short-term and long-term purposes may not be easily matched.

However, despite the familiarity of this general discussion, the temporal orientation has only rarely been taken seriously when analysing theoretically the relationship between the HEO's and their environment. It is hard to find relevant conceptual tools for understanding this dimension: how is the HEO-region interaction temporally focused in relation to the needs and purposes of both sides. What is the time perspective for the regional expectations towards the HEO's?

We are unable to develop this question thoroughly within this paper. However, in order to take account of the temporal dimension at least preliminarily, we will apply a simple distinction between the HEO's *reactive* vs. *proactive* orientation towards their regional effectiveness. By reactive orientation, we refer to the HEO's emphasis of short-term applications and services, where the primary form of interaction is to answer to the needs of the region. Thus, the regional relevance of a HEO comes from its ability to respond to the problems of the present or near future. In contrast, the proactive orientation refers to the idea that the HEO's regional relevance comes from its ability to transcend the present challenges and anticipate future developments. Thus, it is precisely the way the HEO does *not* focus on current solutions that makes it relevant in the long run.

In Finland, it is generally interpreted that the primary function of the polytechnics is to react to the short-term needs of a region, while the universities are expected to concentrate on such proactive research and education that will be regionally relevant only in the long term. However, as the discussion above in Sections 2-4 suggested, and as we will try to argue later, this is an oversimplification.

3. Primary effect mechanism

The distinction between the linear and non-linear interaction is, as a general idea, well discussed and specified in several theoretical contributions. However, we argue that there is another, related distinction that has been largely neglected in the scientific discussion. It relates to the different kinds of *regional effect mechanisms* available for the HEO's. The idea of effect mechanisms is based on the realist theory of causality (e.g. Harré & Madden 1975; Cartwright 1989) and its applications to the study of social mechanisms (e.g. Bhaskar 1989; Little 1993; Lawson 1997; Hedström & Swedberg 1998; Tura 1999). In this context, the concept of regional effect mechanisms refers to the causal mechanisms explicating the ways the HEO's may contribute to the development of a region. The questions this idea poses are of the following type: Why should an HEO be located in a region? What is it that makes it regionally effective and relevant?

We will approach these questions by borrowing from an analysis of Storper (1995) about the traded and untraded interdependencies between a firm and its environment. According to Storper, these interdependencies are the central explanatory mechanisms for the process where actors of, for example, a certain sector of industry locate themselves close to each other thus forming a regional agglomeration. *Traded interdependencies* refer to the dependencies of the firm on the availability of raw materials, capital, technologies, subcontractors and markets. Agglomeration enables a firm to decrease its direct transaction costs by providing for specialisation, concentration and efficient division of labour within the agglomeration. Traded interdependencies partly explain the rationality of the local agglomeration in the context of disintegration and externalisation of the firms' operations.

However, Storper (1995) argues that the agglomeration is not just a way to cope with the changing industrial dynamics, but also a *source* of it. Agglomerations also produce and advance the development of knowledge and technology. The reason for this is the path-dependent nature of regional development: it goes along the so-called technological trajectories accumulating in the course of time. Therefore, the firms are tied to several informal local interconnections that make the accumulation possible. These interconnections may

include common values, norms and language, as well as common practices and rules of action. These interconnections Storper calls *untraded interdependencies*. Untraded interdependencies decrease the indirect transaction costs by enabling more efficient co-operative behaviour.

We believe that applying Storper's analysis would shed light on the understanding of the regional effectiveness of the HEO's. Accordingly, we will call the two main types of the regional effect mechanisms *traded* and *untraded effect mechanisms*. As above, traded effects are an answer to the direct transaction costs: by bringing knowledge, education and services close to the partners and customers (students, firms etc.) the HEO, as well as its customers, are able to reduce the costs that physical distance may cause. These relate, for example, to the reduction of the simple transfer costs, to the efficiency of the recruiting and recovery of students, and to the more efficient follow-up of the customers' needs and the HEO's supply. Thus, the question of the location of the HEO is fundamentally a *logistical* question. The more efficient knowledge is produced, transmitted and offered to the region, the more effective is the HEO. The better the HEO allocates its resources (investments, experts, student places) to the region, the more effective it is.

Traded effects are, at least in principle, tradeable, priceable and moveable. They can be, again in principle at least, directed in a certain region as well as some other. If the HEO locates a given educational programme by considering its traded effects, it can base its decision purely on its logistical efficiency, for example, on the place of residence of the students, or of the teachers and experts. It is interesting to notice that the development of ICT and fast traffic connections reduce, from the viewpoint of traded effects, the importance of agglomeration in the context of the HEO's. Still, in many political and scientific discussions, the regional effects of HEO's are approached and evaluated purely from this perspective (see e.g. Puukka 2004).

In untraded effects, the primary effect mechanism is based on the HEO's being a part of the technological trajectories of a region and affecting the development of those trajectories. When affecting this way, the HEO takes part in the formation of a local institutional environment and resource generation. Untraded effects thus answer to the problem of indirect transaction costs: costs caused by unestablished, discontinuous interaction, where the normative and regulative ground of interaction has to be negotiated and defined from the start. Here, the question of the right location of an HEO is not a logistical problem but is connected to the HEO's ability to create an environment for the development of local knowledge and technology, knowledge spillovers etc. The better the HEO is organised to shape and direct the regional development, the more effective it is. Untraded effects are thus largely untradeable, unpriceable and immovable effects; they are based on such normative and institutional interconnections that cannot be transmitted from one region to another.

Many forms of HEO activities rooted in the classical idea of the Humboldtian University, like its general role as "vitaliser" of cultural life and builder of the world views, are in fact based on the model of untraded effects despite their intention to maintain the relative independence and separateness of universities. On the other hand, with the recent rise of the new regionalism and the discussion on regional innovation environments, untraded-type effects have gained increasing attention together with emphasis of the non-linear type interaction processes. It is thus important to see that the two dimensions of linear vs. non-linear models of interaction and traded vs. untraded effect mechanisms are not mutually displaceable or even co-variable

dimensions. All four combinations of them are both conceptually and empirically adequate. However, this distinction is rarely noted in discussing the regional role of universities and polytechnics.

4. Internal structure of the regional system of higher education

While the first three perspectives are purely conceptual and general in nature, the fourth one is connected to the specific structure and development of the Finnish system of higher education. Despite this difference, we find it crucial to the understanding of the regional role of the HEO units. This perspective concerns the *internal* structure of the system of higher education within a regional context. It focuses on the questions of the relationship between the regionally located HEO units, especially between the universities and polytechnics within a certain region.

The challenges in relationships between the two “pillars” of the Finnish system of higher education can be traced back to the birth of the polytechnics during the 1990s. The change of the old vocational institutes into a legitimate part of the system of higher education has not been an easy task. There has always been a certain split between the interests in developing polytechnics towards the system of higher education, and interests in maintaining their vocational roots and developing them into higher-level vocational colleges. From the point of view of universities, some developments within polytechnics have been seen as problematic and undesirable. While the general role of polytechnics in the system of higher education has been largely established during the 2000s, some of these questions remain open. In particular, the development of post-graduate degrees in polytechnics, as well as the role of their own R&D activity is still disputed. (See e.g. Liljander 2002; Kotila & Mutanen 2004.)

When considering research and development from the perspective of laws, statutes and official documents, the situation should be clear and unproblematic. Both pillars of the system have their own, specific and limited fields of action: scientific basic research for universities, and applied, regionally oriented R&D for polytechnics. Within these limits, the pillars are encouraged to maintain and strengthen their co-operation. Thus, in principle, the universities and polytechnics act in separate fields, and there is an explicit distinction between their missions in research and development. We will call this an *official interpretation* of the relationship between universities and polytechnics. (E.g. Rantanen 2004.)

There are, however, good empirical reasons for being sceptical towards the official interpretation. When looking at the concrete ways the universities and polytechnics act and interact in R&D activities, it seems hard to make such a clear-cut distinction between their purposes and fields of action. Universities, and especially technical and commercial universities, are deeply connected to the concrete development of, for example, new products and processes. On the other hand, R&D staff in polytechnics typically has university-level post-graduate degrees, which makes it hard to limit their research activities outside the “scientific” field. Of course, this empirical situation can be interpreted in at least two ways: it may be only a consequence of undesirable overstepping of the defined limits; or it may indicate some deeper, principled problems in the official interpretation. This question remains open, but it is particularly interesting in the specific regional contexts, where universities and polytechnics are currently defining their common model of co-operation and division of labour.

Another sub-dimension of this general perspective concerns the systematicity and continuity of the interaction between the universities and polytechnics. We may approach this by making a distinction between the *systematic* and *ad hoc* relationships. Systematic relationships refer to the ways the universities and polytechnics organise their model of co-operation and division of labour relatively persistently. What is crucial here is that the systematicity penetrates both the strategic and practical level of interaction. Ad hoc relationships, correspondingly, refer to the interaction that takes place in a more case-specific way. In such interaction, the forms of co-operation, as well as the roles of the parties, are not defined *a priori*, as general principles. Rather, they are developed during the concrete co-operation processes.

Description of the case studies

In the empirical part of this study, to be carried out in 2006, the focus will be on the examination how three different organisations (Häme Polytechnic, Lahti Polytechnic and Helsinki University of Technology Lahti Center) have carried out their mission as developers of innovation activity in their regions. The analysis focuses on clear-cut operational entities selected from each organisation, giving us reason to emphasise that this research does not study how the organisations as a whole have participated in developing the region and its businesses. There are several differences between the functions and tasks of the organisations examined, both as regional actors and in general. The common denominator for the functions selected in this study is their role as an innovation-related intermediary between the university/polytechnic and the companies. They all are founded in order to support the firm's innovation activities in a region. Although not independent organisations, their functions can be examined through the concept of the third task unit – or in Koskenlinna's (2004) terms a mediator organisation.

The organisations participating in the research and their units responsible for their company development units are, as we speak, deepening their co-operation. Thus, the study serves the organisations while in search of their own role and focus, as the co-operation in the future will be increased. The closer co-operation has repeatedly also been urged by the Ministry of Education and other financiers. The study and its results will assist the organisations as they strive to develop their actions and co-operation with the SME sector. Although comparing the organisations, it must be emphasised that it is not a question of "giving gold medals and points" but of building requirements for interactive learning.

Helsinki University of Technology Lahti Center / Innovation Services

Since 1998, the clinic-type projects supported by the National Technology Agency (Tekes) and other financiers (Employment and Economic Development Centres, Ministry of Education) have been carried out at Helsinki University of Technology Lahti Center. In the projects, the financiers' support for R&D has been targeted at the development of the companies' business and strategy skills and competences in the region. Through the Innovation Services, companies have been developed in many sectors of business life, the focus being on the following innovation process sectors:

- *applied research in companies*: theses and other research projects directly supporting the innovation processes in companies;
- *research and development*: preliminary studies and R&D related development projects supporting the innovation processes in companies;
- *companies' strategic development*: studies and development projects related to the companies' strategic planning or planning and development of new businesses, also assistance in creating new business ideas and establishing new companies;
- *marketing development*: market analyses and studies supporting the companies' innovation processes; and
- *long-term co-operation in companies*: persistent development and supplementing of the company competences, innovative capability and innovation process management.

The partial public funding has enabled the implementation of development projects in about 100 companies in the last seven years.

Lahti Polytechnic / Innovation Centre

According to the national policy definitions, the regional development carried out by the polytechnics is to be targeted at small and medium-sized enterprises. It is generally accepted, however, that there is insufficient time and resources in the SMEs to co-operate persistently with universities/polytechnics. Different methods and models have been developed, but no common comprehensive, widespread way has been found. Instead, there are numerous different methods, which are being evaluated to find the most suitable and efficient practices. To meet the challenge of the regional development task set for polytechnics, Lahti Polytechnic founded an Innovation Centre in 2004, to act as an intermediary of the R&D and other services between the companies and the polytechnic. The diversified company projects and part of the services implemented through projects have been concentrated in the Innovation Centre, which is constantly striving to serve the companies better. The services offered to the co-operation partners include research and development, making marketable products of inventions, incubator services for start-ups, as well as services related to design and company communications. In the empirical part of the study, the examination of the Innovation Centre activities is limited to the company sector projects, especially to the projects developing the SMEs' business strategy skills, research and development, and the so called diversified product dynamo projects.

Häme Polytechnic / InnoSteel

At Häme Polytechnic, InnoSteel projects have been chosen for the study. InnoSteel is a co-operation network with Häme Polytechnic as the organisation in charge, focusing on multi-partner research and development projects. The aim of the network is to become a leader in Finland in product development and training of metal construction at an international level. The centre to be established would concentrate on product development and increasing professional skills in companies and at different educational levels of sheet metal products and steel construction. InnoSteel acts between companies, product developers, researchers, teachers and students. Besides training, the network aims at generating product, production and business innovations, to transfer technology and testing, as well as manufacture prototypes.

The budget of the InnoSteel projects at the implementation stage is over 5 million euros. The financiers of the entity are the European Social Fund, the European Regional Development Fund, Ministry of Education and Ministry of Labour, Häme Centre of Excellence, municipalities and private companies in the region. The InnoSteel projects strive to promote the exploitation of the latest product and production technology and the creation of innovations, thus securing the competitiveness in the global markets of the biggest industry of the region.

HEO units as regional innovation actors: a preliminary examination

In this early stage of the research, we are only able to present some tentative observations on the two regions included in the study, and the cases described above. Thus, the following examination should be interpreted as a preliminary view of the motives, foundations, structures, and effects of the units to be analysed, formed mainly based on several discussions and interviews with the relevant actors. It is not a description of the results of the study.

However, the short presentation above gives us some interesting directions to follow in order to explicate the nature and characteristics of the HEO units examined. First, there seems to be no principal differences between the purposes and ways of action of the units. For example, the nature of the parent organisation seems not to affect them decisively. Second, they all seem to extend, in one way or another, the conventional limits of their parent organisations. In the units within polytechnics, this extension is connected to the emphasis on strong R&D activity. In the university unit examined, it is due to the notable practical orientation of its purposes and ways of action. Third, innovation is understood in all of the units as not limited to the high tech and knowledge intensive industries, but as including different levels of innovative activity in the companies of more traditional industries and the service sector. This also holds true for InnoSteel despite its focus on a specific sector of industry. Fourth, there is a prominent regional orientation in all of the units. This is partly connected to the funding sources of the units, but it also reflects the fundamental intentions and goals that lie behind their concrete activities.

When considering the first dimension of the nature of interaction between the units and the region (linear vs. non-linear models), our supposition about the non-linearity of the relationships in question seems to hold in general. The regional dimension is not an external factor to be taken into account in defining the scope and purposes of the units. Rather, it is internally connected to the latter: the regional needs and expectations *define the nature of the units*, not just affect their concrete ways of action. This is true both for the strategic level and for the operational level.

This is particularly clear in Helsinki University of Technology Lahti Center. Located 100 km away from its parent university, it has developed a regional development culture of its own, differing from the traditional academic orientation towards the interaction with regions. This is reflected in the way the Innovation Services defines its scope of action by starting not from the basic functions of the university, but from the different phases and aims of the innovation processes within companies.

The case of Lahti Polytechnic is not, in fact, straightforward. In Lahti Polytechnic, there is an old tradition of the vocational college with its own culture and ways of action. This tradition, while of course emphasising the constant and close interaction with its environment, basically follows the linear model. This is also reflected in the functioning of the Innovation Centre, partly because of its young history as an independent unit. Thus, its operations are more evidently in line with the linear basic functions of the Polytechnic. There is still such an internal, definitional connection to the region, at least in the strategic level, which justifies interpreting the basic interaction model of the Innovation Centre as non-linear.

In their temporal orientation, the units examined are also quite alike. Again, there is no conclusive difference between the university unit and units of polytechnics in this dimension. The starting point of their activities is strongly characterised by the intention to solve the current, short-term problems of the customers, especially SMEs. At least one reason for this reactive orientation is the project-based funding of the activities that typically directs them towards the development of short-term results and applications.

However, there are contrasting efforts to include a more proactive element to the activities. One way to go along with this direction is the organised development and application of the systematic, future-oriented methods used at least by InnoSteel. Another one, illustrated by the operations of Innovation Services, is an effort to deepen customer relations and make them more persistent, and to proceed towards more proactive orientation through this long-span co-operation. The success of this process is due more to the personal, trust-based relations between the staff of Innovation Services and companies than to the execution of systematic methods.

The third dimension concerning the traded and untraded effect mechanisms of the HEO's is the most difficult to analyse in this stage of the study. We will leave the question of the effect mechanisms of the polytechnics aside for this paper. However, it is interesting to briefly look at the case of the universities. The regional branch units were typically founded to execute the growing tasks of continuing and Open University education. The interest of the universities was also to expand its recruiting area. It was assumed that the location of certain university activities close to the regions would promote the involvement of the people in higher education and the ability of the companies to utilise research. Therefore, the reasons and motivations behind the foundation of the branch units were mostly logistical. The branch units offered an effective way to bring the people and enterprises to the universities. The logic of the third decentralisation was, consequently, ultimately the logic of the traded effect mechanisms.

During the 1990s the idea of a university as an integral part of a region started to take place in Finland. This also implied a change in the role of the regional branch units. Alongside the logistically motivated service activity transmitting university-level knowledge to the region, activities based on the ideas of their own areas of expertise and of the permanent, central role in regional development were developed within the branch units. This development also took place in the Lahti region, where the local branch units began to strengthen their profile as identifiable regional and scientific actors with untradeable and immovable effects, on the one hand, and as developers of the local institutional environment, on the other. In Hämeenlinna region, instead,

the regional role of the universities is still more based on the traded-type logic. The leading role in the regional development has rather been funnelled into the local polytechnic.

The observations above already point to the fact that the internal structure of the regional system of higher education in the cases examined here is not easily combined with the official interpretation of the relationship between universities and polytechnics. In the strategic level, the differences between the regional orientations of the units are minor and refer more to the resources and specific expertises of the units than to the differences in their basic functions. In the operational level, nothing supports the official interpretation: all the units described focus on the applied R&D activities, and stress their role in the development of the company-level innovation processes. The customers of the units do not differ remarkably. While sometimes the defining role of the polytechnics has been understood as focusing on the SMEs of a region, in these cases there is no such distinctive feature separating the universities and polytechnics. Neither can the division of labour be tenably traced to the differences in the scientific quality of activities or in the methods used.

The interesting question from the point of view of the whole system of higher education is whether these differences result in fruitful co-operation between the two pillars or in a destructive combination of collisions and ineffective, expensive overlaps. This is a question not to be answered here, but two things should be borne in mind. First, in the Learning Economy model of innovation policy, the role of the universities comes naturally closer to that of the polytechnics. If the universities are altogether supposed to have a role in such innovation policy, this process is hard to avoid. This functional convergence does not, however, imply that the intellectual resources gained from the universities and polytechnics would not differ from each other. On the contrary, this difference still maintains the functions of both universities and polytechnics in the regional innovation environment.

Second, the apparent overlap between the tasks and activities of the two pillars when examined at a comprehensive, general level does not necessarily imply a similar overlap in concrete cases of co-operation. It is quite possible that a clear, undisputed definition of the roles of the two pillars in fact takes place in those individual cases. This might be the situation in the non-university regions like Lahti and Hämeenlinna. This refers to the model of the co-operation and division of labour fundamentally different from the official model. In this model, the unambiguous division of labour is abandoned in favour of the case-sensitive, ad hoc based definition of the roles of the universities and polytechnics. The “casting” of the HEO’s takes place not in general principles but in individual projects, programmes and research groups, and it may vary remarkably from one case to another.

Of course, this model may also result in bloody competition, if the case-based definition process is not successfully carried out. Whether this model correctly describes the situation in non-university regions and whether its applications have been successful, remains to be studied. However, our intention was to show how the characteristics of non-university regions concerning this relationship can be interpreted not as a dysfunction or fault of the coherent division of labour, but as a theoretically, empirically and politically interesting counterexample of the adequacy of the official interpretation.

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