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## Regional effects of universities and higher education: a knowledge overview of Swedish, Scandinavian and international experiences

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## Regional effects of universities and higher education: A knowledge overview of Swedish, Scandinavian and international experience.

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### ABSTRACT

The growing role of knowledge as the base of the economy has meant growing expectations of universities all over the world to function as engines for regional growth. The independent role of universities is slowly being replaced by governmental policies for human capital formation, knowledge dispersion, innovation systems, triple helix, etc. One example is Sweden's new University Act that added a third task to universities' two traditional tasks, education and research, viz. cooperation with surrounding society. Theoretically, this change in policy is supported the hypothesis presented by Gibbons et al (1995) of an emerging Mode 2 of knowledge production.

Based on Swedish, Scandinavian and international experience, this paper summarizes knowledge of regional effects of universities and higher education. One conclusion is that the "regiment effect" (Florax 1992) seems to be the most obvious regional effect of universities and that hopes for university-led innovative regional development have hitherto seldom been fulfilled. The paper also analyses the obstacles to more intimate cooperation between universities and surrounding society and knowledge production a la Mode 2. This analysis is performed by applying the concept of social capital. Two of the conclusions are that most regions do not have the capacity to absorb the output of the universities (Florida & Cohen 1999), and that the internal social capital of universities is not adapted to governments' demands, nor are the relations between universities and other stakeholders in regions.

**Keywords:** University policy, Regional effects, Mode 2, Social capital

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## 1. Introduction

Discussions on the knowledge society have taken up many areas. Common to most of them is that the universities and their education and research programmes have been in focus. Since the 1980s, a large number of studies have examined the effects of research and higher education for the economic growth of industries, towns, regions and countries. This paper summarises some of the most important findings with special reference to Sweden and the Nordic countries, which have amongst the highest expenditures on research and higher education in the world, measured as a proportion of GDP.

The discussion on the knowledge society has also revolved to a great extent around changes in the production of knowledge as such. Perhaps the most influential contribution, Gibbons et al (1994), developed the thesis of a process of transition from Mode 1 to Mode 2, in which Mode 1 constituted the traditional, intra-scientific, intra-disciplinary production of knowledge, while Mode 2 characterized the socialisation of the production of knowledge. According to the latter approach, the production of knowledge is being pursued to a growing extent in a form of cooperation not only between disciplines but also with parties outside the academic world – users of research that also participate in and determine the relevance of knowledge, and contribute to quality control. The role of the universities in the Mode 2 production of knowledge is not so evident. Rutten and Boekema (2004) have even claimed that, if the universities cannot adapt to the changes in demand for knowledge made by society, they will be marginalized and society's resources for the production on knowledge will be allocated to other parties.

Gibbons et al (1994), and work on similar theses by Ziman (2000), Etzkowitz & Leydesdorff (1996) and Nowotny et al (2001), have made the contribution that education and research policies in a number of countries have not only focused on levels and distribution, but also on the need for cooperation between universities and other stakeholders in society, on utility and areas of use of research, and on the influence of the general public and politics. One example of this is Sweden which legislated in 1997 that, in addition to education and research, the universities also have a third equally important task, namely to cooperate other parts of society.

This paper has two purposes. The first is to summarise existing studies of the regional effects of the universities in various respects, mainly from a Swedish and Nordic perspective. The other purpose is to analyse the obstacles to in-depth cooperation between universities and other parts of society according to Mode 2. The analysis has been made with the aid of the concept of social capital.

After Putnam (1993, 2000), social capital has mainly been used as a designation of norms and values as well as relations and networks in *civil society*. In this paper social capital is used instead as a comprehensive concept for the norms, values and relations that exist *in the university world and between this world and surrounding society*. A working hypothesis is that universities' social capital is adapted by tradition to Mode 1 production of knowledge, and that a transition to Mode 2 therefore requires a comprehensive change in the universities' social capital.

Section 2 describes the development of the Swedish university policy, mainly from a national perspective, but also from the perspective of the regions. Sections 3-5 summarise and discuss experience gained of different regional effects of the universities' activities: multiplier effects

and direct labour market effects, location and spin-offs effects, and the effects of general knowledge spillovers.

In section 6 an analysis is made of the reasons why Swedish universities are still almost totally dominated by Mode 1 production of knowledge and in section 7 a number of areas that deserve further illumination are given prominence. In both these sections norms, values and networks are central concepts in the analysis. Together these phenomena form the social capital of the universities and between the universities and other parts of society and this perhaps constitutes the main obstacle to the emergence of Mode 2 in Sweden.

## 2. The emergence of the Swedish university policy

As in other countries, up to the beginning of the 20<sup>th</sup> century the old Swedish universities in Uppsala and Lund were mainly educators of priests and public servants. The ideals that had dominated in Europe since the beginning of the 19<sup>th</sup> century had been formulated by the founder of Berlin University, Wilhelm von Humboldt. According to these ideals, education should not strive towards short-term material goals and visible results. The shaping of individual personalities should be the overall aim of university education. Another central principle was the freedom and independence of research vis-à-vis different social interests.

Only in exceptional cases were the leaders of the emerging industrial society educated at the traditional universities, but at the technical colleges in Gothenburg (Chalmers' Institute of Technology) and in Stockholm (Royal Institute of Technology, KTH), which were started in the 1800s. However, during the decades around the First World War, the universities started to be transformed "from small, social, homogenous elite and socialisation sanctuaries - into relatively large, diversified, professional education research and organisations mostly for the middle class" (Nybom 1997, p. 21, our translation).

In some cases researchers in the universities' scientific subjects were engaged in industrial projects (Eriksson 1978). Sörlin and Törnqvist (2000) give several examples of this but they also point out that research done by the industry itself played a greater role for its inventions and product development. During the 1910s and onwards, several sector research institutes were founded. This can be seen as a clear sign of the gap between academic university research and the needs of industry.

At the beginning of the last century, the great importance of technical and scientific research for industrial development laid the foundation of a view of higher education and research as a positive driving force in society, "...while the government, which had previously preferably seen that the universities and the academic researchers made as little fuss as possible, now started to hope, and perhaps demand, that science did the impossible" (Nybom 1997, p. 24, our translation). This approach has been in and out of favour and has been expressed in different ways in different periods. While the budgets for the universities decreased as a proportion of GDP between 1925 and 1939, the military orders placed in the USA, chiefly for the atom bomb, clearly marked the immediate socially utility of science. This also had a clear impact in Sweden.

As early as in the 1940s, Swedish research policy was given a peculiar special feature, namely that research should only be pursued at the universities (Nybom, 1997). "After the war the

Swedish research policy doctrine was that institutes are evil and that universities are good and all other discussion was superfluous” (Sandén and Sandström 2002, p. 197, our translation). The consequence has been that Swedish institute research has been considerably less extensive than in other countries. This is particularly the case with publicly financed industry research. In EU countries at the beginning of the year 2000, an average of 24% of the public R&D budget was allocated to industrial research. In Sweden the figure was 3% (Sandén and Sandström 2002).

During the first decades after the war the “linear model” dominated the Western world’s view of research and higher education. If research was given funds and a free hand, it was expected to deliver new basic knowledge to laboratories at institutes and companies. These laboratories then developed inventions and new products, which could be commercialised and mass-produced and thereby contribute to growth. Basic research was to constitute a prime engine for social development, but its cooperation with other parties of society consisted only of its supplies. Applied research, innovations, commercialisation and serial production constituted the future links in this chain (se Sörlin & Törnqvist 2000). This model, which was based on observations of the effects of technical scientific research mainly in the USA, was transferred during the period of optimism in the 1960s fairly uncritically to the social sciences and there it was expected to contribute to improving society in a corresponding way (Sandström 2000).

Partly as a consequence of this politically undisputed conception, a considerable process of expansion was started in both higher education and research. The growing need of labour with higher education qualifications as well as reasons of social and regional equality were also strong driving forces behind this expansion. The university colleges in Gothenburg and Stockholm were converted into universities in 1954 and 1960 respectively and were given more resources. The higher technical education programmes and research programmes at the Royal Institute of Technology and Chalmers were considerably re-enforced. Two new universities were established in Umeå and Linköping in 1963 and 1970 respectively. Two new technical colleges were established shortly thereafter, in Lund and Luleå.

A certain amount of scientific criticism was directed against the linear model as early as in the 1960s. In society at large, the scientific belief in the future was weakened considerably during the 1970s. The left wing movement and greater awareness of the environment coincided with economic structural crises. Despite the expansion of research and higher education, the economy stagnated. Opposition to nuclear power came to symbolise the new lack of faith in technology and science. However, the expansion of the higher education system and research continued, in principle independently of these events but also in a partly new way. In addition to the expansion of the six existing universities, a large number of regional university colleges were built. This development had started in a small way with a few so-called university annexes in the 1960s. As opposed to the universities, these colleges would not do research but would merely work with higher education in order to meet the needs of the labour market. However, research outside the universities expanded in other forms, mainly through the emergence of a number of so-called sector research organisations under different ministries and government agencies. In principle, these sector research organisations came into being in conflict with the official research policy, i.e. that research should be pursued at the universities, but they were founded and financed by ministries and government agencies outside the controls of the research policy. Even if the simplified view that research directly generates growth had been shaken, there were other reasons for the expansion of research. The public sector had been extended and its different bodies demanded “an efficient, regular

and ideologically congenial evaluation and information activity” (Nybom 1997, p. 128, our translation).

In the 1990s, confidence was expressed in the positive effects of research and higher education through, for example, the right wing government’s transformation of the wage earners’ investment funds into research institutes, and the following social democratic government’s initiatives in respect of the regional university colleges and the introduction of the third mission for universities. In the first case, the new research foundations, formally free from political control, constituted a central component in the right wing government’s growth policy. In certain respects the right wing government’s view of research can be compared with the simple linear model of the 1950s and 1960s in which research was to create new growth with the aid of more funds. The Prime Minister, Carl Bildt, emphasised the importance of being in the front line in the development of information technology, which was expected to have great economic importance (Benner 2001, p. 31). In the latter case the universities were appointed to be driving forces in the service of regional development. The third task of the universities that came into being in 1997, i.e. that the universities, in addition to education and research should also collaborate with surrounding society, is an expression of the increasing importance given to universities in social development.

However, the picture described above of larger budgets and greater public control of universities is far from complete. The universities have certainly, without making any protests, received new funds for research and education but, on the strength of their specialist skills, they have also successfully maintained the independent academic ideals. The scope and focus of higher education have been governed by political decisions and financial budgets. On the other hand, in many respects research has remained under the control of researchers and from the 1980s onwards the academic world has moved its positions forward vis-à-vis the government agencies. The basic reason appears to be that the sector research that was governed by bureaucrats and interest groups did not achieve the often unrealistic expectations placed on it, and was also not always of good quality. It proved to be the case that it was the researchers themselves who were the leading experts in their fields. Politicians and bureaucrats could direct research funds to desirable areas but, in these areas, assessments of quality in applications and the research performed were matters that required expertise (cf. Harding 2002).

The ongoing transformation of the industrial society into a knowledge society has also had the effect that increasingly larger sections of the labour market require higher education qualifications. Society has been made academic and not just in the sense that an increasing proportion of the occupationally active population should have higher education qualifications. As the needs of theoretical education in society have increased, the academic methods have become standard. The “academic-theoretical model” has therefore also gained a footing in education programmes and institutions that formerly had a practical focus, for example the training programmes for nurses and the agricultural university. Even research cooperation between universities has been made academic (Benner & Persson 2002). Sandström (2002) has called these tendencies an “academic paradox”.

Seen from this perspective, the methods of higher education and research permeate Swedish society today more than ever. On the one hand, it can be maintained that it is this that has taken research and higher education further and further away from its ideal of being an independent observer and critic. At the same time as society is being made increasingly academic, universities are being socialized to a corresponding extent (see e.g. Nybom 1997, p.

88). As long as the universities were a small part of society, trained its elite, and pursued a small amount of research, it could be said that they lived up to the autonomous ideals to a certain extent.

The present political objective in Sweden, that 50% of people born in any one year shall participate in programmes of higher education, is just one of many signs that universities have become a highly integral part of society. The defenders of the universities' traditional position protest against increasing political control (see, for example, Gustavsson 2000). With few exceptions (e.g. Sörlin 2003), there has been no real discussion in Sweden of whether the 200-year old Humboldt ideal is compatible with the knowledge society of the 2000s.

While faith in the linear model has failed and the policy for higher education and research at the national level has been characterised by superficially conflicting features in respect of cooperation by universities with other parts of society, politics at the regional level have, at least superficially, been clear cut: higher education and research has increasingly come to be seen as the foremost driving force for regional growth and development. The reason why the linear model has been able to stay alive and even been strengthened in its regional variant is associated above all with the successful examples of Umeå and Linköping.

Umeå University, which was founded in 1965, has come to represent the driving force for development that a university can give to a peripheral small town. Through local political mobilisation, strategic initiatives and persistent lobbying of the government offices, Umeå won the struggle to be the home of the university of the province of Norrland (Olsson 2003b). For several decades, Umeå has been one of the most rapidly growing municipalities in Sweden and, for the last ten years, it has been the largest municipality in Norrland. Linköping in southern Sweden, whose university was founded in 1970, has also experienced very strong population growth.

On the other hand, the ways in which the "regional linear model" function in practice, i.e. how higher education and research should function as driving forces in reality, have remained unclear. Apart from initiatives to strengthen human capital through training programmes, regional centres have also regarded university colleges as a means for consolidating growth. The goal of the municipalities and the university colleges has often been that the colleges should be given university status. For the colleges themselves, the reasons have mostly been associated with growth, more resources and higher status. Other local and regional parties have noted the strong growth of Umeå and Linköping during recent decades and have regarded a university as being of decisive importance for the development for their own municipalities and regions. Even if the regional colleges and other parties in each place have accordingly agreed on the goal of university status, their reasons have differed. The college has had its reasons and the region its reasons. There are few examples of the two participants working out a common strategy for seriously linking the university ambitions of the colleges to their role in their region development.

### 3. "Regiment" and labour market effects

#### 3.1 Regiment effects

While many government activities have been obliged to accept cutbacks during the last ten years, both the number of students and the number of jobs have increased in Swedish higher

education. The number of persons employed increased from 48 000 in 1995 to 62 000 in 2002.

The number of students increased during the ten-year period 1993-2002 by 114 000, or by 51.1%. However, the increase in the six established university towns<sup>1</sup> was limited on average to 27.9%, while the regional university colleges increased their numbers of students by as much as 103.4%. The expansion of university colleges during the 1990s outside the six established university towns has thus had the effect that they increased their proportion of students from 31% in 1992 to 42% in 2002. In 2002, however, they had only 23% of the employees working at universities and university colleges in the country.

Job opportunities that are financed externally are, as a rule, always welcome in a municipality or a region. In this respect there is no difference if the employer is private or public. The employment effects of a university college are no different in this respect from a steelworks or a regiment. These types of effects have therefore sometimes been called “regiment effects”. Florax (1992), in a study of the Netherlands, found that the regiment effect was the only obvious effect of university investments.

The employment effects are not merely limited to direct effects in the form of work for a number of employees - in the case of the universities: teachers, researchers and administrative staff. The consumption of the employees and, in the case of the university colleges, of the students, of which much takes place locally, also gives indirect employment effects in everything from commerce and childcare to the building of new houses and the maintenance of houses. With the aid of calculation models based on a German (Giese 1987) and a Briton (Armstrong 1993), effects on consumption and employment have been estimated for the university college in Borås (Holmqvist et. al. 1995) and Umeå University (Lindgren & Marklund 1995).

The points of departure of both studies are consumption, taxes and fees, based on the salaries of the personnel, less consumption and tax revenues that benefit other places. In addition to this, approximate calculations are made of the universities’ other local expenditures. In the case of Umeå, these expenditures amount to a mark up of 72% on the consumption of the personnel. In the case of Borås the figure is a 46% mark up.

If the students’ consumption is included, the picture changes considerably. While the Umeå study arrived at the conclusion that the indirect employment effects were approximately 38% of the direct employment effects, the result of the Borås was that the indirect effects were at least 100% i.e. that each employee generated another job in Borås. The British study made at Lancaster University showed a multiplier effect of 26%.

The main explanation of the great differences between the two Swedish studies is probably the proportion of full time students per employee living in the town. While Umeå in 1995 had less than three students per employee and thus was the most personnel-intensive university per student in the country, the corresponding figure for Borås was approximately 13 students per employee. The university college in Borås has, as most regional colleges, lacked permanent research resources. It has been an “education-intensive” college where most of the personnel have spent all, or most, of their working time on teaching. The Borås study showed that the students’ local consumption was even greater than that of the staff. On the other hand,

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<sup>1</sup> The six are Uppsala, Lund, Stockholm, Gothenburg, Linköping and Umeå.



Umeå University, with its research resources, has many employees who mainly do research work and who spend little time on regular teaching. Even if the multiplier effect is thus much smaller in Umeå compared to Borås, the mere size of the university has had such an effect that it is estimated to have contributed to approximately 25% of the growth in Umeå during the period 1960 to 1995 (Wiberg 2003).

One conclusion of this comparison is that the local employment effects of a university college do not merely vary with the number of employees. The consumption of the students is also of importance and the proportion of students per university employee varies between the universities. This consumption is based to a great extent on state study funds, (loans and grants to students) which, in addition to the colleges' own employment and the consumption that generates, constitutes an additional external surplus to the local economies at places that have university colleges. If the local effects of the university colleges are isolated to include only the local consumption perspective, the comparison thus indicates that an education-intensive college has greater local effects per monetary unit than a university with a great deal of research.

### **3.2 Labour market effects**

The government's expansion of the regional university colleges has had a number of interwoven purposes. By generally raising the level of education in the regions, it is expected that educational levels in regional trade and industry will improve which, in the long term, should modernize the region's industrial structure and create a long-term potential for growth. Other purposes have been to reduce geographical and social distortions in recruitment to higher education studies and thereby improve the growth potential in more regions, and to reduce the social and economic divides in and between them.

At the end of the 1990s, the recruitment of new students to university colleges was relatively even in relation to the population. To make the distribution completely even, 8% of the new students should have been redistributed between the municipalities (5% if the municipalities are aggregated to local labour markets). However, there is a considerable range between the individual municipalities. The average transition frequency to university within three years of upper secondary school during the years 1988/89-93/94 varied for example between 58.7% and 15.3%.

The municipalities with the highest frequencies of transition to university studies are not a uniform group. They include established university towns and Stockholm suburbs with the highest average incomes in the country as well as peripheral low-income municipalities without any academic traditions. The twenty municipalities with the lowest frequency of transition appear to have more features in common. With a few exceptions they consist of small industrial communities or municipalities, which have a peripheral position in their region and are dominated by primary industries. One reasonable interpretation is that both physical and mental distance often constitutes barriers to transition to higher education.

One of the aims of the regional expansion of university colleges was, as pointed out above, to raise the level of education of the labour force of each region and thereby modernise its industry and industrial structures. A primary prerequisite for the fulfilment for these aims is that the graduates remain in the region in which they have been educated. This varies between the university towns. One year after graduation it would seem that approximately half of the university graduates are still in the place where they have studied.

In particular it is the Stockholm region that best retains its graduates and it is also Stockholm that experiences the strongest immigration of graduates. Uppsala is among the university towns in which the smallest proportion of students remains after graduation. Uppsala University is also the university that provides a major proportion of graduates for the needs of both the Stockholm region and the entire country.

Wikhall (2001) has shown that there is a very strong relationship between the number of graduates that stay per income earner, and the proportion of graduates on the local labour market. In other words there does not seem to be, at least at the present time, any saturation effect. On the contrary it would seem to be that there is a demand for more graduates on local labour markets with many graduates.

There are several reasons for the discrepancy between the regional breakdown of those who start at university and those who have already graduated. Almost half of the graduates of today graduated some 20 to 40 years ago, i.e. long before the expansion of the regional university colleges in the 1990s. Wikhall is of the opinion that it is probable that we have not yet seen the full results of this expansion. Another reason is that differences in industrial structures have the effect that the demand for graduates varies between the regions. In terms of transition to a knowledge society, the Stockholm region has been in the fore, followed by the other two metropolitan regions and the major university towns, while the labour markets of other regions have mostly had a much lower demand for graduates. Therefore, a regional university college is hardly enough for the rapid modernisation of the regional industrial structure. This conclusion is probably even more valid in respect of the effects of university programmes at local *learning centres* in small and peripheral labour market regions. If the educational programmes are not directly linked to local demands, or supplemented with measures to enable the new graduates to obtain work corresponding to their skills on the local labour market, there is a great probability that the graduates will move to labour markets where their skills are in demand. Even if this is to the advantage of the individual, the effect on the local labour market region is negative. The region's "absorption capacity" is in other words of decisive importance for whether the graduates will be resources in the region they have been educated in.

## 4. Location and spin off effects

### 4.1 Location effects

As early as in 1982, an OECD study established that the location factor that high-tech companies valued particularly highly was access to qualified labour. The importance of universities as research environments was ranked in fourth position (OECD 1982). In other words, the power of attraction of university towns consisted chiefly of the special supply of labour with higher education that existed in these places. Today, more than twenty years later, it has almost become an established truth that the companies in the knowledge society choose to locate on the basis of the specific labour supply in the town.

However, empirical studies indicate that this "truth" can very well be a myth. Lundquist (2000) has studied the regional variations of new companies in Sweden in 1996 and has not found any statistically significant relationships between proximity to universities/higher

education and new companies.<sup>2</sup> The most important factors that explain the establishment of new companies were instead the number of existing small companies i.e. regional traditions and experience of small companies. The only respect in which proximity to universities had effects on new companies was the level on education in the new companies.

The results referred to above are for new companies as a whole. Should then proximity to universities not have an effect on new companies engaged in research-intensive activities? When Lundquist tested his model on new companies in the research-intensive sector alone, no statistically significant relationships emerged at all. This can partly be explained by the fact that the number of new companies was small, which increases statistical uncertainty. Almost half of the new companies in this sector were in Stockholm, while other university towns and major larger regions had very few companies. Lundquist's result indicates therefore that there is no simple cause and effect relationship between the regional allocation of university budgets and new companies, not even in research-intensive industry. The establishment of new companies is generally explained by existing traditions in respect of small companies, while new companies in the research-intensive sector seem almost to be characterized by an agglomeration threshold in which Stockholm is the only region that comes over the threshold.

While Lundquist's statistical analysis did not support the thesis of the university as a localisation factor, there are naturally arguments that support the thesis. Case studies can be used to support such arguments. The importance of Stanford University for developments in Silicon Valley, and the importance of MIT for high technology centres around Route 128 in Boston are the two most commonly cited examples. In Europe, Cambridge in England is normally used as the foremost example of how university research constitutes a driving force in regional growth.

The foremost Nordic example of a development of this type is Oulu in northern Finland (see e.g. NordRefo 1993). At the end of the 1950s, the town had 55 000 inhabitants. Today it has more than twice as many (123 000 in January 2002). When the town's university was founded in 1958, it was the first state university to be established outside Helsinki. One explicit motive was that the university would contribute to the development of industry in northern Finland. Therefore technical education programmes were given priority. In 1974 the state technical research centre (VTT) established a laboratory for electronics and computer technology at the university. However, there was a delay until the 1980s before the university achieved its role as a driving force for trade and industry in the region. In 1980, a company, Aspo Comp, was established, which manufactured electrical cables close to the university. The following year Nokia Mobira placed a unit for the manufacture of relay stations in Oulu. (Nokia had already located a cable factory in the town in the 1960s). Also IBM and other electronic companies located units in Oulu in the 1980s. In 1982 the Nordic countries' first science park was established in cooperation with the town, initially in an old dairy, but after some years at the university. The technology centre is in the district of Linnanmaa where, apart from the university, VTT also has its laboratory. The area is marketed under the designation *Teknopolis Oulu*. In 2002 Oulu University was the second largest in Finland, with six faculties, 14 500 students, and 3 100 employees.

In Sweden, Umeå University has been a model for a driving force for development that a university can give a small, peripheral county town in Northern Sweden. However, there are very few examples that this university has generated the establishment of private companies.

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<sup>2</sup> Lundquist's study is also commented on in Sörlin and Törnqvist (2000).

The foremost example is the pharmaceutical group, Pharmacia, which established a development unit in Umeå as early as 1967. In the middle of the 1970s, Pharmacia closed the development unit, partly as a consequence of non-existent local cooperation with researchers. Instead the Umeå plant started to produce instruments. This work is still being done in Umeå, under new ownership and with a broader focus. On the other hand, the importance of the university has been considerable where activities in the public sector are concerned. It has probably been of decisive importance for the localisation of Norrland's regional hospital, the localisation and re-localisation of other seats of learning such as the University of Forestry, units of governments agencies as the National institute for Working Life, and National Defence Research Institute, and the localisation of public regional offices (Wiberg 2003). Moreover, in the last decade there are several examples of localisation and re-localisation of private regional offices and production plants in Umeå. However, it is more likely that it is Umeå's growing role as the "capital" of Norrland that has contributed to these more recent decisions rather than the fact that there is a university there.

The success story in Oulu has a smaller and younger equivalent in Sweden, namely the towns of Karlskrona and Ronneby in the economically backward southeast part of Sweden.<sup>3</sup> In the 1980s, the little industrial town of Ronneby was severely affected by industrial closures. In contrast to the usual reaction of local politicians – to demand replacement industries and support packages from the government - the local council chose to invest in a software centre for education, R&D, and industry, located in the historical surroundings of the resort Ronneby Brunn. After government agencies and companies had been mobilised, the research centre, Soft Center, was inaugurated in 1987. It was quickly filled and, just few months after inauguration, a decision was made to extend it.

When the government proposed the establishment of a new university college in Karlskrona-Ronneby in a government bill the following year, it was Soft Center that decided the Ronneby section's profile of systems knowledge and business administration, while the technical training programmes went to Karlskrona. The 1990s were characterised by a continuous expansion and companies such as Volvo Data, Skandia Data and SE Bank Data moved in. In the year 2000, Soft Center consisted of eight buildings, with 80 companies and 1200 employees.

Developments in the naval town of Karlskrona differ in many respects from those in Ronneby. Karlskrona was also severely affected by closures in the 1980s, for example its naval base. The government compensated the town for this closure by moving the National Board of Housing, Building and Planning to Karlskrona and establishing a university college there. Ericsson had had a factory for manufacturing telephones since the 1940s, which was later sold. However, a new, rapidly growing company in the Ericsson group was more important for Karlskrona, as well as the location of a telecommunications operator in 1991, when Sweden deregulated the telecommunications market.

Towards the end of the 1990s, Karlskrona had become a good example of how a backward crisis region could reverse a trend and be modernised in a short space of time. At the beginning of the 2000s, 35 companies with 4 500 employees were in the town's TelecomCity project. However, since then, as in Ronneby, the crisis in the IT and telecommunications industry has led to cutbacks.

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<sup>3</sup> The review of Karlskrona/Ronneby is based on Nilsson (2002a and b).

One decisive question is the role the university college has played in making Karlskrona and Ronneby an attractive place to establish companies in. There does not appear a simple cause and effect relationship. The company centre, Soft Center, in Ronneby was inaugurated two years *before* the university college and was an important factor for the establishment of the university college, not the reverse. However, when programmes of higher education in Ronneby had started up, it would appear to have constituted an important argument for establishing companies there during the period of the shortage of labour in the IT sector in the 1990s. The existence and focus of the university college also played an important role for the establishment of the telecommunications operator in Karlskrona. Otherwise, however, the expansion of the telecommunications industry in the town during the 1990s can be better explained by the cooperation between growing, existing groups of companies and the university in the form of the TelecomCity project, than by the fact that the university college may have constituted a magnet for external companies. However, the supply of newly educated labour in the region has naturally been essential for expansion.

The fact that the high-tech industry, which is mostly concentrated in Sweden to the Stockholm area, needs to import labour from other parts of Sweden and abroad can be seen as a sign that the regional spread of university colleges does not provide the desired effects. However, it is not only the high-tech industries that need personnel with a university background. Today all sectors do. This is the most important argument, not only for all regions having the ambition to have a university college, but also for a very large number of municipalities outside the university towns to start up learning centres with university programmes.

The university landscape has thus been considerably evened out in several stages since the 1960s. The establishment of universities in specific parts of the country, which for a few decades favoured the new universities in Linköping and Umeå, has been replaced by keen competition for students and resources. As the university colleges have spread out in the country, it is probable therefore that their importance as a factor for establishment of companies has been increasingly reduced. While the absence of a university college probably gives a region a negative position, it can hardly be claimed any longer that a university college, or even a university, can give a region a positive special position. Instead, it appears to be a general agglomeration factor which governs many localisation decisions in such a way that private and public companies and organisations choose to locate their operations on the largest labour market and that with the best availability in terms of their activities.

On the other hand, there are examples of university colleges that, as a result of having the right focus, the right timing, and the right supply and newly educated labour have functioned as magnets for localisation purposes. Oulu and Karlskrona/Ronneby are the two foremost examples in the Nordic countries. It is hardly a matter of chance that they have both been technical university colleges with a focus on expanding sectors.

#### **4.2 Spin-off effects**

According to the “linear vision” described above, universities are expected to produce research results that in different ways form the foundation for inventions and new products that are thereafter commercialised, come out on the market, and contribute to growth. One of several expressions of these processes are the companies that have been hived off as a result of research at universities.

Since the 1980s, Swedish universities and university colleges have taken a number of measures to establish hived off companies. Courses in entrepreneurship, the formation of holding companies and risk capital companies, technical foundations, company incubators and science parks are the most common measures for the promotion of hiving off. Most of these measures, or perhaps all of them, have been inspired by foreign models. For example, the world's first science park was established at Stanford University as early as in 1951. The first two European science parks were established in 1960s in Great Britain, of which one was in Cambridge. During the 1980s, the number of science parks in the world increased tenfold from 34 to over 300. The first science parks in the Nordic countries were both established at the start of the 1980s: the above mentioned the Teknopolis Oulu in Oulu and Idéon in Lund (Nilsson 1995). In 1989 there were ten science parks in Sweden situated in the six university towns of that time and in Luleå. Since then more have been established.

The only comparative study hitherto of companies hived off from Swedish universities was published in 1993. It could be seen from this study that, in the major university towns in 1991, there were 562 companies that had their roots in universities and university colleges. Approximately 400 of these were started during in 1980s.

More than a third of the hived off companies were in the electronics sector, including telecommunications and data communication and computers. Approximately 20% of the hived off companies were in the biotechnology and medicine sectors. In total, 3500 persons were employed in the 562 companies in 1990 and their total turnover was approximately SEK 2.7 billion (Olofsson & Wahlbin 1993).

Hived off companies can be roughly divided in to two groups:

1. Companies whose products are direct results of a special research project.
2. Consulting companies that are based on the skills that the founder has acquired through his/her activities at the university.

Studies have shown that most of the hived off companies are of the latter type. A large proportion of Swedish and Nordic hived off companies are part time companies, which means that their employment effects are limited (NordRefo 1993, Olofsson & Wahlbin 1993). A study of rapidly growing companies in Sweden made in 1992 showed that companies that were hived off from universities and university colleges generally remained small (Uhlin et al 1992). The rapidly growing companies had their origins instead in another company, often a major group (Ahrens 1992).

Studies made in the 1980s of the international high-tech growth regions have arrived at similar results. No more than 17% of the new high-tech companies in Cambridge were started by university people. On the other hand, most of these companies had links to the universities in such away that they were hived off from companies that were themselves formerly hived off from the university. Studies of Silicon Valley have drawn similar conclusions. Only 3% of the companies that were established there in the 1960s were started by persons that came directly from the university (Segal Quince 1985, Miller & Cote 1985, both referred in NordRefo 1993). German experience also points in the same direction.<sup>4</sup>

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<sup>4</sup> "But universities and entrepreneurship are difficult to combine, according to Peter Weingart, professor in sociology at Bielefeld University. The "transfer offices" established at the university to bring out technological innovations on to the market have not achieved much. There is a considerable cultural divide. The informal transfer of technology is nine times greater than the formal." (Article on SISTER's annual conference published in Universitetsläraren no 10/2003).

The great visions in respect of the hiving off of high-tech growth companies from universities have, in other words, only been realized to a small extent. This is also confirmed by official statistics of new companies in Sweden. Of the 37 430 new companies that were started in 2002, only between 2 and 3 per thousand were a result of research and development work pursued by universities and university colleges (ITPS 2003).

A number of hived off Swedish companies can be described as medium-size but there are few, if any, examples of a company that has grown to a substantial size. Several reasons had been presented for this. One is that many of the researchers that start companies do not have any ambition to allow the company to grow. Many want to remain at the university at the same time as they want to have a small sideline occupation. Another explanation is the risk capital required. A third long-term explanation is that direct hive-offs of commercial activities from universities are in sharp contrast to traditional academic ideals. Apart from the above-mentioned American Stanford and MIT, whose cooperation with industry started in the beginning of the 1900s, two European equivalents usually are mentioned Cambridge in England whose first hived off company was established in 1881 and Grenoble in France, whose cooperation with the hydro power industry started at the end of the 1800s (Guldbrandsen 1995).

The above-mentioned studies of Cambridge and Silicon Valley indicate that even there the scope of direct hive-offs is limited. However, the results can be interpreted in such a way that a culture of cooperation has come into being over several generations of researchers and companies, i.e. a considerably more complicated interaction than that formulated in the simple hive-off vision. If a culture of this type can be established, it can hardly be possible to maintain those parts of the academic ideal that advocate separation from society in all other respects. The examples indicate accordingly that it takes a long time to build up social capital with trustful relations and (at least partly) common values among the academic world and trade and industry. This can be the reason why the “simple” measures do not give the desired rapid results.

As pointed out in the beginning of this section, there are few successful examples internationally that have had an extremely powerful impact throughout the world, and science parks in particular have been seen as the method for ways in which universities can be the regional motors of growth. The world famous examples must however be seen for what they are: brilliant exceptions against a normal background in which the universities and university colleges have certainly had growing importance in their regions, but this importance lies more in demand and labour market effects and general social cultural effects than in the creation of new industries through their research. In a study of universities and university colleges in northern Scandinavia, including the successful example of Oulu, made in 1993, it was stated that “science parks are populated in the first place by relocated units from established companies. Only 25% to 30%, on average, of the companies that are in science parks are newly established independent companies. In many cases units of public agencies or university functions are the major tenants in the parks. One common factor among the tenants in the science parks is that they only have limited contacts with the research that is taking place at the nearby university or university college” (NordRefo 1993, our translation). An international analysis made at the same time indicated that most science parks did not live up to the expectations that existed when they were established (Massey et. al 1992). A Swedish study of 140 companies associated with research showed that “recruitment advantages” constituted by far the most important reason for establishing a presence in a science park (SOU 1996:89). There can thus be a risk that the high expectations in respect of the expansion

of universities, science parks and so on, have the effect that they will appear to be failures when the investments are eventually evaluated.

## 5. Knowledge spillovers

While location and spin off effects can be measured directly by asking the companies in a spatially limited area, other methods are required to measure the indirect knowledge spillovers generated by the universities. The knowledge created through university research has the character of public goods, which companies can benefit from. One reasonable assumption is that this effect diminishes with distance. These assumptions have been tested in a number of American studies.<sup>5</sup>

One of the studies referred to most in this field is Varga (1998) in which the links between the costs of university research on the one hand and innovations on the other are studied at regional level in the USA. Varga's study shows that both product innovations and companies' investments in R&D are strongly limited to two major regions: California and the North Atlantic coast. Government-financed university research is also largely concentrated to these regions. Varga selects 125 metropolitan statistical areas (MSAs) and he finds support for the notion that a critical mass is required if university research is to result in innovations. The relationship between the two variables is only strong in metropolitan regions with more than one million inhabitants and more than 30 000 students. In regions with less than one million inhabitants, an increase in research investments does not appear to give the same output in terms of numbers of innovations.

The study by Lundquist (2000) referred to above of the research-intensive industries in Sweden in 1996, gives results that can be given similar interpretations as Varga's study. Stockholm is the only metropolitan region in Sweden with more than one million inhabitants. It is the region that has the largest research resources, but it has nonetheless a considerably larger concentration of research-intensive industry than it should have in relation to its research resources. However, objections have been raised against this interpretation. One is that the regional university colleges hardly had any research resources at all before 1996 (the year that Lundquist's study is based on), and that it can be reasonable to expect time lags of at least ten years before the increases in the resources provided for these university colleges can be expected to give definite results. Another is that successful research can be commercialised (and thus give effects in the form of employment and added value) in other places (for example in the Stockholm region) than the region where the research is done. A third is that aggregated figures of the universities' research resources do not take the focus of the research into consideration and that also, among the technical research activities, only a few areas can be expected to be of importance for the research-intensive industries (Andersson 2000).

Two studies presented recently in the USA and Sweden also arrived at partly other conclusions than Varga. Goldstein & Renault (2003) have studied the importance of the universities for the economy of regions, measured as the annual income of wage earners in all USA's 312 MSAs between 1969 and 1998.<sup>6</sup>

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<sup>5</sup> See, for example, Acs et al (1992, 1994), Adams (1990), Jaffe (1989), Mansfield (1995), Nelson (1986).

<sup>6</sup> Five MSAs were excluded due to their size or peripheral localisation: Chicago, Los Angeles, New York, Anchorage and Honolulu.



The period of the study is broken down before and after 1986, since the middle of the 1980s constituted a turning point in the role of the American universities. With the support, for example, of state bodies the universities started at this point in time to invest in the commercialisation of research results on a broad front, by taking out patents, licensing, starting up incubators, research centres and risk capital companies. The effect of the universities on the economy of the regions should thus be stronger during the latter period.

This hypothesis is also supported by the results of Goldstein & Renault. In the first place, it is expenditure on R&D and whether the region has a research university that is among the 50 largest, that show a positive significant relationship with incomes. During the earlier period, average income mainly had a covariance with the general economic situation outside the university. Another result is that the covariance of population of the region was positive in relation to average income regardless of the size of the university, and that the existence of research universities in the small regions was considered to be able to compensate for small population size. Despite these results, the relationship between the universities and average incomes is weak. A considerable increase in research budgets would only give a small increase in incomes.

Andersson et al (2003) has studied regional economic effects of the expansion of the regional university colleges in Sweden between 1985 and 1996. Their study has production and average productivity at municipal level as dependent variables. A breakdown between municipalities with established universities and those with new university colleges/universities showed, perhaps little surprisingly, that the municipalities with established universities had higher average production and productivity than other municipalities. However, they also found that the marginal effect on production of increasing the number of researchers in municipalities with new university colleges is approximately ten times greater than a corresponding increase in the municipalities with established universities. Where the number of students is concerned, their results showed that the marginal effect on production is three times larger in the municipalities with new university colleges.

A recently published study by Fisher & Varga (2003) investigates the relationship of university research with patent applications in 72 Austrian regions with the aid of economic and statistical methods. As opposed to the other studies referred to here, they used data that had been differentiated in a number of research areas and high-tech sectors. There is a clear spatial relationship between research expenditures for a number of selected technical and natural science disciplines and patent applications of high-tech industries.

Both the studies made by Goldstein & Renault (2003) and Andersons et al (2003), as well as the studies made by Lindquist (2000) Sörlin & Törnquist (2000), Varga (1998) and Florax (1992), are completely or partly based on aggregated data without any differentiation of, for example, any type of research expenditures or the focus of education. The fact that the results of the studies, and not least the interpretations of the results, differ considerably is a clear indication that approaches with a macro emphasis should be based on more highly differentiated data in the future. The results of Fisher & Vargas (2003) support this conclusion. It is also clear that studies that ignore all parts of the long and complicated cause and effect chain from undifferentiated higher education expenditure to gross regional product can only provide general indications of the regional importance of the university colleges. In many ways their role can be to inspire, but definitely not to replace, studies with a micro emphasis of the links in the assumed causal chain between universities and growth.

## 6. Swedish universities in a transition period. An analysis of the obstacles to Mode 2 knowledge production.

The review made here has provided a few examples in which universities have obviously contributed to the growth to a town or a region. This seems to apply in cases where the university has been given an initial advantage in the form of special “monopoly” for higher education on regional grounds, or education programmes that have been provided at the right point in time and thereby contributed to regional expansion of industry. Apart from these successful examples, there is not much support for the thesis that universities are the great growth motor for national or regional growth.

The effects of universities reported and discussed above are mainly of Mode 1 character, i.e. they arise through the universities performing their traditional missions of education and research. On the other hand, requirements in respect of cooperation can be seen as a demand that the universities shall proceed towards Mode 2; that the universities’ activities shall be governed to a greater extent by the needs of society. While the effects of university colleges taken up above have often arisen spontaneously without deliberate strategies on the part of the university college or other groups, cooperation requires, if it is to be successful, well-considered action on the part of the universities and those that they are expected to cooperate with.

Since Sweden has chosen to concentrate its research resources to universities and not to research institutes, it would be reasonable to expect that the Swedish universities perform the tasks that research institutes perform in other countries, i.e. that they also pursue applied research in cooperation with industry and other parties. In an investigation linked to this study, the Swedish Institute for Studies in Education and Research (SISTER) made a review of cooperation at twelve selected universities and university colleges in June 2003.<sup>7</sup> Some of the results of the survey are summarised below:

The status of cooperation appears to be given high priority on the basis of how it is presented on the websites of the universities/university colleges. With one exception, all had clear links to websites that take up the task of cooperation.

According to the decision of Parliament, each university/university college shall draw up an action programme for its cooperation mission in which it shall report what it is doing to fulfil its assignment. However, an action programme of this type could only be found at five of the twelve universities studied.

It is more common that the small universities and university colleges explicitly focus on regional aspects in their presentations of cooperation. The larger universities often do not interpret what they mean by “surrounding society”. Their formulations revolve in general around “the national” and “the international”.

Evaluations of cooperation projects appear to be very uncommon.

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<sup>7</sup> The universities and university colleges studied were: Blekinge Technical College, Chalmers, Dalarna University College, Halmstad University College, Karlstad University, National College of Art and Design, Royal Technical College (KTH), Luleå Technical University, Lund University, Mälardalen University College, Umeå University and Uppsala University.

Among personnel at university colleges with long experience of cooperation projects, there is criticism towards transforming cooperation measures into project form. Experience shows that long-term sustainable financing of cooperation activities is necessary. Government agencies that grant appropriations usually lack responsibility for the long-term perspective and there seem to be few projects that have succeeded in creating their own sources of finance after the end of the project period.

One conclusion of the studies referred to above is that the universities and university colleges in Sweden have cooperated with society in many respects for a long period of time. Concrete cooperative measures, for example research and studies into the problems of the region, science parks and other measures for hiving off activities, existed and increased in scope before 1997. In other words, the universities appear to have been sensitive to the demands of society. Nonetheless, the government does not appear to be satisfied. Political influence over the universities has increased and demands in respect of cooperation have been laid down in legislation.

The foremost explanation is probably the increasingly stronger focus on growth as the goal of the policy. The increasing interest in growth has placed the role of universities in focus. The labour market of the knowledge society is considered to require an increasing number of people to have higher education. To an ever-increasing extent, university research and education have started to be seen as a driving force for new innovations, new companies and new employment (see, for example, Nilsson & Uhlin 2002).

The growth perspective has led to new implicit and explicit demands on university research. While the amounts available for the universities to distribute themselves, the so-called faculty appropriations, have remained unchanged at a fixed monetary level during the last decade (Sandström 2003), the increase has taken place in the form of research council funds and sector research funds. This can hardly be interpreted as anything else than a lack of faith in the ability of the universities to distribute the funds or, to put it more positively, as the intention of the donor of the funds, i.e. the government, to direct resources to the areas it wants to give priority to.

In principle the question is whether the state and other research financiers should have the right to direct their funds to the areas they want to give priority to or whether the university itself is more suitable to allocate research resources. No one can deny that there are democratic arguments that political control is reasonable. Parliament and government shall implement the policies on which they have been elected in different policy areas. In this respect, education policy is no exception.

A possible interpretation is therefore that central government, despite an existing increase in the degree of cooperation, gave prominence to cooperation as a mission on the same terms as education and research, since it was not satisfied with the speed of this development, or wanted to clearly indicate that cooperation should be developed into something more than it had been hitherto, mainly formal measures of cooperation. An interpretation of this type is in line with the notion that one of the main advocates of Mode 2 in Sweden, Göran Brulin, has presented. According to Brulin, the work of universities should be changed in three decisive ways if the third mission is really taken seriously:

Research should cease being based on theory and be based on practice instead.

There should be an emphasis on absorption instead of innovation. “The absorption of new ideas and imitation of good solutions often means more for the development for a region or a country than basic research and new discoveries” (Brulin 1998, p 36).

The cooperation mission must affect both the basic education programmes and research programmes at universities. The primary task is not longer to educate civil servants but to liberate a horizontal development dynamism.

To what degree then is this in line with the autonomy that most people in the academic world experience as being threatened by government control, theoretically supported by Mode 2 arguments?

It would be a misconception to believe that the universities of the 1800s, under the influence of Humboldt’s ideas, were completely screened off from other parts of society. While the forming of individuals’ personalities was, according to the ideal, a primary purpose, the universities constituted strong institutions for the preservation of society. They stood above different interests of society but, at the same time, secured the continued existence of the general interests of society and government. The knowledge supplied by the universities of the 1800s was thus, to a great extent, ideologically coloured knowledge. The universities’ training of priests and public officials constituted a central component in the formation of the myth of the national state, in Sweden and in other parts of Europe. In this respect there was thus, even in the 1800s, intimate cooperation between universities and society.

The process of transition of the universities from ideological fosterers of public officials to practitioners of science in the modern sense of the term was a long and drawn out process which was expressed in different ways in different countries and in different disciplines. In general it was the natural sciences that started to formalise the scientific methods in the universities by testing hypotheses through experiments that could be repeated. In the humanities, in the core subject of history, the “revolution” was started in Sweden with the breakthrough of Weibull’s source criticism, inspired by France, at the start of the 20<sup>th</sup> century. When, in the 1930s, Karl Popper formulated the requirement it should be possible to test scientific theory empirically - and thus it should be possible to falsify - it was given an importance that can hardly be overestimated.

In many respects, the scientific ideals that have guided post-war universities have had more in common with Popper than with Humboldt. It is by applying these ideals and, at the same time, having a critical approach to the interests of both the government and other stakeholders in society that the universities and research have acquired the confidence and trust they enjoy today. Now that the government has increased its political influence over the universities in some areas and has made stricter requirements in respect of cooperation with other parts of society, it is hardly surprising that this is regarded by universities as constituting a risk that they will be forced to give up their ideals as independent and impartial seekers after truth.<sup>8</sup> At the same time it is, as pointed out above, entirely reasonable from the democratic perspective that political control also includes the education and research policy. They are no *a priori*

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<sup>8</sup> For one of many examples see Rotstein (2000, p. 65). “For research nothing is more important than autonomy. Without this it is not possible to pursue either critical or useful research. The free searching for new knowledge is of central importance, without it research and higher education are reduced to a soulless form of evaluation that repeats already established conceptions and legitimises the established power’s hegemony over our thinking. Neither cultural life and democracy nor trade and industry are served by controlled research. The academics, including the management of my own university, that have actively participated in undermining the autonomy of research, may therefore bear their disgrace.”

arguments that higher education and research should enjoy autonomy that other sectors lack. The fact that there may well be good reason to discuss the actual content and effects of the decisions that are taken on increasing political control of the universities and increasing cooperation is another matter.

If the universities are to function as an effective resource in a new growth and innovation policy which Sweden and other parts of the west world seek, it is necessary that they accept their partly new role. On the other hand, it is necessary that politicians and bureaucrats accept the universities' need of a special type of autonomy that can enable them to pose questions, to be innovative, and to play their expected role in the growth policy. The problem can be expressed in terms of a lack, to a large extent, of social capital adapted to the new function that the government wants the universities to have. This lack of the "right" sort of social capital is not only to be found between universities and other stakeholders and levels in society, but also between university management, which must take both external and internal requirements into consideration, and the universities' teachers and researchers who are primarily striving to preserve their relative independence.

The universities have built up their strong position by maintaining a special position in respect of objectivity and scholarship. While the government that, in the 1800s held its own vis-à-vis different social interests, governs today taking into consideration the interests of different groups, science and its institutions have succeeded relatively well in maintaining their position as objective seekers after truth. For generations they have fostered researchers in the scientific ideals and built up a strong international intra-academic social capital with common norms and strong internal links. One of these norms has been integrity and the reluctance to accept external influences. The universities themselves have selected their research problems and have designed their teaching themselves. Those people who were doing the research in each sector accepted the emergence of sector research funds, since they meant more resources and did not require changes to methods and/or other external considerations.

On the other hand, the production of knowledge according to Mode 2 involves a clear break with the role that the university has successfully built up. It means that universities are forced to take external factors into consideration in respect of posing questions and methods; that research focuses on both theory and application; and that its quality and utility is also be the subject of external assessment. Put briefly: the universities would be forced to abandon their position of being "above" the interests of society and to become a stakeholder, certainly a stakeholder with special skills, but nonetheless a normal participant among other participants in the public sector and trade and industry.

It is hardly surprising that there is opposition in universities to developments of this type. Most people working in universities do so since they want to work with research and teaching. Most people with action-oriented interests most likely choose other occupations, but those who are to be found in universities probably often apply for posts where they have a great number of contacts with other sections of society. It is probable that the requirements in respect of cooperation meet greater understanding among those who are already involved in cooperation of this type in formal and informal networks and bodies. On the other hand, the fact that a university officially supports the idea of cooperation and takes measures for cooperation cannot necessarily be seen as an expression that its personnel do so.

The predominant method used by the universities to deal with the requirement for cooperation has been to establish special bodies, such as cooperation offices, holding companies, technical

foundations and science parks, with special personnel. This can be seen in itself as an expression of the difficulties in integrating the cooperation mission into the ordinary activities of the university institutions. Individual researchers usually lack the incentive to add a further task to their research and teaching. "Cooperation" does not give any academic qualifications. One alternative would naturally be to make financial incentives possible for cooperation. The potentially simplest type of cooperation for teachers/researchers – and for which there are financial incentives – namely private consulting work, is however usually in conflict with university rules for sideline occupations. Therefore, in principle, there are only negative incentives, for example a lack of research funds, which can make cooperation an urgent necessity. A basic change in the incentives structure is therefore probably absolutely necessary if cooperation is to be developed into an integral part of university activities.

There is also reason to examine the foremost stakeholder that is the driving force behind cooperation, namely central government, and what it has done, and not done, to achieve its ambitions. A critical examination of the actions of central government could be interpreted in such a way that even if it wanted universities to be driving forces for national and regional growth, it does not know how this should be done.

R&D's share of GDP increased from 2.8% to 3.8% between 1990 and 2000. The establishment of the research foundations for the so called collective wage-earner funds and the reorganisation of the government research councils have enhanced the possibility of directing research funds to politically desirable areas. Concrete results in the form of spin-off effects, or regional or national growth, as the result of these initiatives have however not occurred yet.

With the possible exception of Karlskrona/Ronneby, the expansion of the regional universities in Sweden has not had an obvious impact on regional development. The responsibility for universities, including its third mission, lies with the Ministry of Education (and where the University of Agricultural Sciences is concerned, with the Ministry of Agriculture), despite the fact that the third mission, with the present focus on growth, is to a very high degree an industrial policy issue. With the exception of the establishment of a government delegation for cooperation, with a budget of SEK 50 million per year for the period 2002-2004, the Ministry of Education has largely delegated the responsibility for the interpretation and implementation of the third mission to the universities themselves. On the other hand, in the industrial policy field, the National Agency for Innovation Systems, with its annual appropriation of slightly more than SEK 1 billion, has in practice become the leading figure and financier of the universities' cooperation activities, since a substantial proportion of its resources are allocated to regional innovation systems and triple-helix projects.

At the regional level, the growth agreements/growth programmes, under the management of the county administrative boards or the regional self-government bodies and often with co-financing from the EU's structural funds, constitute a platform for cooperation between universities and other parts of society.

The central government strategy for the promotion of cooperation between universities and other parts of society consists, in other words, mainly of financing selected projects. A strategy of this type meets at least two problems that must be overcome:

The cooperation mission consists of a number of different measures and activities of which some, without any doubt, should be run in project form while others in all likelihood should

have more of a long-term focus. If the “infrastructure” for the projects also consists of associated projects that are limited in time, the continuity of cooperation is put at risk, and there is a risk that links that have been established will be dissolved and that the attitude towards cooperation among the parties concerned will deteriorate when there is a lack of finance for essential infrastructure.

In terms of social capital, the strategy can be described in such a way that, with its financial incentives, it has the aim of changing attitudes towards cooperation and establishing and strengthening links between universities, industry and the public sector. In other words the measures focus on the *external* links of the universities (and other parties involved). The problem with the generally negative incentive structure *in* the universities towards external cooperation and the general social capital in the universities is not tackled with this strategy.

Of these two problems the one-sided project focus is the easiest to rectify. Allocating funds to a structure for cooperation is, in principle, merely a budget allocation issue. On the other hand, the ways in which the universities’ internal social capital should be changed in a desirable direction from the cooperation perspective requires an in-depth discussion.

The first question that must be posed is whether the advantages of changing the universities’ internal social capital really outweigh the disadvantages. What would be lost if the universities took on their social mission in full? The answer from those who currently defend the independence of universities would probably be they would lose the role that is so important for democracy, i.e. that of independent examiner and critic, and thus democracy would be undermined. There would be a risk that the established scientific approach with its theoretical research would be replaced by one-sided practice-oriented study activities. At worst the universities could lose their reputation as independent bodies that always seek after the truth and be transformed into a consultant among all the other consultants that present the results the financier wants to have. The focus on results that have a commercial application could lead to extensive new priorities that would affect the humanities and social sciences, but also to a situation in which commercial applications were given considerable priority over technological-scientific basic research that is at a stage that is a long way from possible future commercialisation.

Accordingly, the misgivings can be summarised in the following way. There is a risk that universities, if they give full emphasis to the cooperation mission, will be transformed into national or regional institutes for technical-economic consulting services and for the commercialisation and application of research that, to a large or small extent, is being done elsewhere. Thus many of the values that are traditionally associated with universities would be lost, including their position as independent bodies, which constitutes the foundation of their position as free seekers after truth.

However, the question is whether this interpretation of the consequences of the cooperation mission is the only possible interpretation. Can it be the case that both the advocates and the critics are both right in their own way – although they are also wrong? If so, the mistake they make is that their points of departure are their own disciplines and research orientation and they forget the diversity of objectives, research tasks and methods in Swedish universities. A cooperation mission with a growth focus *can* entail a number of problems for the social sciences and humanities. As mentioned above, it can partly entail cutbacks since the contributions made by these disciplines to economic growth are often difficult to prove. And partly there are, without doubt, very good reasons to maintain that there is a risk that the

disciplines that scrutinise and investigate society and those in power (which many subjects in the humanities also do) would end up in a situation of dependence if, at the same time, they pursue active cooperation with these parties and if these parties increase their influence over the universities. Extensive cooperation *can* thus have negative consequences on both education and research resources and academic quality in the social sciences and humanities, and on democracy in society.

At the same time it must be said that these negative consequences are definitely not automatic. Cooperation with other parties should, in general, increase access to education and research resources and information. The risk of a negative situation of dependence on parties in cooperation can be counteracted with discussions and training programmes in research ethics and integrity. Where society is concerned, these parties also have a great need of having research done into specific problems. This has been clearly demonstrated by the growth of sector research.

Active cooperation with external parties is already an established tradition in large parts of technical, scientific and medical research. For these disciplines, cooperation often leads to more resources, better access to various types of information, and better opportunities for empirical observations and experiments. As in the case of the social sciences and humanities, there is naturally always a risk that a situation of dependence may arise, that inconvenient research is not initiated, or that embarrassing results are not published in order to protect future financing. It is necessary to have – and there are – resources for independent research.

Also from the perspective of society – central government, industry and the third sector – the positive effects of cooperation with technology, medicine and science are obvious where welfare and growth are concerned. The problems from the perspective of society are rather that there is not enough cooperation. Cooperation is mainly with large, well-established parties and their contributions to the creation of new business are weak. Research does not reach far enough and is not sufficiently transformed into commercial innovations.

The above discussion – which shall naturally be seen as a hypothesis rather than proven truths – could end up in the conclusion that, in many respects, there is a win-win situation in increasing cooperation between universities and society. However, the design and scope of cooperation must be able to vary considerably between different disciplines. The demand for cooperation for growth may not be permitted to have a negative effect on the role of universities as upholders of culture and on subjects with weak links to growth. Nor may cooperation naturally come into conflict with the academic ideal of seeking after truth.

The large majority of people in the universities probably agree in theory with this formulation of their cooperation activities. However, in practice there is opposition since an increase in cooperation would mean that other personnel than those in the special cooperation bodies would be drawn in. For many this would require changes in both working duties and in internal and external contact networks. For universities as a whole, acceptance in practice of the cooperation mission would require changes in their formal and informal valuation and incentive structure, and of standards and attitudes on the role of universities in society and their internal work, in brief of their social capital.

The last mentioned change can only be regulated or administered to a small degree from above in all types of organisations. In universities with their strong tradition of individualism



and independence, this would probably be particularly difficult. A possible method on the part of central government would naturally be to link an increasing proportion of research resources to research in cooperation with other parties in society. However, there are several problems with a compulsory strategy of this type. It would probably create frustration and ill will towards cooperation in the academic world and the incentive for industry to become engaged in cooperation under such premisses would be small.

The misgivings expressed by Rutten and Boekema (2004) - that the universities will be marginalised and lose resources if they are not capable of adapting to new demands for knowledge in society – would appear to be extremely improbable in the foreseeable future in Sweden. Academic research still has high political status. How the academic world will be successful in defending their appropriations in competition with other producers of knowledge and social interests in the future is, however, impossible to say. Nonetheless, it is probable that the experienced utility to society of the universities will be of significance in this competition.

Accordingly, society can use both the whip and the carrot to increase the participation of universities in knowledge production of Mode 2 type. However, a change in the universities' internal social capital can only be achieved by their teachers and researchers and it will only take place if they feel that it would be to their advantage in their profession. Naturally, a change of this type will take time and would be facilitated by a common strategy, formulated in an open discussion. The point of departure should be that there is no distinct conflict between the academic ideals and cooperation with other parties of society and that the problems that arise can be solved.

A possible conclusion is thus that the third mission of the universities can, in the long term, come up to the same level as the other two and thus constitute an important element in the development of Mode 2 knowledge production, but that it requires resources of both a permanent and project nature, fundamental changes to the universities' formal incentive structure, and changes of the universities' internal social capital.

The discussion in this section has only been from the universities' perspective – which to a great extent is a reflection of the research that has been pursued and which has been summarised here. However, a comprehensive discussion must naturally also include the regional environment with which the universities are expected to cooperate. However, much less research has been done into the importance of the regions for the ways in which cooperation with universities should develop. Nonetheless, one general conclusion seems to be that the regions' absorption capacity, i.e. their capacity to absorb the knowledge, technology and innovations generated by universities, is of decisive importance for the extent to which the universities will have regional effects (Florida and Cohen 1999).

## 7. Issues for further research

In this paper the regional effects of universities have been examined from a number of different perspectives. One definite conclusion is that the results differ depending on the level at which the problems are analysed, the time horizon considered, and the methods used. Another conclusion is that our knowledge in many areas is still very limited. Of the problem areas taken up here, four deserve to be given particular prominence.

The first problem area concerns the universities' regional effects analysed with the aid of economic-statistical models. On close examination, the studies referred to here show very different results. One explanation of the difference in results is probably the highly aggregated level of the studies. Since different education programmes and research fields can be assumed to have very different effects on new businesses, patent applications and other differentiable regional growth variables, there is hardly any reason to expect stable and clear-cut relationships between the regional breakdown of university budgets and the regions' total production or new businesses. Studies of this type quite simply require a better theoretical foundation which clarifies those tasks of the universities that can be expected to have a relationship with certain sectors. If statistically based model studies are to add any new knowledge, they should thus accordingly be based on much more data differentiated by subject area on the mission of university education and research, as well as more dependent variables differentiated by sectors.

The second problem area concerns the role of size in regional investments in higher education. In Sweden, the region effect has been most noticeable in the medium-size university towns, i.e. Uppsala, Lund, Umeå and Linköping, which have all had unbroken growth for a long period of time, but the effects should not be insignificant in Stockholm (with almost 25% of the employees working in higher education in the country) and Gothenburg (with 15% of the employees). The relatively smallest university of the six major universities, Linköping, has six per cent of the higher education employees in the country. Luleå Technical University, which has most personnel of the other universities, has less than half the proportion, and the town of Luleå, like other towns with small universities, has had much weaker population growth than the established university towns. This problem area also has the tendency that it is easier for the metropolitan regions and the established university towns to retain new graduates and to attract other persons with a higher education than the regional universities. The universities have undoubtedly effects on important factors such as the structure of the regional labour market and well as the supply of culture and recreation. The last mentioned must be seen as central components of the social capital of civil society. The amount of resources required for investments in universities to lead to regional self-reinforcing processes and the existence or not of a "critical mass" that must be reached, and the extent to which the growth of the successful universities takes place at the expense of others, are politically sensitive issues that should be the subject of research.

The third problem area concerns the regional effects of specific measures taken by the universities and other regional stakeholders to strengthen cooperation between them, or to put it another way, the universities' *external social capital*. This is a matter of the scope, content and timing of the measures. Nilsson (2002a) has, for example, emphasised the importance of taking the right initiative before anyone knows it is right, i.e. the importance of not investing in yesterday's winner. Oulu and Karlskrona/Ronneby appear to be the best Nordic examples of this. This area also includes the "absorption capacity" of the regions, i.e. their capacity to assimilate the students, knowledge and research that the universities produce.

The fourth problem area concerns formal and informal incentive structures, standards and values and the networks they create (and do not create) in universities, i.e. the universities' *internal social capital*.

A reasonable hypothesis is that the last two problem areas are interrelated, that in both cases there is a lack of social capital in the form of sufficient links and common values between the universities, trade and industry and the politically governed sector to enable the political goals

of knowledge production of Mode 2 type to be achieved. A discussion of research needs in these areas can be held with the aid of Figure 1.

Figure 1. The universities' social capital broken down into different component parts.

Internal social capital	External social capital		
Links/relations charged with attitudes, norms, traditions etc. that are expressed in the form of: - "Spirit" - Climate for cooperation - Methods for renewal and development, conflict solution etc. - Incentive structures	Related to education and research	Related to the environment	Related to the market
	Links/relations to research and education financiers, users of research, external researchers and other cooperation and development partners	Links/relations to the local/regional environment, to decision-makers in the public sector etc. (Lobbying capacity, etc.)	Universities as a trademark and other general relations to stakeholders with whom there is no direct contact.

Source: Application of Westlund (2003).

The universities' internal social capital was discussed in section 6. The conclusion drawn was that changes in internal social capital can only come about if it is to the advantage of teachers and researchers. If cooperation with other parts of society should mean, for example, better salaries, more research funds, and academic qualifications, it is probable that changed attitudes would lead to a greater interest in building links to stakeholders outside the universities. In principle no research has yet been done into attitudes and relations in universities and their importance for building links and relations. In this respect research on companies is much more advanced than research on universities.

If we go over to the universities' external social capital, it is the education and research related capital that is usually mostly associated with the discussion on cooperation. In this perspective, effectiveness and successes for innovation systems, clusters and triple helix cooperation are linked to the structure and content of the social capital that is related to education and research (see, for example, Garlick (2000) and Kim, Ohlsson and Sandström 2001), but it is quite clear that many fundamental facts have not yet been compiled. There are, for example, no studies of the resources that universities invest in cooperation and – not least important – what their effects are. In this context, studies of the regions' absorption capacity are also important. In these areas also research on companies is considerably more advanced.

The social capital of the universities that is related to their environments (i.e. not that which is directly linked to education and research) includes the participation of the personnel and the students in formal bodies and networks of a less formal nature. It also includes the role of the universities as creators of attractive urban environments with a wide selection of culture and recreation facilities. In none of these areas are there any investigations of how, and to what extent, the universities interact with their environment and the effects of this interaction. The same applies to the market-related social capital of the universities. The universities participate in a market place where they compete for students, personnel and financial resources. In principle, the universities act in these areas like companies and invest in various types of marketing activities. Also in this respect there is a lack of basic knowledge.

The conclusion is that the universities' intentional and unintentional investments in social capital in all probability have a decisive effect on their cooperation with other parts of society and thus their effects on regional development. Hitherto, however, we know very little on the scope and the effects of these investments.

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