

University of Aarhus – the Stepping Stones

Abstract

The University of Aarhus has more than 20,000 students, making it the second largest university in Denmark. It is also the second-oldest multi-faculty university in the country, and is celebrating its 75th anniversary in 2003. Like the other Danish universities, the University of Aarhus is currently facing major challenges. Changes in the Danish University Act and a strong political wish for closer partnerships between the private business community, the public sector and the country's universities have gradually altered the role of the universities in Denmark today.

This paper looks more closely at the history of the University of Aarhus, the importance of the University for the Aarhus region, and the opportunities and barriers facing an “old” comprehensive University in its attempts to adapt to the new role of universities in the knowledge society.

Introduction¹

The University of Aarhus can celebrate its 75th anniversary in 2003, making it the second oldest multi-faculty university in Denmark². The University was founded on 11 September 1928. The foundation of the University had been preceded by 10 years of disputes about the location of the second university of Denmark. The disputes involved the other cities – Viborg, Sønderborg and Kolding – that were candidates for the location of the Jutland university, opposition from the University of Copenhagen and arguments with the Danish Government, which did have a positive attitude to the creation of a new university, but was unwilling to contribute to the running of the university.

The battle for the establishment of the University started in 1919, when a committee was set up under the Ministry of Education for the purpose of evaluating whether there was an actual need for another Danish university. In 1921, the Municipality of Aarhus, representatives of the city's business community and representatives of a number of other institutions in Århus joined forces in a joint organisation “University Association Århus”, which was to be engaged in lobbyism aimed at the public authorities. One of the objectives was to ensure that the Municipal Hospital in Århus could be positioned as the leading hospital in the provinces, which could only be achieved through the creation of actual study programmes in medicine.

Not until in the autumn of 1925 did the government committee reach the conclusion that there was a need for a new university to ease the pressure on the University of Copenhagen. A majority on the commission favoured Århus as the location of the new university. However, it was established that the State could not fund either the start-up or the running of the university.

¹ The introduction is based on the University of Aarhus' own report, which is available at www.au.dk. Cf. Lykke, P. (2001).

² Cf. Ministry of Science Technology and Innovation. (2003).

The co-operation between the Municipality of Århus and the business community in Århus had to be activated yet again, this time in an attempt to create a sufficient economic basis for running a university. In 1927, the final plan for the start-up of the University was presented on a modest scale compared with the ambitions. Finally, the Government could announce in 1928 that Århus could commence offering university degree courses for a trial period of 3 years, provided that this did not have any negative impact on the Budget.

This was the beginning of a long incremental development process from 4 employees, whose salaries were paid by the Municipality of Århus, and 78 students in the first semester to a comprehensive classic university with five faculties, just under 22,000 students, a total staff of 3,000 employees, 1600 of whom academic staff, in 2002.

During the first 3-year trial period, the University was primarily locally funded, but with the passing of the Danish University Act of 1931, it was decided that the State was to fund operating costs and administrative expenses, provided that the University financed all capital investments and expenditure itself.

Five years after the foundation of the University, i.e. on 11 September 1933, His Majesty King Christian X could inaugurate the new university buildings and name the University: Aarhus Universitet – University of Aarhus.

This funding model was maintained right up to the 1940s. Under this model, the State was responsible for operating costs and administrative expenses, whereas the construction of new university buildings was solely to be financed by private funds generated by University Association Århus. This special local support also meant that both the Municipality of Århus and the University Association were represented on the Board of the University of Aarhus right up to 1970.

The gradual development has been described in the University of Aarhus' own account of its history and consists, in brief, of the establishment of the Faculty of Arts and the Faculty of Medicine in 1935, the Faculty of Economics and Law in 1936, the Faculty of Theology in 1942 and, finally, 26 years after the establishment of the University, the fifth faculty in 1954: the Faculty of Science.

The reason for the lengthy period of establishment until the University had achieved the status of a comprehensive university was primarily the State's unwillingness to fund the establishment of more than one faculty at a time. During this period, the number of students increased gradually and passed 5,000 students in 1965. Only five years later, in 1970, the University had 10,000 students, and the number of students passed 15,000 in 1977.

The Århus region

With its just under 290,000 inhabitants, Århus is the second largest city in Denmark. The city is located in Eastern Jutland in the County of Århus, which, with 645,000 inhabitants, is the largest county in Denmark. The Municipality of Århus is also one of the areas in Denmark that has seen the largest population growth in the past 30 years. This distinguishes Århus from the Greater Copenhagen area, which has seen an actual decline in population in most of the same period, cf. Table 1.

The population growth in the Århus region has been above the national average throughout this period, but while the rate of growth was slightly higher at county level than at municipal level in the 1970s and 1980s, the Municipality of Århus was the driving force behind the increase in population up through the 1990s. The Copenhagen area has seen an actual net influx of inhabitants in the past 10 years after many years of marked “emigration”.

Table 1: Development in population in Denmark and the Århus region 1971-2002.

	1971	1980	1990	2000	2002	1971-1990	1990-2002
Denmark	4950598	5122065	5135409	5330020	5368354	4%	5%
Copenhagen	1344219	1214382	1153223	1199470	1209189	-14%	5%
Århus County	534333	573916	597143	637122	644666	12%	8%
Århus Municipality	238138	244839	261437	284846	288837	10%	11%
Århus County excl. Municipality	296195	329077	335706	352276	355829	13%	6%

Source: Statistikbanken (Statbank Denmark). Danmarks Statistik (Statistics Denmark)

The change in settlement pattern in the past thirty years is closely connected with changes in the Danish industrial structure, where, in overall terms, Denmark has moved from being an agricultural and industrial society towards a service society, cf. Table 2.

In the early 1970s, the primary and secondary sectors dominated the Danish industrial structure with just under 40 per cent of the total employment. Up through the 1950s and 1960s, the population moved from the rural districts to the large provincial towns. This trend continued in the 1970s and 1980s together with a relocation of, in particular, workplaces in industry from Greater Copenhagen to the provinces (Maskell, 1986). However, the picture changed up through the 1990s, where particularly the public and private service sectors gained ground.

Today, just less than 50% of the total employment is in the service trades, and, in particular, knowledge-based services such as legal practise and consultancy services, IT services and the like have been seeing constant growth. In the period 1994-2002, total employment in knowledge-based services increased by 55,000 employed persons, corresponding to an overall increase of just over 50%. In the Municipality of Århus alone, the number of people employed in knowledge-based services increased by 6000 in this period, which corresponds to nearly a third of the total increase in employment in the municipality.

Table 2: Industrial structure in Denmark 1971-2001.

	1971	1983	1991	2001
Total Employment	2381700	2540277	2625579	2774671
Agriculture, fisheries, etc.	10.7%	7.5%	5.5%	3.7%
Manufacturing, etc.	28,1%	19,1%	19,4%	16,9%
Building & construction	8,8%	6,1%	5,9%	6,2%
Trade, hotel & rest.	15,9%	16,3%	16,4%	17,8%
Transport, etc.	6,6%	7,1%	7,2%	6,2%
Services	31,5%	43,9%	45,7%	49,1%

Source: Danmarks Statistik (Statistics Denmark). Statistical 10-year summary and Statistikbanken (Statbank Denmark)

The transformation from industrial society to (knowledge-based) service society has, in particular, favoured metropolitan areas, which have been the main driving force behind the economic upswing and increase in employment in Denmark since the start of the economic boom at the beginning of 1994.

The Greater Copenhagen area together with the Municipalities of Århus and Ålborg stand out from the rest of Denmark with a growth rate of more than 10%. This can be compared with a modest growth rate of 4% outside the metropolitan areas. At county level, in both Ålborg and Århus the growth rate has been more on a level with the national average than with the growth rate in the metropolitan areas in this period, cf. Table 3.

Table 3: Development in employment in metropolitan areas and in the rest of Denmark 1/1/1994-1/1/2002, 1994=100.

	1994	1996	1998	2000	2002
Denmark	100	102	104	107	108
Metropolitan areas	100	103	106	110	111
Greater CPH area	100	102	106	110	112
Odense Municipality	100	103	106	107	108
Århus Municipality	100	103	105	110	112
Ålborg Municipality	100	105	108	111	111
Rest of Denmark	100	102	103	104	104
Funen County excl.	100	102	102	102	102
Århus County excl.	100	104	106	107	107
Northern Jutland County	100	102	104	104	104

Source: Statistikbanken (Statbank Denmark). Danmarks Statistik (Statistics Denmark).

At a first glance, the industrial structure in the County of Århus may seem to be very similar to the industrial structure for Denmark as a whole, cf. Table 4. However, the table does not give a completely accurate picture. The difference in industrial structure is generally the same between the Municipality of Århus and the rest of the county as the difference in industrial structure between Greater Copenhagen and the rest of Denmark. The Municipality of Århus is overrepresented within a number of the liberal service trades, in particular within knowledge-based service trades such as legal practice, IT software development, auditing, etc. As mentioned, this sub-sector has seen marked growth in the past 10 years, and here the institutions of higher education have very much been able to supply these service trades with raw material in the form of a workforce with a high level of education and training.

The same applies to the educational sector and the health care sector, both of which are of relatively greater importance to employment in the Municipality of Århus than is the case in both Greater Copenhagen and the rest of the county, cf. Table 4. On the education side, it is, to a certain extent, obvious that the university institutions in Århus increase the share compared with the other regions with a total employment figure of around 3,500 employees at the University and the School of Business alone.

In the health care sector, the University Hospital in Århus – the second largest hospital in Denmark – is of particularly great importance to employment with its around 8000 jobs.³ Added to this is the concentration of nurse's training courses in Århus. The "local" presence

³ Århus University Hospital consists of a partnership between a total of 5 hospitals. The institution is described in further details at its website www.auh.dk.

of educational institutions has been of decisive importance to the filling of vacancies in the hospital sector in Århus.

Unlike these sectors, the agricultural and industrial sectors are underrepresented in the municipality, just as the main difference between Greater Copenhagen and Århus is the overrepresentation of the former in financial and business services as well as public administration.

Table 4: Industrial structure in Denmark, Greater Copenhagen and the Århus region, 2002

	<i>Denmark</i>	<i>Århus County</i>	<i>Copenhagen</i>	<i>Århus</i>	<i>Rest of Denmark</i>	<i>Rest of County</i>
Agriculture, etc.	4%	3%	0%	1%	5%	5%
Manufacturing	17%	16%	10%	12%	20%	21%
Building and Construction	6%	6%	5%	6%	7%	7%
Trade, hotels and restaurants	18%	18%	18%	18%	18%	19%
Transport, telecom, etc.	6%	7%	9%	9%	5%	5%
Finance and business services	14%	13%	22%	17%	10%	10%
Public administration	6%	4%	7%	4%	5%	3%
Education	7%	8%	7%	9%	7%	7%
Health	5%	6%	5%	8%	5%	4%
Other public and personal services	17%	18%	17%	17%	17%	19%
Total	2774671	329577	753857	171721	2020814	157856

Source: Statistikbanken (Statbank Denmark). Danmarks Statistik (Statistics Denmark).

The University of Aarhus and the other educational institutions at university level have consequently had a direct effect on the development of the city in the form of an increase in the number of jobs at the university institutions as well as indirectly in connection with a number of capital investments and the servicing of the institutions in recent years.

Furthermore, the large production of graduates has meant that employed persons in the Århus region generally have a high level of education and training. In the Municipality of Århus, 11% of all employed persons had a university degree in 2002, cf. Table 5. This distinguishes Århus markedly from the rest of Denmark outside Greater Copenhagen, where only 5% of all employed persons had a university degree. If we look at the three large university cities in the provinces, it is worth noting that both Århus and Ålborg have been better able to hold on to its own university graduates or attract university graduates from other areas. Unlike Århus and Ålborg, Odense has been more squeezed in the middle of the country with employment opportunities being better in both east and west.

Table 5: Total employment and percentage with a university degree in Denmark and in various metropolitan areas

	1/1/1993		1/1/2002	
	Total employment	University degree	Total employment	University degree
Denmark	2609859	4.8%	2782306	7.1%
Århus County	303005	5.2%	329577	7.8%
Greater Copenhagen ¹	680916	8.3%	753857	12.6%
Århus Municipality	153977	7.5%	171721	11.3%
Aalborg Municipality	85273	5.1%	94634	8.1%
Odense Municipality	93849	4.7%	100089	7.0%
Denmark excl. Greater Copenhagen	1928943	3.5%	2028449	5.1%
Århus County excl. Århus Municipality	149028	3.0%	157856	4.1%

Source: Statistikbanken (Statbank Denmark). Danmarks Statistik (Statistics Denmark).

¹The Greater Copenhagen area is defined as the Municipalities of Copenhagen and Frederiksberg and the Copenhagen County

Århus is also the number one university city of Denmark, at least in terms of the number of university students per inhabitant. The total number of students who are studying for a bachelor's degree or a higher degree was 25,000 students in 2001, which, compared with the population, is just under 9 students per 100 inhabitants. This is slightly higher than in the Municipality of Copenhagen and the Municipality of Frederiksberg with just over 8 university students per 100 inhabitants. This is also a considerably higher ratio than for the other large university cities in Denmark, Ålborg and Odense, cf. Table 6.

However, in the past ten years, the three largest university cities in the provinces have had a higher growth rate in the number of students than Copenhagen. A trend that shows that there is increased distribution of university degree courses and study programmes throughout the country.

With just below 20,000 students in 2001⁴, the University of Aarhus is the second largest university in Denmark, whereas, with its 6,000⁵ students, the Århus School of Business⁶ holds the same position among business schools in Denmark. This makes these institutions of higher education by far the largest contributors to the total number of students at university level in the Municipality of Århus.

⁴ Cf. Ministry of Science Technology and Innovation (2003), p. 3.

⁵ Part-time diploma students at the business school are not included in the official statistics presented in table.

⁶ The Aarhus School of Business is described in further details at its website www.asb.dk

Table 6. Total number of university students in Denmark, distributed on the location of the universities.

	<i>No. of students</i>	<i>Growth in no.</i>	<i>Students per 100 inhabitants</i>
	2001	1991-2001	2001
Denmark	105005	19%	2.0
Municipalities of CPH and Frederiksberg	48176	15%	8.2
Copenhagen County	4345	-26%	0.9
Odense	9136	33%	5.0
Århus	25034	30%	8.7
Aalborg	8941	35%	5.5

Source: Statistikbanken (Statbank Denmark). Danmarks Statistik (Statistics Denmark).

The combination of a private sector and a public sector specialising in knowledge-intensive industries and a large production of graduates has given the Århus region excellent conditions for growth in the past decade. Quite a good example of these general framework conditions is that the IT sector in the Municipality of Århus alone has just as many employed persons with a university degree as there are in the IT sector in the rest of Denmark outside the Greater Copenhagen area (Nielsen, 2003).

While the importance of the University as a “raw material supplier” to the private and public sectors is consequently obvious, the importance of the University’s direct involvement in the interaction with trade and industry may not be quite as visible, and this is, in many ways, an area that has always had a built-in latent conflict throughout the history of the University.

University of Aarhus 1970-

The history of the University of Aarhus and its gradual development in the period from its establishment and until 1970 were described in the introduction. In the following, the development of the University in the past three decades will be described, with special focus on events that have contributed to linking the institutions in the region, such as the Municipality of Århus, the county municipality, the University and trade and industry, closer together in recent years.

After the municipality and the University Association had been represented on the Board of the University during the first forty years of its existence, this changed in 1970 with the first Danish Local Administration Act. Like the other universities, the University became a State institution. In connection with this change, the University’s autonomy, freedom of research and two-tier system of research and research-based study programmes were maintained and stressed as fundamental elements of the Danish university tradition. This also meant greater separation between the three institutions: the public (central and local government) sector, the University and the private sector.

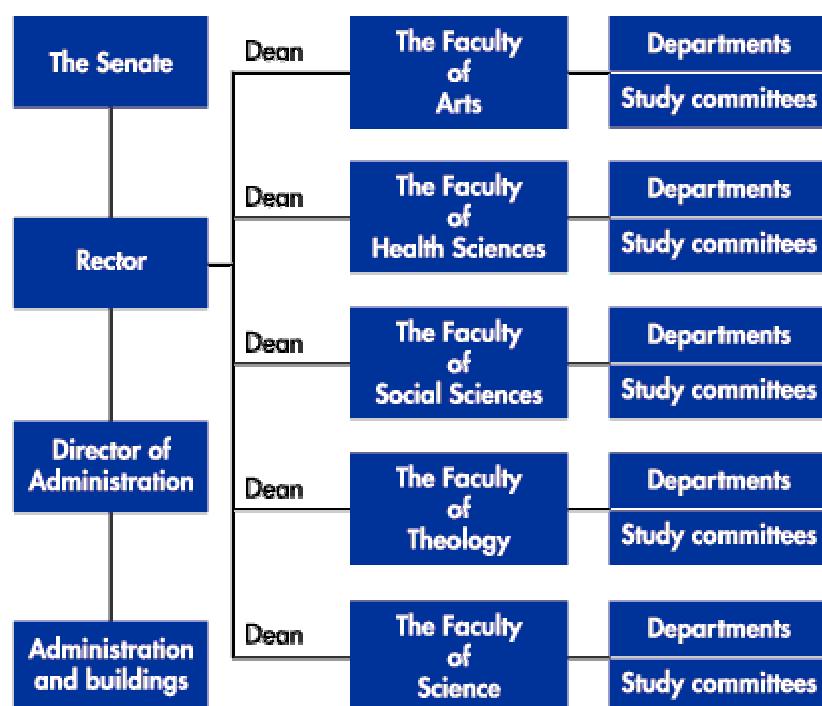
The University of Aarhus’ basis and plans from 1995 describe its mission as being the classic comprehensive university, which subscribes to the continental universities’ latest major

proclamation from 1988⁷. Autonomy and freedom of research as stated in the universities' Magna Charta are consequently the University of Aarhus' official creed, however, with a flavour of the Anglo-Saxon campus tradition, as stated in the University's development contract of 2000 with the Ministry of Education.

The management of the University

The comprehensive university today consists of the above five faculties, which all have extensive autonomy. As early as in 1968, the Faculty of Law and Economics became the Faculty of Social Sciences with the inclusion of Political Science (created in 1959) and Psychology (1968). The gradual development and extension of the University continued during the 1980s and 1990s. The Faculty of Medicine changed its name to the Faculty of Health Sciences when the Royal Dental College became part of the University in 1992. The five faculties and the overall management structure are shown in Figure 1.

Figure 1: Organisational chart for University of Aarhus



Source: University of Aarhus

Development and extension of the University

As mentioned in the introduction, the total number of students at the University of Aarhus increased markedly in the 1960s and 1970s. But with the establishment of the new university in Odense in 1965 and the University Centres in Ålborg and Roskilde, together with, for

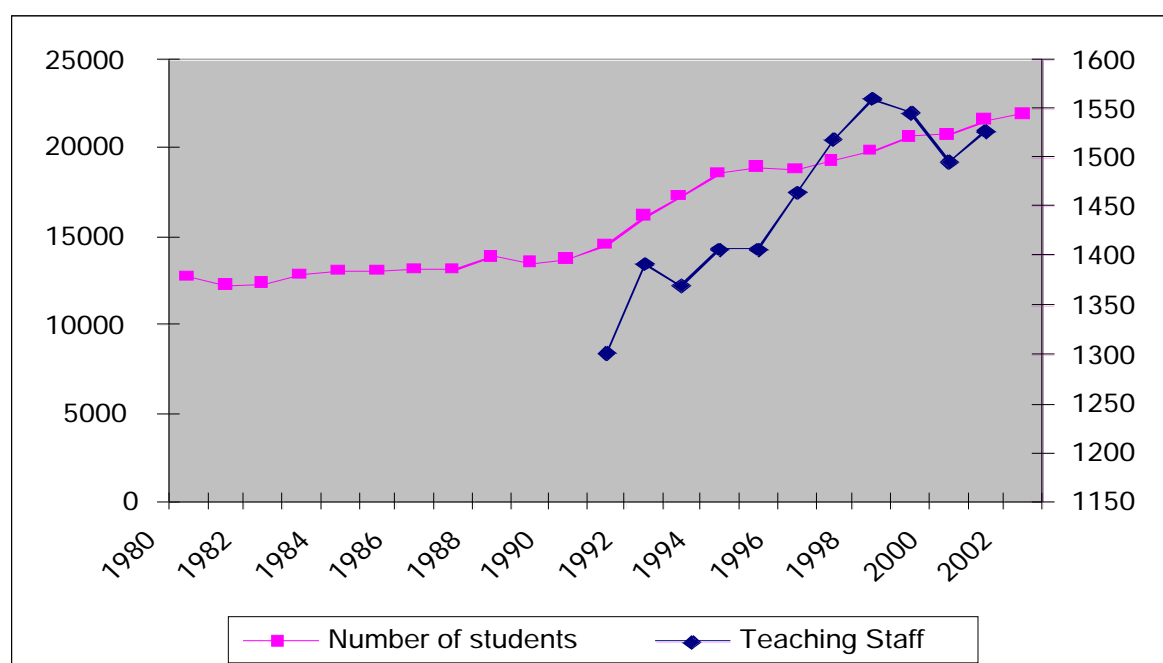
⁷ In connection with the 900th anniversary of the oldest European university and with the prospects of a large single European market in 1992, a number of European universities, including the University of Aarhus, gathered in Bologna in 1988. To mark the independence of the universities, the universities' Magna Charta was drawn up and signed, see, for example, Aarhus Universitet (1995).

example, the expansion of the number of students at the Århus School of Business in the 70ties and the 80ties, the rate of growth decreased and the number of students was maintained at a fairly constant level below 15,000 students during the 1980s.

This development was very much politically determined and was a result of a policy of extensive restriction of admission to study programmes at university level. A large number of young people with an exam that made them eligible for admission were, in effect, prevented from being enrolled in their favourite degree course. Especially for popular study programmes such as medicine, psychology, law and political science, the admission restrictions were so rigorous that less than 10% with an admission-eligible exam could, in fact, be admitted.

With the new Danish University Act in 1992 and a changed funding model, the number of students began to increase again, and the number of students passed 20,000 for the first time in 2000, cf. Figure 2.

Figure 2: Number of students and teaching staff at University of Aarhus 1980-2002



Source: The University of Aarhus

The University's level of specialisation and number of students

In the same period, there were a number of changes in the admission of students. Because of the relatively good "market potential" of, in particular, graduates with a degree in social sciences and probably also partly because of the low "production cost", the number of students at the Faculty of Social Sciences increased up to the early 1990s. The same was the case for the natural sciences.

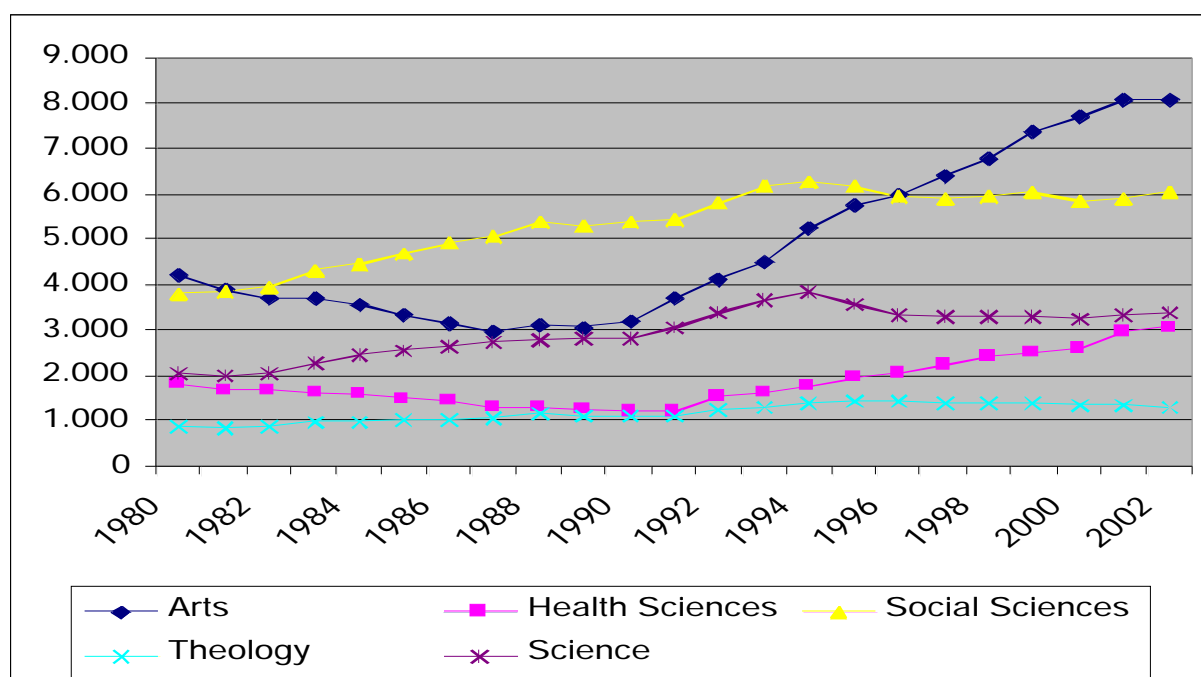
The growth in the number of students in the 1990s has, however, been highest in the Faculty of Arts and the Faculty of Health Sciences. The number of students in the social sciences is relatively constant, whereas there are problems recruiting science students, cf. Figure 3. The

recruitment problems and a large “production” of Ph.D. candidates have meant that the Faculty of Science has had great financial difficulties in the past 5-10 years.

Graduates find employment in both private business enterprises and public corporations, depending on the faculty and side of studies in question. For example, the study programmes in the humanities are, to a great extent, aimed at producing graduates for Danish upper secondary schools, whereas the Evangelical Lutheran Church in Denmark is a major employer of theologians. Graduates in social sciences and science graduates are more evenly distributed between employment in the private and public sectors. Graduates in the health sciences primarily find employment in the public health sector.⁸

Furthermore, there has been a constant increase in the number of graduates for actual research positions at all the faculties during the period. The total number of Ph.D. degrees nearly quadrupled from 58 in 1991 to 208 in 2001.

Figure 3: Number of students at University of Aarhus, distributed on faculties, 1980-2002



Source: The University of Aarhus

The University's funding

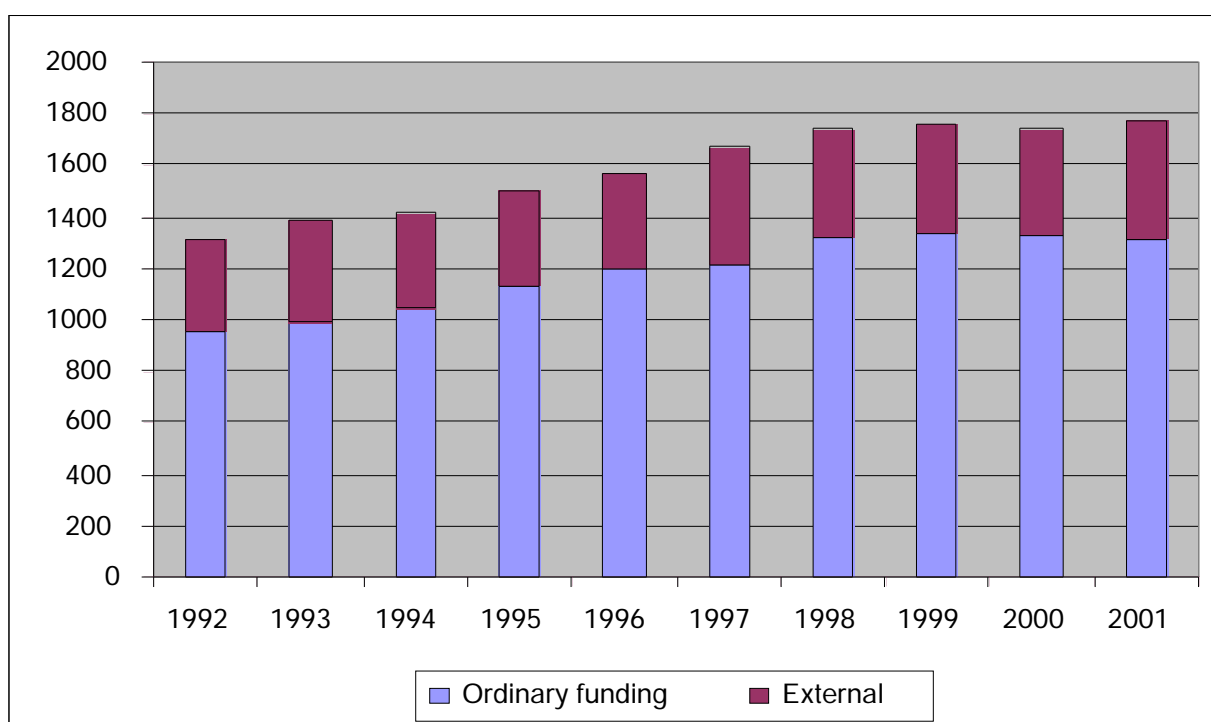
Since 1970, the State has funded both capital investments and the running of the University of Aarhus in the same way as for the other universities. This means that the University is primarily funded through a basic appropriation reflecting the University's production of graduates (study level increments). The ordinary basic appropriation amounted to DKK 1.3

⁸ Employment statistics shows that in 1998 approximately 77% of all graduates from the University of Aarhus in humanities, 67% in the health sciences, 63% in the natural sciences, and 56% in the social sciences are employed in the public sector Maskell (2001).

billion in 2003, whereas external funds, especially in the form of financing of research centres, etc., amounted to just under DKK 0.5 billion. This distribution between ordinary funding (75%) and external funding (25%) was fairly constant throughout the 1990s, during which period the total funding increased by 36%.

Out of this total annual budget of just under DKK 1.8 billion, the University of Aarhus has a special status in relation to the other universities in the form of a special pool of “free research funds”, where research activities at the University of Aarhus annually receives around DKK 50 million through Århus University Research Foundation. On the face of it, an amount that constitutes 3 per cent of the total budget may seem modest, but, in recent years, the amount, which is allocated by Århus University Research Foundation, has made actual co-operation with other regional players possible, as, in accordance with the University’s development contract with the Ministry of Education, such foundations: *“have opportunities, which the University as a state institution does not have, for participating as a shareholder in business enterprises, the object of which is to promote the exploitation of research results or to create a better framework for research, education and training”*. (Aarhus Universitet, 2000)

Figure 4: Funding of the activities of University of Aarhus, 1992-2001.



Source: The University of Aarhus

The free research funds in the Research Foundation come primarily from the company Auriga A/S - formerly Cheminova. In 1944, the shares in the Danish chemical company Cheminova were transferred to the University of Aarhus. The Research Foundation’s return was not of any great importance during the first twenty years. But when Cheminova became listed on the Stock Exchange in 1986, this entailed the establishment of a considerable basic capital. This distinguishes the University of Aarhus from the other universities in Denmark – for good and bad some might say. The University of Aarhus is a wealthy university precisely because it has

received funds through the Research Foundation and has these funds at its own disposal⁹. The University has actively used these funds to extend its relations with its surroundings.

The listing of Cheminova on the Stock Exchange in 1986 and the establishment of the first science park in the same year are examples of the relations with the surroundings that the University with its former Rector, Henning Lehmann, commenced in a period in which the formal links with the “outside world” were limited. In recent years, however, the maintenance of these relations has been of great importance to the continued dialogue and co-operation with the University’s surroundings, including, in particular, its relations with the County of Århus, the Municipality of Århus and the business community in and around Århus.

The University and the region

The University of Aarhus’ development contract with the Ministry of Education expressly states the University’s dependence on local commitments, the University’s special obligation because it was set up as a privately owned institution and the importance of continuing and developing the existing co-operation initiatives.¹⁰

This applies to both the public sector and the private sector and, based on the development contract, the University has participated actively in a large number of joint cross-institutional projects for the purpose of ensuring the dissemination of knowledge to the public and private sectors.

When the University’s Rector for 17 years, Henning Lehmann, left his position in 2000, it was, indeed, with the following testimony of his work:

“Throughout his period as rector, Henning Lehmann has attached importance to creating good and mutually profitable co-operation between the University’s research activities, Danish trade and industry and the local authorities. The Science Park and the IT City in Katrinebjerg are examples of tangible evidence of this.”¹¹

A vision paper drawn up by the University in co-operation with the County of Århus in 1999 is a tangible expression of this co-operation. In brief, the vision paper deals with joint plans for research, education and training in the research areas of IT, biotechnology and health. One of the principal objectives outlined in the vision paper is to promote the commercial importance of these areas.

Co-operation and openness in relation to the University’s surroundings have generally increased in recent years. This development is connected with a changed (political) view of the role of universities in relation to the rest of society, in particular in relation to the national innovation system¹². The interaction between trade and industry and universities has partly been brought about through a changed focus on the relation between Danish university policy and Danish industrial policy and has partly been made possible with the amended Danish

⁹ Cf. Thommessen (1997)

¹⁰ Cf. Aarhus Universitet (2000)

¹¹ Cf. Aarhus Universitet press release 29-01-2002.

¹² Cf. Lundvall (2001)

University Act from 1992¹³. The desire to strengthen this co-operation has been emphasized as one of the essential changes in the new Danish University Act that was passed in 2003.¹⁴

Under Danish industrial policy, the co-operation between public institutions, research environments and the private sector became a priority area from the mid-1990s. This included the establishment of formal innovation environments in 1998, where all the large university cities have established an innovation environment with State subsidies¹⁵. In Århus, this was achieved through Østjysk Innovation¹⁶, a company in which the University of Aarhus is a co-owner through the Research Foundation and an organisation that is located in the Science Park in the immediate vicinity of the University. The purpose of the innovation environment is to create high-tech business enterprises and thus ensure commercialisation of the research conducted in Denmark, including, in particular, research at university level. And there has been a change in attitudes precisely in this area in recent years, according to Lars Stigel, Director of the innovation environment, who stresses that: *“Any talk of ivory tower and a lack of openness towards trade and industry on the part of the University, the University Hospital and the other research and educational institutions is a relic of the past. ... The dynamism is there, and activities are conducted in a beautiful interaction between research, capital, business enterprises, municipality and county”* (Stigel, 2003).

Another central feature of the understanding of the marked change of direction is the overall industrial policy framework that, during the 1990s, with inspiration from Michael Porter’s “The Competitive Advantage of Nations”,¹⁷ lead firstly to a mapping of Danish resource areas¹⁸ and subsequently to a mapping of national and regional cutting-edge competence, including both existing and potential competence clusters.¹⁹

In connection with the mapping of special competence clusters – the cutting-edge competence of the individual areas – a large number of well-known and well-documented industrial clusters were mapped. There was also focus on potential clusters, and the relatively new research field of “Pervasive Computing” was mentioned as a potential competence cluster in Århus.²⁰

The IT City and the “Center for Pervasive Computing” are examples of institutions that have been financed in co-operation with the County of Århus and with support from the other counties in Jutland and Funen as well as State subsidies from the Ministry of Science, Technology and Innovation and the 3G mobile net auctions that have been held. These institutions are good examples of the national and regional focus on the strengthening of the

¹³ Cf. Langberg (2002)

¹⁴ Cf. Ministry of Science Technology and Innovation (2003)

¹⁵ Cf. The Danish Ministry of Business and Industry in: Erhvervsministeriet (1998)

¹⁶ Østjysk Innovation’s mission, portfolio of investments and relations with the research environments are described at the website www.oei.dk.

¹⁷ Cf. Porter (1990).

¹⁸ Unlike the traditional horizontal industry divisions, a resource area consists of vertically connected industries such as food (agricultural production-processing-sale), construction and housing, medico, health or the like, cf. Danish Ministry of Business and Industry (1997).

¹⁹ The mapping of resource areas and competence clusters has been performed by the National Agency of Enterprise and Housing (the former “Agency of Trade and Industry”). The reports and information about the ongoing work are available from the Agency’s website at <http://www.ebst.dk/ressourceomraader>.

²⁰ Cf. The Agency of Trade and Industry (2001)

special cutting-edge competence of the individual regions in recent years.²¹ However, the co-operation between the University of Aarhus and the regional business community was already commenced in the mid-1980s in the form of the newly built science park, which provided the physical framework for this co-operation.

The Science Park²²

The first science park in Århus was established in 1986 in the immediate vicinity of the University of Aarhus. In a look back on the establishment of the science park, the Director of the Science Park since the beginning, Erik Jantzen, stresses that the combination of the Rector of the University of Aarhus, the Director of the regional telecommunications company and the Director of one of the major banks constituted a strong trio that represented the academic world, private trade and industry and the capital side on an executive committee. This was the basis for the creation of the Science Park, strongly supported by the then mayor of Århus, Thorkild Simonsen.²³

The Science Park commenced its activities with an equity capital of DKK 6 million, contributed by 70 shareholders, of which Århus University Research Foundation was one of the largest with a capital contribution of DKK 1.5 million. The Science Park expanded heavily in the following years, but was then hit by the recession in the early 1990s, which resulted in vacant premises and a mood of crisis. However, since the mid-1990s, things have only improved, and the Science Park is today run as a limited liability company on ordinary business conditions with a total capital of DKK 110 million. The premises are becoming fully occupied, and the activities are therefore now being expanded with the construction of two new science parks.

Most business enterprises in the science park carry on activities within the business areas of IT and medico/biotech, and, in 2003 and 2006, each of these areas will therefore have a separate science park, which will be built in the immediate vicinity of the respective environments. This means that the medico/biotech science park will be built adjacent to the hospital environment (2003), whereas the IT science park will be connected to the new IT district - IT-katrinebjerg (2006). Both these initiatives are given priority in the University's development contract with the Ministry of Education and are a continuation of the vision paper drawn up in co-operation with the County of Århus.

The two overall resource areas – Medico and health and the IT and communications sector – are also the two areas in which both the formal and informal joint relations between the University of Aarhus and the other regional institutions have been built up through many years. Seen overall, these two resource areas have been of great importance to the Århus region during the past ten years.

Table 7. Total employment in all and for the ITC and Medico resource areas, distributed on regions, 2002.

	Total	IT & communications	Medico and health
Denmark	2782306	228444	336866

²¹ The industrial policy work in Jutland and Funen is co-ordinated under the County of Århus, and the various target areas are described at www.jylland-fyn.dk.

²² The activities of the science park are described at www.sp-aarhus.dk.

²³ Cf. JyllandsPosten (2003)

Greater Copenhagen area	36.4%	52.0%	36.3%
Århus County	11.8%	13.5%	12.7%
• Århus Municipality	6.2%	9.6%	7.0%
• Rest of Århus County	5.7%	3.9%	5.7%

Source: Special run Danmarks Statistik (Statistics Denmark)

This is reflected in Table 7, which shows that the concentration of employed persons in both IT & communications and Medico and health is higher in the Municipality of Århus than in the rest of Denmark, including in the Greater Copenhagen area seen as a whole.

As both these resource areas were also characterised by an increase in employment in the 1990s that was markedly above the average for the rest of trade and industry and as the relative growth in the Municipality of Århus is above the national average for both resource areas, cf. Table 8, it is understandable that both these resource areas are high-priority areas in the regional co-operation.

Table 8. Growth in employment in all and within the resource areas of ITC and Medico in different regions, 1994-2002.

	Total	IT and communications	Medico and health
Denmark	8%	27%	18%
Greater Copenhagen area	12%	32%	14%
Århus County	9%	25%	20%
• Århus Municipality	12%	28%	25%
• Rest of Århus County	7%	18%	13%

Source: Special run Danmarks Statistik (Statistics Denmark).

However, the nature of the co-operation differs considerably for the two areas, especially regarding the involvement of the third party: the private sector.

Århus University Hospital²⁴

One of the reasons for the foundation of the University was a pronounced wish on the part of the hospital sector to develop a strong provincial hospital, and the University's longstanding co-operation with the public sector is precisely an example of a high degree of applied research in the co-operation with the county, which is the authority responsible for hospital services, and of co-operation that has developed into covering the whole Jutland-Funen area. The University of Aarhus has therefore been of decisive importance to the realisation of the founders' vision to make Århus Municipal Hospital the leading hospital in the provinces.

The network organisation Århus University Hospital came into existence in 1990, but now based on a vision to create "*examination, treatment and care at a high international level*"²⁵.

Århus University Hospital is a partnership between the five hospitals in Århus that are administered under the County of Århus and the Faculty of Health Sciences at the University

²⁴ The partners and a large number of joint projects, including a project on the development of the electronic patient case notes system, are described at the University Hospital's website www.auh.dk.

²⁵ Århus University Hospital, 2002.

of Aarhus. Furthermore, the County of Northern Jutland and Aalborg Hospital are formally attached to the co-operation.

The overall objective of the co-operation is to ensure a connection between basic research activities and clinical research activities so that the path from research to practical application of the established knowledge becomes as short as possible.

As a construction, the University Hospital is established as a network organisation, and the same applies to a number of interdisciplinary research and development projects under the aegis of the University Hospital. This means that projects or themes are created on an ad hoc basis based on concrete ideas or requirements. The project management is decentral, but agreement management allows for overall day-to-day co-ordination of project activities.

The co-operation also shows that a critical mass within medical research does not in itself create co-operation with the private sector or, for that matter, that the presence of such a critical mass automatically sprouts new medico and biotech companies. On the contrary, statistics based on resource areas show that medico and health care employees in the Municipality of Århus are employed in the public sector, where 7.9% of those employed in this sector in Denmark work in the Municipality of Århus. In comparison, only 4.4% of medico and health care employees in the private sector work in Århus. The Greater Copenhagen area offers a glaring contrast to Århus with a heavy specialisation of employees in the private medico and health care sector with 52.2% of all employed persons in the private medico and health care sector being employed in the Greater Copenhagen area, cf. Table 9. This is, among other factors, a result of all large companies in the medico and health care sector being based in the Greater Copenhagen area.

Table 9. Total employment and employment in medico and health, distributed on sectors and regions, 2002.

	Total employment		Medico and health	
	Private sector	Public sector	Private sector	Public sector
Denmark	1835524	946782	76445	260421
Greater Copenhagen area	35.5%	38.1%	52.2%	31.6%
The rest of Denmark	64.5%	61.9%	47.8%	68.4%
Århus County	11.9%	11.8%	8.9%	13.8%
• Århus Municipality	6.0%	6.6%	4.2%	7.9%
• Rest of Århus County	5.9%	5.2%	4.8%	5.9%

Source: Special run Danmarks Statistik (Statistics Denmark).

IT-katrinebjerg

Another large-scale co-operation project in Århus is the IT City katrinebjerg. The ongoing construction of the new IT city within the city illustrates that individual persons are an important force for the development of the co-operation between local government, trade and industry and the universities and that these individuals act as prime movers in the attempt to highlight the special competence strengths of Århus in a particular area.

As shown in Tables 7 and 8, the IT and communications area is one of the most important industrial areas in the Århus region. This resource area has been a marked force in the Århus

region, and a large number of high-profile persons in the area are found in the network around the IT sector. It is difficult to highlight individual events that have created the favourable IT environment, but with the establishment of the National Centre for IT Research in 1996 under the Ministry of Research, the rapidly growing IT environment in Århus suddenly became more visible. The centre was set up in connection with the Department of Computer Science at the University of Aarhus.

In connection with the development of the special IT environment in the northern part of the city in the immediate vicinity of the physical location of the University, the University decided to move a number of its research and educational activities to new joint premises. This concerned departments in both the Arts, where Media Science was moved to the new premises, and in natural sciences, where part of the Department of Computer Science was moved to the new premises. This has subsequently meant that several institutions have developed in the IT park area that is collectively known as IT City katrinebjerg (IT-byen katrinebjerg).²⁶

The number of institutions includes the Alexandra Institute,²⁷ which was set up in 1999 for the express purpose of building a bridge between research and trade and industry. This statement of intent means that the various institutions in the new IT area are to carry on research activities to the benefit of both the local authorities and the private sector. The Alexandra Institute does, in fact, consist of members from virtually all IT parties in the area, including universities, business enterprises, public authorities, etc.

One of the latest projects managed by the Alexandra Institute is a project under the Jutland-Funen IT commitment, where a competence centre, ISIS Katrinebjerg, is being developed. One of the objects of the centre is to build a bridge between the health care sector and IT research.

Examples of other activities in the IT area are “Centre for Internet Research”, “Innovation Lab”, “Center for Pervasive Computing”, “New ways of Working” as well as a number of study programmes offered by the University and the joint collection of all IT study programmes in Western Denmark under IT-Vest. The intention is to gather all the University of Aarhus’ IT-related study programmes and research activities in this area within a short number of years.

Center for entrepreneurship²⁸

In the same area of Århus there is another example of the increased interaction between local government – universities – trade and industry: the newly established center for entrepreneurship. The centre was established in the IT City in 2002. The centre is based on a co-operation agreement entered into between the four institutions of higher education in Århus – the University, the School of Business, the Engineering College and the School of Architecture – as well as the County and Municipality of Århus. The centre is funded by the County of Århus and the Municipality of Århus with support from the EU’s Social Research Fund.

²⁶ The marketing of the IT City’s activities includes a monthly newsletter, which is sent out from www.katrinebjerg.net.

²⁷ A summary of the Alexandra Institute’s activities can be seen at www.alexandra.dk.

²⁸ The organisation and activities of the centre are described at the website www.cfe-aarhus.dk.

The background for the establishment of the centre was the desire for a joint cross-institutional campus for entrepreneurship, and the idea was outlined for the first time at the beginning of the 1990s, with special inspiration from Chalmer's Technical University in Sweden. However, the co-operation between the institutions of higher education did not come to anything, but the rectors agreed to stay in touch. However, it was not until after study trips to the USA in 1999 and 2000, with participation of mayors from both county and municipality as well as representatives from the educational institutions, that the project was revived. The inspiration for Århus – one campus came primarily from Stanford, and the object of the centre is precisely to establish a forum for local knowledge dissemination²⁹. To quote the press release from the formal inauguration of the centre in 2002: *“that the establishment of the Center fits in well with the wishes for co-operation in the county and in relation to the Jutland-Funen industrial co-operation, but also in relation to the thoughts that the Ministry for Science, Technology and Innovation has had on the creation of better contacts between centres of knowledge, trade and industry, municipality and county in the local and regional areas”*.

Since the mid-1990s, the general manager of the centre has, moreover, taught university students in how to start up their own business as a credit transfer activity at the University.

As an expression of the University of Aarhus' involvement with the institution, the Rector of the University is the Chairman of the Board of the center for entrepreneurship.

Incuba venture³⁰

In 1999, the IT Council in Århus carried out a large-scale analysis of the strengths and weaknesses of the industrial structure of the area. One of the conclusions was that, in many ways, Århus had ideal framework conditions for ensuring continued growth. There were many business enterprises, a relatively large number of new establishments every year, a good framework in the form of incubator environments for, in particular, knowledge-intensive new establishments, in the form of the science park, the newly established development park, a newly established innovation environment and, not least, the supply of a large workforce with a high level of education and training.

However, there was an essential difference on one point in relation to the other metropolitan areas: it was virtually impossible to find a locally rooted venture capital company. A detailed review of the Danish Growth Fund's allocation of venture “growth capital” showed that only a modest share went to the Århus region – seen in relation to the size and positions of strength of the region. This applied to both the allocation of venture capital in the IT area and in medico and biotech. Especially the financing of medico and biotech business enterprises was virtually non-existent outside the Greater Copenhagen area.

On this basis, a task force was set up under the Municipality of Århus for the sole purpose of evaluating the possibilities of establishing a venture company. The committee had representatives from the local business community, institutions of higher education and the newly established innovation environment. The committee reached the conclusion that there was a great need for a locally rooted venture company, and analyses used for the committee's recommendations also showed that there was a large number of new establishments and growth business enterprises, especially in the IT area.

²⁹ Cf. Simonsen & Dreisler (2003)

³⁰ Incuba's history, organisation and investment portfolio are presented at www.incuba.dk.

Concurrently with the committee's work, other players in the Århus region were working on plans to set up a venture capital company. This included one of the major investment companies in the region, Scouw & Co, which, with special relations to the food industry, saw a large problem especially in the biotech industry, where it was difficult to create a basis for the establishment of new business enterprises.

There were consequently several ongoing initiatives aimed at the establishment of a locally rooted venture company. Two factors became decisive for Scouw & Co's initiative resulting in the establishment of a venture capital company with a total start-up capital of DKK 200 million in 2002. The first factor was that the State supplier of venture capital – the Danish Growth Fund – had changed its investment strategy. Today, the Danish Growth Fund enters into partnerships with local investment companies instead of solely financing individual business enterprises. The second factor was that Århus University Research Foundation became actively involved as a shareholder in the venture capital company. Partly as a result of the credibility of the Research Foundation and partly because of the Foundation's relations with the science park and innovation environment – the target group for Incuba's investments – the Research Foundation became a lever for the project in relation to the other capital investors.

The network and networkers – and the many small steps forward

Among the institutions in the Århus region, there is a strong network of relations between representatives of the institutions. Formally, all the institutions are represented in the overall IT Council as well as in the business forums and liaison committees of the municipality and the county. In the following, a limited illustration is given of just a few parts of this network in which key persons are involved time and again in the development of science parks, IT and innovation environments as well as the venture capital market.

The present Chairman of the Board of the science park, Professor Peter Landrock of the Department of Computer Science, is one of the few university professors who became a business owner as early as in 1986 and then moved to the science park, from where the business enterprise Crypthomatic expanded³¹. Århus University Research Foundation is also represented on the Board of the science park.

Director Ole Riis Hansen, who, as owner of a local IT company, Cotas A/S – now owned by the windmill producer Vestas – was the Chairman of the Board in Innovation Østjylland from 1998-2002 as well as an active participant in the establishment of the mission statement for the venture capital companies. Consul Erling Lindahl replaced Ole Riis Hansen as Chairman of the Board in Østjysk Innovation in 2002. Erling Lindahl is also a member of the Board of Directors in Incuba and the main driving force behind this venture company. Incuba's Board of Directors also includes three representatives of the University of Aarhus. As mentioned, Århus University Research Foundation is a shareholder.

The entrepreneur Preben Mejer, who built up the IT business enterprise Danadata in the 1980s and early 1990s, which was then sold to the Danish telecommunications company TDC, has been one of the most high-profile persons in the IT environment in Århus. Preben Mejer is

³¹ Cf. Rektorkollegiet (2001)

today the Chairman of the Executive Committee of the IT Council in Århus and is, together with Professor Morten Kyng, one of the principals behind the new Center for Pervasive Computing, which was set up in 2000. Morten Kyng from the Department of Computer Science established the Centre for IT Research back in 1996 and was able to create interest in the IT environment in Århus through this centre. Morten Kyng is today Professor of Pervasive Computing, in a professorship financed by the IT company Systematic, which is owned by Director Michael Holm. Michael Holm was Chairman of the Executive Committee of the IT Council until Preben Mejer took over.

The common denominator for these persons is a close affiliation to the Department of Computer Science at the University of Aarhus. A department under the University that has played an important part in the development of the co-operation in the IT environment in Århus.

- And a few steps back

As mentioned above, Århus University Research Foundation has been an important lynchpin in the interaction between the private sector, the University and both regional and national public institutions in recent years. But the “free” research funds that the University has at its disposal through its ownership also has a downside, which has often brought the University of Aarhus into conflict with its mission and has placed the University in the public spotlight.

As early as in the 1970s, it emerged that Cheminova had deposited toxic waste on harbore tange on the west coast of Denmark for decades. One of the first large-scale Danish environmental disasters, which seriously tested the University of Aarhus’ credibility as being independent of capital interests in the early 1980s and which has continuously given rise to unrest, including in connection with the evaluations of who was to pay for the clear-up after the environmental disaster.

Problems arose again in 1997, this time after the national TV channel (DR1) of the Danish Broadcasting Corporation broadcast the documentary “Made In Denmark”, which showed how peasants in Nicaragua used Cheminova’s pesticide Methyl Parathion in a hazardous way. This gave rise to an inquiry in the Danish Parliament, the Folketing, on the role of the University as the principal shareholder in Cheminova.

The Dandy case

The University’s fundamental principle of freedom of research and independence from capital interests was also tested in a debate that arose in 1999 when research results from two researchers at the Royal Dental College were held back by Dandy, a Danish chewing gum producer.

This case was also dealt with in the Folketing, and public meetings were called at the University, where the Rector’s role was to be clarified.³²

The Dandy case meant that a number of business managers subsequently expressed scepticism about future co-operation with the University.

³² Cf. University of Aarhus’ 17 press releases in the period 8.11.1999-30.11-1999.

Both in relation to Dandy and Cheminova, the opposition to the integration with trade and industry has, to a certain extent, come from employees at the Faculty of Arts, but also the University of Aarhus' only Nobel Prize winner, Jens Chr. Skou, publicly criticised the University's disregard for the freedom of research and publication.

The importance of the University to the development of the region

Through its 75 years in existence, the University of Aarhus has gradually developed into a comprehensive university with 5 faculties, 3000 employees and just under 22,000 students. The size of the University means that there are so many areas of contact between the University and its surroundings that it would be an impossible task to describe all these relations.

However, the two illustrations of areas of co-operation in the medico and health and IT sectors respectively show both the University's increased openness to co-operation and the special challenges that various parts of the University are facing in the attempt to create more integrated co-operation between public institutions, the private sector and the University.

As previously mentioned, the Århus region is one of the areas in Denmark that has seen the highest economic growth and increase in employment in the past 10-20 years. There can hardly be any doubt that the University and the other institutions of higher education have been a contributory factor in this development. The number of students is high in relation to the population, and the workforce's level of education and training is generally high. The marked industrial transformation from an industrial society to a service society and, not least, a knowledge-based service society in the past 10 years has especially favoured regions with a workforce with a high level of education and training.

If we look at the Århus region's attempt at attracting foreign investments under the joint marketing measure "Investment location Århus Region" (www.invloc.dk), it can be seen from the past year that a very large share of the activities that Århus uses in its marketing and profiling are closely connected with the activities described above in which the University of Aarhus plays a central part.

Headlines such as "*Aarhus soon ready with new biotech science park*", "*Aarhus-based IT company Systematic is donating DKK 4.5 million to professorship within pervasive computing*", "*Hewlett-Packard enters into deal worth millions with IT City Katrinebjerg*", "*center for entrepreneurship opens in Aarhus*", "*New venture fund established in Aarhus*", "*IT science park in Aarhus to become a new growth engine*" constitute a major part of the news that has been presented to the outside world in the course of 2002 and 2003.

It is nevertheless difficult to find indicators that show that the development in the private sector is due to initiatives commenced by the University or the other institutions of higher education. With the exception of the science park, which was set up in connection with the University in 1986, and which has been a midwife or an incubator for around 140 (predominantly small) business enterprises, by far the majority of the relations and co-operation of the institutions of higher education with the private sector have been commenced within the past five years. The general increase in employment during most of the 1990s can therefore hardly be attributed to the University's role as an active player in trade and industry.

There may therefore be much truth in the report of the Danish Economic Council (2003)³³, which shows that there is no visible effect of the universities when the productivity development of the individual regions is studied. The effect on productivity is rather that the workforce generally has a higher level of education and training in the university regions. On this basis, one of the arguments presented is that, instead of spreading out the university institutions, more should be done to ensure the mobility of persons with degrees at university level.

Future challenges

The universities in Denmark are currently in an unsettled management situation³⁴, and it is, of course, difficult to evaluate the scope and significance of the new University Act, that states that: *The general principle for managerial staff is that the Board of Directors hires the Rector; the Rector hires the Deans; and the Deans hire the Heads of Departments. The procedures for appointment ensure academic and managerial legitimacy.*

However, based on the Minister of Science's comments on the EU Commissions paper on the new role of universities in Europe³⁵, there can hardly be any doubt that there is a desire for much closer co-operation between the universities and the surroundings, in particular the private business sector.

*I agree with the Commission that the university of the future must provide students and teachers with a dynamic workplace with room for both immersion and close interaction with the surrounding society.*³⁶

Political goodwill is, in itself, probably hardly enough, for there are a number of barriers and unsolved problems in the co-operation between the public and private sectors.

One important challenge for the universities will, for example, be to evaluate the degree to which they are actively to participate in the development of trade and industry, for example by promoting the desire among their employees and students to start up their own businesses. The challenge entails an evaluation of whether the universities are to work more actively to patent research results and base their research activities on the immediate requirements of trade and industry – or whether the universities should rather try to strengthen their basic research activities.

Some might argue – e.g. the Danish Economic Council – that precisely the Århus region is quite a good example of the existing separation of tasks having proved its viability. With the marked increase in employment in the region in the sectors, in which the University's role has been to contribute a workforce with a high level of education and training, and with no visible indications that the increase in employment and the economic progress can be attributed to

³³ The Danish Economic Council is an independent institution, which, twice a year, publishes a report on Denmark's general economic situation, cf. Danish Economic Council (2003). Each report contains special themes. In the latest issue (May 2003), the areas of focus included the universities' contribution to local productivity. The report is available at www.dors.dk.

³⁴ Ernøe-Kjølhede et al (2000).

³⁵ Cf. Commission of The European Communities (2003)

³⁶ Cf. Ministry of Science Technology and Innovation press release 21-02-2003

active participation by the university environments, questions can be raised about the necessity of the universities' increased involvement in trade and industry.

These questions cannot be answered here, but they give rise to increased focusing on what we know about the importance of the universities in terms of the creation of innovation, employment and new business enterprises. There are today no actual measures of the universities' importance as a motive force in the regional innovation systems. And any answers to the question of the importance of, for example, the science parks and the Danish innovation environments necessarily require that realistic targets and indicators are laid down that show whether the targets and objectives are met.

The Danish Economic Council also points out that research and development are important parameters in the Danish innovation system and that market errors may occur, especially in relation to small and medium-sized enterprises. SMEs rarely have the resources necessary to implement or participate in large scale research and development programmes, and effective dissemination of knowledge will therefore be a good means of ensuring that SMEs remain competitive. However, the question is whether the universities in their present form are sufficiently capable of handling precisely this role.

There is much to indicate that, despite political goodwill, the universities are not the preferred partners of the private sector, and, especially in relation to small and medium-sized enterprises, there may be barriers of understanding or attitudes that make a partnership difficult.

A clarification of the role of the University also entails a clarification of whether the University exists for the sake of the university city or a larger region. In Århus, it is a characteristic feature that the university effect on the increase in employment in recent years has, to a very great extent, resulted in increased concentration in the metropolitan areas, including in the immediate commuter hinterland of the metropolitan areas.

In Denmark, the economic growth has been especially marked in Århus, Ålborg and Greater Copenhagen. The remaining county hinterland (Djursland in Århus and Vendsyssel in Northern Jutland) has generally had stagnant development or even seen a decline.

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