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## **Developing Universities**

*The Evolving Role of Academic Institutions in Denmark*

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# Chapter 14

## Developing Universities: The Evolving Role of Academic Institutions in Denmark

Birgitte Gregersen and Jørgen Gulddahl Rasmussen

### 14.1 Introduction to the Danish Context

From a traditional economic point of view, it may seem as a paradox that a small country (5.5 million inhabitants) with high wages, high taxes, a large public sector, a relatively low level of R&D activity, and a relatively low proportion of people with a higher education in science and technology has been able to stay relatively competitive and rich for decades. Especially two interrelated explanations have been put forward in recent studies of the Danish National System of Innovation (Lundvall 2002b; Christensen et al. 2008).

#### 14.1.1 *Social Cohesion and the Danish Welfare State Model*

The first explanatory factor is related to the Danish welfare state model with its long tradition for emphasizing social cohesion. A crucial ingredient in the social cohesion model has been a relatively equal income distribution obtained by comprehensive redistribution mechanisms.<sup>1</sup> Another is the long tradition of equal access – meaning in principle, independent of income and social status – to a relatively high level of public-financed welfare state services such as education, health care, social services, environment, and infrastructure. The importance for creating and maintaining social cohesion by, for instance, bringing the majority of children from all social groups together in a common public school system should not be underestimated, neither should the principle of “free” and equal access to health care services.

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<sup>1</sup> Gini index for Denmark: 23.2 (2005, rank 1), HDI: 0.949 (2005, rank 14) and GDP per capita (PPP US\$ 2005): 33,973 [source: OECD 2008 and UNDP 2007].

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Since the beginning of the twentieth century, Denmark has had strong trade unions and center-left wing political groups with the welfare state and social cohesion as their main political agenda. A central societal institution in formulating and implementing the welfare state model has been the corporatist system of interaction between the state, the trade unions, and the employers' organizations. This cooperation has created the so-called Danish flexicurity-model combining a high flexibility for employers to hire and fire with relatively high degree of income security for the employees. Related to the social cohesion model is the relatively high labor market participation rate for women in combination with an extended public supported childcare scheme since the 1960s.

However, the social cohesion model has during some years been exposed to increasing political pressure from neoliberal tendencies. This is reflected in increasing income inequalities, reductions in the social benefits, changes in the social insurance system toward a higher proportion of private insurance and pensions, more private hospitals, and more parents sending their children to private schools. Although the average unemployment rate during the last couple of years has been reduced to around 3%, still groups with low formal qualification have difficulties in getting and keeping steady jobs – a tendency that has been fortified by the current financial crisis. This is especially the case for many immigrants from outside Europe and USA. The Danish society has not been efficient in integrating these groups into the labor market.

### ***14.1.2 Low R&D Intensity but Continuous Incremental Innovations***

A second hypothesis why Denmark has been able to maintain its high-income status has to do with continuous product, process, and market innovations carried out by the majority of small and medium-sized firms. However, this dominating sector of small and medium scale enterprises (SMEs) invests very little in R&D and has only modest direct interaction with universities. One exception from this general picture of the Danish business structure dominated by SMEs is the traditional scale-intensive agroindustrial sector. This sector is today characterized by a high degree of standardization of products and processes, heavy EU subsidies to the primary production, an efficient processing industry, and a few dominating distribution channels. Another exception is the fast-growing science-based pharmaceutical industry with a high level of patent activity.

Many small countries have a business structure with specialization based on low- and medium-tech goods, but according to Maskell (2004), the Danish case has some specific features contributing to the competitiveness. Especially informal institutions such as the negotiated economy, the egalitarian culture, and the smoothing of exchange of information resulting from established trust relations seem to be significant elements (Lundvall 2002b; Maskell 2004). The combination of such structures with stable macroeconomic conditions is an important key to understand how Danish industry has sustained relatively competitive without substantial inputs of formal R&D (Christensen et al. 2008).

Despite a relatively high specialization in low-tech sectors, Danish total R&D spending relative to GDP has more than doubled since the beginning of the 1980s (from around 1% in 1980 to approximately 2.5% of GDP in 2007). However, among the Nordic countries, Finland and Sweden clearly outstrip Denmark with higher figures throughout the same period. Both these countries' R&D spending is now above 3% of GDP.

As can be seen in Table 14.1, the public R&D spending has not increased to the same extent as the private. However, recently the Danish Government has announced substantial increase in the public R&D budget in 2009 and 2010 in order to fulfill the 1% Barcelona target in 2010.

In the last two decades, the sectors of Danish industry with the greatest research requirements and activities have been the pharmaceutical industry and the ICT/telecommunication sectors. The private research departments in these sectors cooperate closely with Danish and foreign universities, but there is an increasing tendency for Danish business to establish laboratories outside Denmark (The Danish Institute for Studies in Research and Research Policy 2003/2009). For instance, the pharmaceutical firm Novo Nordisk spends around one billion Euro per year on R&D and employs globally around 4,600 people in R&D (2008 figures). Of Novo Nordisk's total of 27,000 employees, 52% are based outside Denmark.

Even if the averages are above the European Union (EU) and the Organisation for Economic Cooperation and Development (OECD) averages, the distribution of R&D expenditures is skewed. Generally, 1.5% of the firms conduct 47% of the total R&D in Denmark in 2006 (The Danish Institute for Studies in Research and Research Policy 2008a), even though since the mid-1990s the small firms have increased their R&D effort.

As Table 14.2 shows, expenditure on total education (primary, secondary, and tertiary) measured as a percentage of GDP has gradually increased since the mid-1990s and exceeds the OECD average as a consequence of an increasing political focus on human resources as driving force for innovation and growth.

**Table 14.1** Denmark's R&D spending as a proportion of GDP 1995–2007 (%)

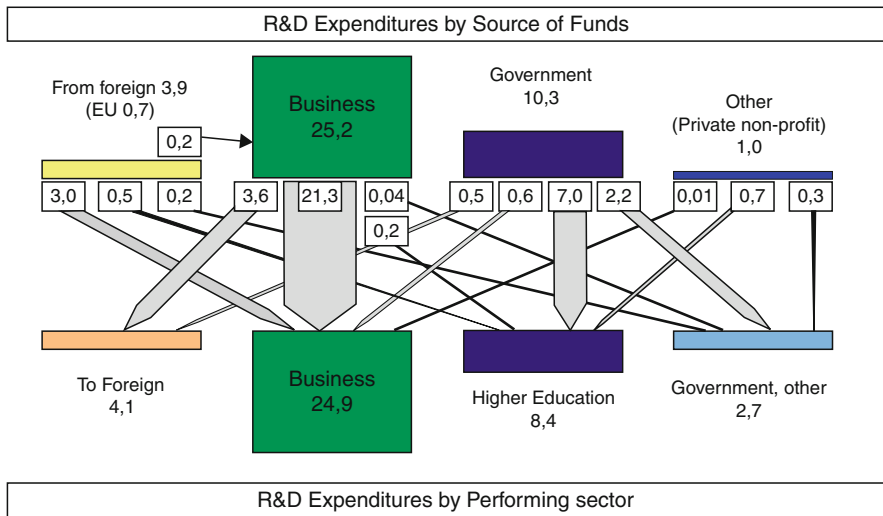
Sector	1995	2000	2001	2002	2003	2004	2005	2006	2007
Private	1.05	1.50	1.64	1.73	1.78	1.69	1.67	1.65	1.65
Public	0.78	0.75	0.75	0.76	0.78	0.78	0.76	0.80	0.88
Total	1.83	2.25	2.39	2.49	2.56	2.47	2.43	2.45	2.53

Source: The Danish Institute for Studies in Research and Research Policy (2003a, 2003b, 2005, 2008a, 2008b); Eurostat

**Table 14.2** Expenditure (all sources) on educational institutions as a percentage of GDP (1995, 2000, 2005)

	Denmark			OECD average		
	1995	2000	2005	1995	2000	2005
Total education	6.2	6.6	7.4	...	...	5.8
Tertiary education	1.6	1.6	1.7	...	...	1.5

Source: OECD 2008, Education at a Glance 2008, Table B2.1



**Fig. 14.1** R&D in Denmark by financing and performing sector 2003 (bn DKK). Source: The Danish Centre for Studies in Research and Research Policy (2005)

Taking a closer look at the distribution of R&D expenditure by funding sources (Fig. 14.1), the private sector make up for nearly 60% and the public sector for nearly 30%. The private sector share is relatively high – above EU(27) level but below, for instance, Sweden and Finland. It is also worth noting that the relative share of funding from foreign sources has nearly doubled from 5% in the 1990s, reflecting a general tendency of globalization of knowledge production. Turning to the distribution on performing sectors, the private sector accounts for more than two-third of the R&D activities, higher education (primarily universities), and other government research institutes for nearly the rest. Over time the university share has increased – as indicated above.

### 14.1.3 Enrollment in HE, PhD, and Lifelong learning

For the last two centuries, all children have attended at least 7 years of primary school. Several decades ago, this was changed into a minimum of 9 years and the large majority today spends at least 12 years in the educational system (including secondary school), ending either with a vocational education or as graduates from high school – general, technical, or commerce. On top of this, an increasing share of young people attends tertiary education. In the early 1980s, around 15% of young people in the age group of 25–64 years had a tertiary (short, medium, long) education. In 2006 this share was increased to 35% (OECD 2008). The increase in the enrollment rate has been especially high for female students, and today young women outnumber men enrolled in tertiary education, but with a wide variation between the different fields, see Table 14.3.

**Table 14.3** Tertiary education enrollment distributed by field of education, Denmark, selected years, %

	2000		2005		2007	
	Total	F share	Total	F share	Total	F share
Education	11	69	11	71	11	71
Arts & humanities	17	65	15	63	15	62
Social sciences, business and law	23	47	30	50	29	51
Science	10	33	8	32	9	35
Engineering	10	28	10	33	10	33
Agriculture	2	52	1	52	1	54
Health & welfare	24	80	22	81	22	80
Services	2	27	2	22	2	22
Total	100	57	100	57	100	58
Total enrollment	189,162	107,644	232,255	133,376	232,194	133,684

F share: Share of females enrolled within each field of education

Source: UNESCO Institute for Statistics 2009

The Danish Industry Association and the Danish Government have for many years initiated campaigns to increase the interest for science and engineering among the youth, referring to a potential future lack of engineers in the Danish society, but the overall distribution of enrollment seems difficult to change.

For many years, all Danish students have had the right to study and have their study supported by a state grant of about US\$900 a month (2008) plus loans for the standardized duration for a bachelor and master study – in total 5–6 years. This means that all young people will be able to finance their higher education nearly without economic support from their parents or other sources. In addition to this, an increasing number of bachelor and master programs have been expanded in capacity, and only a few of the programs have limitations in their intake. Both the grant system and the liberal admission to higher education are now and then discussed among politicians, but restrictions have up to now only been introduced for the admission for non-European students who from 2006 will have to pay a tuition fee. For European students, no tuition fee has to be paid for normal daytime bachelor and master students, only for MBA and other part-time master studies.

Also the number of PhD students (and degrees) has increased especially during the last 10 years, reflecting an international trend toward more formal research training.<sup>2</sup> However, compared with Sweden and Finland, Denmark is still lagging behind, although the government has recently increased the PhD budget in an attempt to catch-up to the Finish level.

During the last 5–10 years, there has been a steady increase in the number of master's level courses offered within a wide range of disciplines as continuing education based on work experience of the participants. Currently, all Danish universities offer such master programs together with a wide palette of other activities under the heading of Open Education programs.

<sup>2</sup>The entrance of doctorate students has increased from 1,168 in 1998 to 2,072 in 2008. The female share has increased from 39% to 47% in the same period (Statistics Denmark, 2009).

Denmark has a long tradition of adult education and training – including vocational training. According to various EU surveys, the Danish work force is among the most active when it comes to participating in continuing education and lifelong learning activities, and the public sector has hitherto spent a higher share of GDP on life-long learning activities than most other countries (Christensen et al. 2008).

## 14.2 The Position of Academic Institutions in the National System of Innovation

The Danish innovation system includes (2008) a wide grid of academic institutions: eight universities, four governmental research institutions for specific sectors and areas, four university hospitals, nine GTS Institutes,<sup>3</sup> several centers of tertiary education (in Danish CVU) and Business academics, seven science parks, and approximately seven “innovation milieus.”<sup>4</sup>

Most of these institutions are public or semipublic. The large, but decreasing share of funding for the activities of these institutions comes from the yearly state budget.<sup>5</sup> A smaller but increasing share of the institutional budgets are funding for strategic purposes, programs, and projects, both from public and private sources. The vast majority of the public R&D investment is allocated to universities (higher education).

In the following, the main focus is put on universities and to a lesser extent on the governmental research institutes and the university hospital – the three groups that together take out the lion’s share of the resources.

### 14.2.1 *Linkages and collaboration*

In what areas and with whom to cooperate are to a large extent within the decision power of the single institution or its subsections – which in fact can be the individual research group or researcher – as long as it can be financed by the institution itself or financed through the linkages. Therefore, the history of the institution, its traditions, and the mutual benefit from linkages play an important role in how relationships are exploited.

In the Danish context, the existing business structure and the knowledge-intensive public sector activities play an important role in forming the linkages. The

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<sup>3</sup> GTS–Danish acronym for Approved Technical Service Institutions.

<sup>4</sup> After 2007, the Danish map of academic institutions has changed due to a new merger process. A few of the existing 12 universities merged into eight, and the majority of the existing 21 governmental research institutions were at the same time merged or integrated with the universities.

<sup>5</sup> The public-financed share fell from 97.5% in 2000 to 96.7% in 2006.

agricultural sector, the pharmaceutical sector, the energy sector, and not the least the public hospital sector are central partners in collaboration on research and knowledge production. These sectors are dominated by large companies and in that sense relatively few companies account for a substantial part of the linkages with specific research groups within universities and governmental sector research institutions.

Besides these kinds of linkages, the innovation system also includes a number of science parks typically related to a university. The above-mentioned linkages also include spin-offs from larger companies or from universities, which are part of the science parks and “innovation milieus.” Such parks and milieus can also have sectoral research institutions and GTS institutes as tenants – and even regular university research can take place on such locations.

In a small economy, such as the Danish, the products produced through this knowledge are sold internationally. This is today not only the case for those activities that is going on between large companies and the research institutions, but also for young and small spin-off companies. The demand for their products and the R&D partners are very internationally oriented.

The firms that mainly produce for the home market or produce rather low-tech products are less involved in research and innovation linkages with the universities than the more research-intensive firms operating in foreign and domestic markets. The GTS institutes have as a part of their mission to increase the creation of linkages between such firms and the more advanced parts of the innovation system, but up to now this has not resulted in any dramatic change in the interaction pattern. It seems as if it is a clear advantage to have employees with an academic degree situated in such firms before the actual linkage-building activities start (Christensen et al. 1999; Vinding 2002). On the contrary the part of Danish business that is only concentrating on the domestic market is gradually decreasing, which means that an increasing part of business is gradually becoming more research intensive.

Weak linkages to the research system have not up to now been directly reflected in a general orientation toward the local market, but with a larger part of business facing a more intensive competition from foreign companies, knowledge becomes an increasingly important competitive factor. Therefore, they have to become more involved in R&D activities. The success of this seems to be dependent on how fast university graduates can find employment in these firms and what their competence can offer to such firms. This implies that university and college education is offering qualifications suited for this.

### 14.3 Mapping the Academic System in Denmark

In order to map the academic system, this section will present a short history of the higher education institutions, a history of the governance system, and a description of main linkages between academic institutions and other partners in society.



### ***14.3.1 A Brief History of Higher Education***

The University of Copenhagen was established in 1479 as a seminary for catholic priests recognized by the pope, but with programs in law, philosophy, and medicine (Ministry of Science, Technology and Innovation 2003:3). This university was during several centuries the only institution for higher education in Denmark. This changed at the end of the eighteenth century when a number of teachers' colleges were gradually established in connection with the introduction of the general primary school, an activity that increased the demand for teacher education.

In the first half of the nineteenth century, the College of Advanced Technology, now the Technical University of Denmark, was established (1829) and later in that century the Royal Veterinary and Agricultural University (1856) and the Danish University of Pharmaceutical Science (1892) were established. This was followed in the first half of the twentieth century with two business schools and the University of Aarhus (1928). Finally, in the second half of this century, the universities of Odense (1966), Roskilde (1972), and Aalborg (1974), and the Danish University of Education were founded in 2000 by merging a number of smaller institutions. Both Roskilde University Center and Aalborg University introduced from the very beginning a Problem Based Learning model (PBL) as their overall pedagogical teaching model.

The teachers' colleges were in the twentieth century followed by a number of colleges for the education of different kinds of professionals within the area of pedagogy and preschool teachers, and a gradual transformation of the training of health personnel from inhouse vocational to institutionalized education. Including the teachers' colleges, this group of institutions counted more than one hundred before a series of mergers began. In addition to this, a number of engineering colleges existed and a number of high schools within business and technology started to offer short-term higher education of 1–2 years within their specific fields.

This increase in the number of academic institutions has within the university sector up to now been followed by only a small number of mergers: One between the University of Odense and a small business school in the southern part of Jutland to the University of Southern Denmark (1998) and another concerned the earlier mentioned University of Education (2000). Within the college sector, the Ministry of Education has through the last 10 years urged the institutions concerned with professional fields to merge, and a series of mergers have diminished the number of these types of institutions rather dramatically. In 2007 the Minister of Science, Technology, and Innovation launched the idea of further mergers within the university sector. The outcome of these negotiations became a kind of "moderate" solution with a total of eight universities.

A large number of relationships at the individual level exist between specific groups of researchers and teachers related to similar programs. The number of linkages at the institutional level is considerably lower and is normally used to secure institutions with small research resources with the support of institutions with larger research resources and thereby enhance the quality of education in the former institution.

## ***14.3.2 The Development of University Governance System***

### **14.3.2.1 From a Collegial Governance System...**

Since the Reformation in 1536, universities in Denmark have been state institutions, but with some degree of autonomy. This means that a collegial governance system based on the professors through a senate has governed the university. Starting 1968, the students demanded more influence on decision making within the universities, and in the beginning of the 1970s, the governance structure that functioned during the next couple of decades was passed by the parliament. In this act, the university senate consisted of a share of 50% professors, 25% students, and 25% technical administrative staff. Their constituencies within the university elected their members of the senate, and the same constituencies in the same proportions elected the rector. During the first half of the 1970s, the faculties, each including a number of departments with faculty councils, were constituted in all the universities. These councils had the same constellation as the senate and had the decisive power on budgets, plans, and academic matters, and they elected a dean for the faculty. In the departments, the entire staff of researchers, teachers, technical administrative staff, and a number of elected students governed the department and elected the head of the department.

For all master's level programs, a Study Board consisting of equal representation of teachers and students was elected and these boards decided upon curricula, course programs, and other matters concerning teaching and education. This was done under an ordinance for each master program made by the Ministry of Education that at the national level defined the general goals of the specific master education. In this way, the governance of study programs to some extent was divided between the Ministry and the Study Board. At the same time, it is important to notice that neither boards nor universities were – and still not are – allowed to start new master's or bachelor's programs without the permission from the ministry, and the ministry has always had the power to assess the quality of existing programs.

During the 1980s and 1990s, the ways of allocating resources to university education changed in a number of steps. For many years, the resources were allocated according to a formula that took into account the number of students and the salaries for the number of permanent research and teaching positions. In the changed allocation system, money to the universities was distributed according to the number of bachelors and masters who graduated. In this way, the mechanism for allocation of means for education changed from input criteria to output criteria. This change was part of the new general principles of allocation of state funds to its institutions, and the change for the universities was to some extent part of the national government's experiments with these new principles.

On a number of occasions, individual professors, some political parties, and different societal organizations did complain, especially about the influence of students and technical administrative staff on research and administrative decisions in universities, and in 1992 the Parliament passed the center-right government's new act on university governance. In this act, the most important change was that rector,

deans, heads of departments, and heads of study formed a more traditional hierarchy and got a more specific leadership mandate. But the election system was continued, and the most important change in governance was the abolishment of a number of committees and the handing over of operative management to the individual leader.

#### **14.3.2.2 To a Hierarchical Top-Down System**

This system was also criticized from different angles. The most often heard critique was that this democratic system was too slow in its decision-making processes. Even if this was never proven, the government anyhow, in 2003, put a new and different act on university governance in operation. In this act, the senate and the faculty boards were abolished and instead a number of advisory academic councils were established. A university board with a majority of external members from business, cultural institutions, and foreign universities formally got most of the power that hitherto had been located in the senate. Furthermore, the rector, the deans, and the heads of departments are appointed, not elected. The rector is appointed by the board, deans by the rector, and heads of departments by the dean. The academic council decides only on strictly academic matters. The individual managers on the different levels decide on all other areas. The only governance structure that has not been changed concerns the Study Boards.

The governance structure as it looks today is formally more autonomous than the former structures. The universities are not any longer formally an integrated part of the state administration, but are defined as kind of firms with a governing board, where the external majority appoints the new members of the board, and the economic and financial responsibility is placed entirely on the board. On the contrary, the universities are still mainly financed by public means, and the government and the minister still have a number of mechanisms to control specific fields and the power to start evaluations into specific universities on subjects of interest. At the same time, the system for allocation of resources for education has during the years been more detailed. The allocation of resources for research has in the same period slowly transformed from a lump sum based partly on traditions and partly on the mechanisms for allocation of educational funding toward a system based on strategic and political priorities.

Along with the new governance structure came a new “resource allocation device” in the form of a formal “development contract” between the ministry and the individual university. The contract normally runs for a period of 4 years and it specifies a number of goals concerning external resources; research publications; international, national, and regional cooperation; number of graduates; PhD production; and a number of improvements of more administrative and organizational kind. Combined with this, most universities have started to develop and announce their strategies, connecting the more specific goals in the contract to more long-term goals and missions of the university (Rasmussen 2006).

These developments are part of a kind of new public management development in the entire State governance. This brings, according to the proponents of such systems, the universities and their management capacity more in line not only with their dynamic environment in general, but also with a national government that

demands more flexibility of its institutions and a research funding system that is increasingly geared toward strategic research programs allocated from the ministry's chair. This is also reflected in the structural development of the national research funding system, where the traditionally discipline directed national research councils have been merged and changed in the direction of more broad areas and programs and away from disciplines and projects.

To complete the description of the national governance system, two additional elements should be mentioned: One is the Standing Committee on Research in the Parliament that debates most legislation on higher education and matters concerning research. The other element is the current structure of the national government where two ministries are responsible for education. The Ministry of Science, Technology, and Innovation is responsible for the universities, and the Ministry of Education is responsible for primary and secondary education and for the part of tertiary education that is outside the purview of the existing eight universities.

### ***14.3.3 Linkages Between Academic Institutions and Other Partners in Society***

#### **14.3.3.1 Linkages Within the Educational System**

As mentioned above, the main body of the educational system from primary education to PhD is public, under the overall responsibility of the Ministry of Education, and in the case of universities, the Ministry of Science, Technology, and Innovation. This is the case even when, as in primary and lower secondary schools, 15% of the children attend private schools. The rules and regulation for private schools and public schools are identical. Within the education sector, the formal linkages between the State and each of the subsectors seem to be more frequent and dominating than linkages between the different sectors (for instance, between the primary and the secondary school sector, or the upper secondary school and the universities). This is also the case for the linkages between the state-owned institutions for vocational training and the other parts of the educational system. But increasingly, additional agreements are made directly between individual institutions on different levels and sectors within the Danish educational system. Most clearly, this is seen between the university colleges and the universities in relation to how shorter and longer higher education can be combined for students who start in the university colleges but want to pursue higher-level postgraduate university programs.

#### **14.3.3.2 Linkages Between Higher Education and Business and Public Administration**

The increase in number of university graduates with jobs in business and public administration has in itself created important linkages between higher education and these sectors in society. What can be noticed is a much more even relationship

between higher education and society. Higher education and academia are not any longer to the same extent seen as institutions with an unbridgeable distance to society, and the knowledge base present within the research-intensive business sector is increasingly comparable with the universities. At least this seems to be the fact with respect to the large knowledge-based firms and the knowledge-based part of public institutions. So even if this is only a small part of the business sector and the public administration, it results in both an increasing understanding between those sectors and in an increasing critique from business and the public sector, when they find that things are not conducted well enough within the university. At the same time, it has dramatically increased the involvement of firms and institutions as providers of cases, projects, and traineeships for university students.

### **14.3.3.3 Lifelong Learning**

Another kind of linkages between higher education institutions, private firms, and public institutions has evolved during the last 10–15 years, where an increasing number of employees have participated in part-time further education, mainly at the master's level (MBA and similar). Some students finance these education activities by themselves, but do often get reduction in their working hours. Other students get part of their tuition fee paid by their employer and others are encouraged strongly by their employer to take part in such kinds of education. As a linkage, this development is not only increasing the competences of experienced employees, but also giving the higher education institutions a closer connection to the everyday life in business and public administration. In time it might also increase the role of alumni organizations that up to now has been nearly completely absent in Denmark when compared with many other countries.

### **14.3.3.4 Linkages in Research**

Linkages in research have been established many decades ago. Establishing the first monofaculty universities in the middle of the nineteenth century could be seen as a result of the needs expressed by agriculture and industry. Not least, agriculture has, from the very start of the cooperative movement to until recently, been among the most impressive builder of linkages to research. On the one hand, the relative weight of these traditionally strong research linkages related to agriculture seems to decrease in the Danish case concurrent with the increasing outsourcing of processing of agricultural products and the decreasing numbers of farmers. On the other hand, the increasing focus on organic farming, genetically modified organisms (GMOs), functional foods, animal cloning, pesticides, pharmaceuticals and animal diseases has in a sense revitalized the traditional research area and strengthened the relations to especially the chemical industry and the pharmaceutical industry. The research linkages that have increased the most during the last decades are between large research-intensive firms and university research. Especially the growing

pharmaceutical and ICT industries have developed strong research linkages to the universities, and other industries are gradually following the same track.

The linkage between SMEs and university research activities is currently not very strong. Recently, several initiatives have been taken by the government, the industry itself, and the universities to try to strengthen the collaboration between the universities and the SMEs, but there still seems to be a long way ahead. Instead, knowledge diffusion to the SMEs has primarily been the responsibility of a variety of technological service institutes, including the earlier mentioned GTS institutes. These institutions direct their activities toward all sectors within the economy and have to a large degree functioned as intermediates for new knowledge produced in Danish universities and the SMEs for implementation of these technologies. They have also, to some extent, functioned as knowledge-diffusing institutions to different types of public (municipal) institutions. Most of these institutions were established by the State and partly financed by public support for basic activities. During the last decade, these institutions have received reduced basic funding from the government and have had to earn more money in the market. Consequently, a number of structural changes within the sector have followed.

#### **14.3.3.5 Technology Transfer Institutions Within the Universities**

Over the years, the role of the universities in knowledge and technology transfer has increased. From being institutions engaged in teaching and research – eventually in cooperation with other research institutions – the so-called third mission of knowledge diffusion and transfer has become an important target. This development has slowly and rather organically obtained increasing importance within the individual universities and especially with an emphasis on the technical knowledge. From the start, this was not any joint or state-supported development, but it emerged through different research groups and milieus in specific departments. This has led to a situation now where all the Danish universities have established technology transfer offices, patent offices, network centers, incubators, knowledge ambassadors, etc., all different kinds of organizational structures and institutions that service knowledge diffusion and technology transfer activities. Today these activities are explicitly included in the University Act and the activity contracts that universities have to make with the Ministry.

### **14.4 The Danish Debate on the Role and Development of Academic Institutions**

During the last 5 years, the academic institutions in Denmark have been a subject of debate both among the political parties in parliament and among several societal institutions such as employers' associations, trade unions, and professional associations, and

among people directly involved in university activities and in creating linkages between universities and other partners in society. The reasons for this have both been the global developments and internal changes in the national innovation system. Such debates flare up for different reasons and have been initiated by different organizations. Debates on different topics within this field, to some extent, circle around efficiency, quality and dynamics within individual institutions, groups of institutions, types of linkages, and the entire knowledge producing and diffusion system. The debates, because of their interlinkages, can be divided into several sets of clusters. In this chapter, the following division will be used: financial aspects, types of knowledge production and diffusion, the future academic workforce, and the way universities are governed, and how the future set up of the tertiary education system should look like.

### ***14.4.1 Money Makes the World Go Round***

One of the arguments within the discussion about the future competitiveness of the Danish society in a globalizing world takes its starting point in how firms in the future will be able to develop new and innovative products and sell these. This debate has a national perspective that relates to the specific Danish industrial structure with many small and medium-sized firms and a large part of the entire production system being relatively low tech. Furthermore, it has an international perspective that relates to the EU and its goals on global competitiveness.

The present government has committed itself to the Bologna Agreement, meaning that the total national R&D spending should amount to at least 3% of GDP by 2010. This is a goal that has a broad support among political parties, societal organizations, and universities. It is at the same time a policy in accordance with the EU ambitions and is in that respect often seen as a kind of national contribution to the European competitiveness.

A debate on this subject has started because it has been a little difficult for many observers to see how the government will live up to its own ambition of 1% public R&D spending. Several university rectors have complained that when they look into the yearly national budget proposed by the government and into the basic state funding of their own institutions, the only thing they see is relative budget cuts due to built-in productivity increase and reallocation to specific research areas. So instead of a yearly increase in the state-funded research, a decrease or at least stagnating allocations during the last couple of years seem to them to be a more accurate picture of the situation. Confronted with this, the Minister of Science promised that the following year an increase would be seen, and the financing goal would be met in 2010.

Regardless, critics express their skepticism. The reason for this is that the government for the last 8 years successfully has followed a policy of no tax increases of any kind. At the same time, the expenditures on health and other social areas are increasing. In addition to this, the coalition that forms the political majority in

parliament is kept together on policies that to some extent point in another direction than increasing state funding of research. This is one of the bases for the skepticism within the universities. Another worry expressed by those who fear about the future development is that the way to fulfill the financial ambition on research could be done through even more severe cuts in the funding of university education than what has already been seen during the past several years. The minister promises that this will not be the case, but this debate hardly stops until the targeted percentage for research spending is met through additional funding.

Summarizing, the debates on the funding of research, teaching, and service concern (1) how the total national budget within these fields develops; (2) how the allocation of resources between different scientific fields such as natural science, humanities, and social science evolves; and (3) how the mechanisms that create public funding for areas, programs, and projects change. Concerning mechanisms, one of the most important changes seems to be an increased use of cofinancing where public funding follows funding from private sources.

#### ***14.4.2 Research and Research Linkages***

Both in the internal university debates, at the national political level, and among societal organizations with interest in research, a debate is running on which areas to allocate the scarce means directed toward research. This debate can at the same time be seen as related to a global, national, and regional dimension as well as to different disciplines, areas, and objectives. One way to explain why this debate has been going on for several years now is that the national resources used for research – including what the private sector is using – with a population of only five million, are seen as very limited in a global perspective. This brings about an argument that a small nation has to concentrate its research activities to specific fields in order to become excellent in knowledge production.

This debate on concentration runs in a different direction. One concerns the contradiction between being on a world-class level within specific areas of basic research, and the counter argument that raises the question if this in reality will support national business, social, and cultural needs. This can be seen as a debate in a certain perspective of mode 1 versus mode 2 research (Gibbons et al. 1994). In that perspective, this debate relates to another debate where the government seems to be in favor of universities and other research institutions directing their activities more directly toward producing results that can be useful specifically for the national and local business. To make things even more complicated, this debate also includes two other contradicting views. One is that more emphasis should be put on hard sciences to make it possible to compete at the global level. The other is that soft sciences are not only more needed for the further development of the Danish welfare state, but are also one of the factors behind the country's successful competitiveness, through its specific social organization. The perspectives of these debates on the future national business structure with its weight on service and creative



industries and the increased outsourcing of traditional industrial and technical areas seem at present to gain in importance.

As mentioned, this debate has been ongoing in different versions for a number of years, and no formalized policy – neither at the national level nor at the level of the individual institutions – has been decided upon. This can perhaps be explained through the fact that no stable and strong coalition has up to now been formed on a united strategy pointing at one specific type of concentration. In all political coalitions, there seems to be proponents for several different kinds of concentration. Furthermore, a look into the more “unstructured” development within the research funding landscape during the last decade might show a slow but steady move away from the humanities and the social sciences and toward the natural sciences and technology. This is a movement that has been possible because of the gradual decoupling of the funding streams for research and education. But a more explicit policy on how much and what kind of concentration seems not to be on the agenda in the short run and is not much echoed in national debates on the development of research.

This means that the linkages that are being established with global research centers, global companies, national research centers, domestic firms, and public institutions and regional partners to a large extent have been a result of a natural development of local research interests and results. National and international institutions, such as the EU institutions, can be supportive in these processes, and so can the universities themselves, but the important players are the research groups themselves and in some cases, firms and other kinds of organizations raising demands and offering support. Concentration in the form of research relations has in this way been part of a rather organic development.

### ***14.4.3 Debates on Higher Education***

The number of programs that offer free admission has increased, and only a few studies such as medicine are strongly restricted. Despite this, the share of university students (long tertiary education) measured as share of the entire population is at the same level as in most other comparable high-income countries, and the government is constantly complaining that the young people are starting their university studies too late. According to the government, this harms the national economy.

The rather free admission of individuals of other European nationalities has several times fueled a debate on the possibility of restrictions. This has been the case because, for instance, medical studies receive a large share of Swedish and Norwegian students who are able to follow programs where Danish is the language of instruction. This has got some politicians to demand that they should not be allowed to study in Denmark without paying, but the government has rejected such ideas as violating rules and regulations within the EU. But these politicians have had more success in restricting the admission of non-European students. From 2006, they must pay a tuition fee to be allowed into a Danish higher education facility.

A debate, which to some extent is pulling in another, on a more global direction, centers around how it should be possible, through a focused use of extra resources, to have a small proportion of students who in the future as graduates will be able to compete and participate in the knowledge production at the highest level. This debate between elite and mass education has recently gained momentum. The debate includes positions that can be seen as rather similar to some of the research policy positions. One is for free and broad admission as has been a Danish tradition, and the other is for reallocating resources in order to concentrate on a small number of programs that have shown great strength in an international perspective and can be seen as vital to the national competitiveness. Several arguments have been presented in this debate – from master-level programs that clearly see themselves as candidates for such an honor to rectors who claim that if the government does not continuously cut the budgets for university education, then excellence in education would on a broader scale be a goal that is within reach in the present structure.

In another perspective, a debate flourishes concerning the direction of university education. This is a debate that can be seen as trying to raise and fulfill goals in quite an opposite direction. The question raised here is how much weight should be given to university bachelor's, master's, and PhD's competence in innovation and entrepreneurship. One of the arguments for this is that it might create more successful start-ups of new firms by university graduates and at the same time make bachelors and masters more useful for small and medium-sized firms. Many universities are experimenting in this field, and the debate is more concentrated on how this could be done than on whether it should be done.

#### ***14.4.4 Internal Governance Structures and External Linkages? Structures***

As explained earlier in this chapter, both the internal structures in university governance and the overall set up of the higher education system have been through several processes of change in the most recent decades. This has not happened without debates between different partners in society and among politicians. At the moment, these debates have calmed down, but they tend to flair up now and then. One is the debate about the conditions for internal governance in universities, especially when the ministry interferes into what the universities see as their internal affairs. Another debate is of a more inter-institutional nature and concentrates on mergers and new linkages between university colleges and between universities and university colleges.

The basic fuel for the debate on university governance is the contradiction between what in the government's language could be called institutional autonomy, and the many direct and indirect governance mechanisms that still and perhaps increasingly are in the hand of the Ministry of Science, Technology, and Innovation. Even when the universities are not any longer seen as traditional state institutions, a detailed state control still prevails. From the period of genuine collegial governance,

the framework that has been set up by the government has always been rather narrow. At the same time, all universities have national teams of external second examiners who participate in most examinations in the university and are appointed by the ministry. Such possibilities for inspection have not been changed as a result of the formal autonomous status conferred on the universities.

Years ago such control methods did not create much debate. The universities were rather unaffected by the external state control. The daily operations and decision making took place in an organic way that was normal when it concerns the development and planning of teaching and research, and the funding for the larger part was a lump sum. These activities were not affected in everyday life by the State regulation. If any real problems were recognized, this was often negotiated on a national scale between the Ministry and representatives from the study boards, deans, or in institutional matters by the Danish Conference of Rectors. This could now and then lead to public debates, but they mostly concern the specific problem more than the matter of governance structures.

One explanation on why the debate has turned more toward governance structures and has become more intense could be categorized into three factors: One is that the dynamic relates both to an increase in the number of new demands that confront universities, and at the same time a situation where systematic budget cuts make state governance more visible inside the universities. Second, the discrepancy between the formal autonomy and the actual governance makes it increasingly difficult for the universities to live up to internal and external expectations. And third, the new autonomy is followed by a demand for the universities to show more systematic management. This means that these leaders are not only appointed by their boss, but are also expected at each level to use managerial methods that often internally are felt as rather mechanistic in a type of organization that has been used to a more organic way of handling things (Rasmussen 2002). Therefore, the debate that takes place on an everyday basis in all universities now and then is reflected in the media and results in discussions on principles and how they are implemented in practice.

The reason why the debate within and between the nonuniversity higher education institutions is different from the university discussion is connected to two other factors. One is the formalization of the educational structure within these institutions in order to increase the level of education to professional bachelor degrees. The other is the need for critical mass, which forces a large number of small institutions to merge and to form university colleges. One difficulty in this process is the rather loose framework the Ministry of Education has set for this process, something that seems to be new for these type of institutions. At the same time, it is a precondition that the education in university colleges is in some ways connected to research, although not research based as in universities, but the university colleges are not provided with state funds to do research. Therefore, some kind of linkage to universities is seen as a way to solve this ambition of a research connection.

The debate within this field has for a large part been related to a question about who should merge with whom and what kind of governance structure should be set up in such a new university. The process started with more than one hundred institutions, and according to the Ministry of Education, it should end with less than ten large

institutions. This has resulted in a number of different structures and with different kinds of linkages to universities. Some have formed rather loose mergers containing institutions with very different areas of education (nursing, teachers' education, and business education), while others have either formed more homogeneous or more centralized institutions. Some mergers include linkages to a university while others do not. At the same time, the first alterations of such new constellations have already been seen.

## 14.5 Concluding Remarks

The increasing interaction between universities and other actors in the innovation system [small and large firms, high-tech and low-tech firms, technological service institutes, hospitals, consultancy and other knowledge-intensive business services (KIBS), public agencies, other educational institutes, etc.] involves a variety of forms ranging from joint labs, spin-offs, licensing, research contracts, mobility of researchers, copublications, conferences, exhibitions and specialized media, and informal contracts with professional network, to flow of graduates. Most countries, including Denmark, have implemented multifaceted strategies to stimulate collaboration between universities and other actors in the innovation system (Mowery and Sampat 2005). However, it is not an easy task to design and implement mutually beneficial collaboration between actors with different missions, cultures, resources, power structures, and knowledge bases (Arocena et al. 2004). There are massive variations among technological fields and sectors in their capabilities and opportunities to create and maintain linkages with universities and other research institutions. For less research-intensive firms and institutions, it might not even be relevant to engage in such direct collaboration. Seen from the perspective of the universities and other academic institutions, they face a complex mix of challenges in order to fill out their "new and bigger shoes" in the modern learning economy (Lundvall 2002a). In this concluding section, we only list a few of these interrelated challenges.

### *14.5.1 Globalization and Restructuring of the Production System*

Historically, a substantial part of the national academic institutions has been linked directly to the national production system. Most clearly, this is reflected not only in the monofaculty universities (for instance, agriculture and pharmaceutical) and in the set up of sector-specific governmental research institutes, but of course also in many other areas as law, business, and engineering. The ongoing globalization and restructuring of manufacturing and services are one of the most important (and difficult) challenges for the contemporary national academic institutions. For instance, if the future software industry is to be relocated to India or China, is it then relevant to continue educating Danish IT specialists? Or if most of the manufacturing is

outsourced, where should the production engineers go? Or if the internationalization and mergers within KIBS continue, will they all end up in London or Beijing? Multinationals set up and close down R&D departments according to contemporary national strengths. Multinationals have for instance during the last 10 years established R&D departments within mobile communication and pharmaceuticals in Denmark, but recently some of the mobile research units have been closed or reduced. At the same time, Danish research-intensive firms establish R&D units outside Denmark and to an increasing degree collaborate with foreign universities and research institutes. How can or should the academic institutions react to this?

One small-country strategy could be a specialization strategy, where a substantial part of the scarce resources is allocated to a few specific areas. To identify these and not least to agree on the selection is a challenge in itself. Nonetheless, it seems as if many countries, including Denmark, try to implement such a specialization strategy and it also seems as if there is a common understanding that areas within ICT, nanotechnology, biotech, and pharmaceuticals should be among the selected, based on expectations about future key technologies and related growth industries.

In the Danish case, another specialization (or maybe diversification) strategy could be to further strengthen the linkages between the academic institutions and public administration, the health care sector, the alternative energy sector, and the environmental industry – areas where the Danish Innovation System still has some internationally competitive strengths.

### ***14.5.2 Increased Internationalization of Knowledge Production and Knowledge Diffusion***

Concurrent with the increasing globalization and restructuring of manufacturing and services is an increasing internationalization of knowledge production and diffusion. One important part of this has to do – as mentioned above – with the MNCs' restructuring of R&D activities and the outsourcing of high-skilled jobs. However, it also affects the academic institutions more directly in the form of increased focus on international research collaboration, more international staff and student mobility, and a growing focus on international publishing. In that way, universities and research institutions have to balance between increasing demands toward international engagements on the one hand, and commitments to collaborate with domestic firms and other actors in the national innovation system on the other. In countries where the domestic production structure is dominated by SMEs within low-tech industries that do not invest much in R&D and have no or very little tradition to collaborate with universities and other research institutions, this dilemma is more manifest (Arocena et al. 2004).

Furthermore, the increasing internationalization of the knowledge production system is forcefully stimulated by national and international R&D and innovation policies. In the Danish context, various EU policies – for instance, the different generations of framework programs – have had substantial influence on the national

policies and the academic institutions' responses to these new funding possibilities. The increasing demand for forming Networks of Excellence spurs in the same direction.

### ***14.5.3 Increased Marketization of Public Sector Activities***

Since the 1980s, there has been a general shift in the public service philosophy toward more and more marketization (Peters and Olssen 2005). This tendency has also made its entry into the academic institutions and its relations to other actors in the innovation system. It is echoed in several ways. First, it is reflected in the increased policy focus on the production of so-called useful knowledge primarily defined as knowledge with a direct economic benefit for the private sector. This is valid both for the ongoing "modernization" and fine tuning of study programs and for allocation of public research funds. Second, the marketization philosophy also prevails in the increasing dependency on external funding. On the one hand, this may stimulate research collaboration between the academic institutions and external partners. On the other hand, there is a risk that an increasing dependency may favor short-term research within a few selected areas at the expense of more long-term research within a broader range of disciplines and thus maybe emptying the key source for collaboration in the long run. Third, the earlier mentioned shift in the allocation mechanism from input criteria to output criteria drives in the same direction.

### ***14.5.4 Increased Commodification of Knowledge***

The enhanced possibilities for universities and research institutions to take out patents have revitalized the classical dilemma between, on the one hand, a broad and easy access to public financed research and, on the other, private appropriation as one of the basic incentives to innovate. But more importantly, the increasing tendency to treat information and knowledge as commodities introduces a basic contradiction in the learning economy. On the one hand, firms and now also universities try to capture knowledge economies through intellectual property rights. On the other hand, knowledge is socially produced in groups and networks, which may be destroyed or damaged when knowledge is treated as a commodity. Furthermore, the commodification of knowledge is accompanied by increasing costs for developing and maintaining an adequate knowledge infrastructure including various transaction costs following the commodification process and protection of property rights.

Most European countries have recently implemented equivalents to the American Bayh-Dole Act, hoping for future revenues from patents taken out by universities. In the Danish case, a new patent act was implemented in 2000 (L347), aiming to increase the commercialization of public research. The new act has given the public

research institutions the possibility to take over the rights to an invention done by a public researcher by paying a “fair” compensation. Furthermore, L347 gave the public research institutions an obligation to work actively for putting the research to commercial use. It is of course too early to evaluate the long-term effects, but commercialization surveys confirm that setting up the necessary institutional infrastructure related to intellectual property rights (IPR) is both a costly, risky, and lengthy learning process (Danish Agency for Science, Technology and Innovation 2007).

It is an important question if the changing IPR regime in public research will influence the internal and external collaboration patterns in the long run. Will the university management allocate more resources to areas with higher probability to patent? Will the demand for secrecy influence the interaction between colleagues, students, and external partners?

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