



Center for
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Higher Education Funding Systems: An overview covering five European jurisdictions and the Canadian province of Ontario

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1. Setting the scene

1.1 Introduction

Funding systems across the world are undergoing a substantial change. This is the case in particular for Europe, where the European Union's member states collectively pursue policies to integrate their economies, political systems and social structures under a broader, more powerful Union. However, all over the world it is becoming increasingly clear that higher education is a critical component to fully realising a country's potential. In Europe this very idea has given rise to a series of ambitious goals and objectives designed to ensure long term European pre-eminence as both a knowledge producer and transmitter. Since the late-1990s the rate of change in European higher education has accelerated to unprecedented levels, largely on the shoulders of three key developments: the Sorbonne and Bologna Declarations (1998, 1999), whose objectives are to make study programmes more compatible across European systems (4,000 institutions and 17 million students), and the Lisbon Strategy (2000), which seeks to reform the continent's still fragmented systems into a more powerful and more integrated, knowledge-based economy.

The *Bologna Process* aims to establish a European "higher education area" by 2010 and today 46 countries (extending from Europe to the former Soviet states) have subscribed to this idea. In March 2000, the European Union committed itself in the Lisbon strategy to the ambitious objective of becoming 'the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion.' European policymakers' intentions took on a more concrete form in 2002 when the more recognizable goal of raising EU-countries' investments in R&D to 3% of GDP was outlined in Barcelona. Aggregate public investment in both education and research still lags behind that in the United States and it seems that EU member states' abilities to make further investments are limited. The investments differ significantly across countries and even more so across subnational regions (Dill and Van Vught 2008). Although state investments in research have grown, industry contributions grew only marginally. The political Lisbon summit goals are proving very difficult to reach, partly due to weak economic growth in the larger member states and due to the fact that the design and the implementation of the policy actions rely on the member states and industry.

The Lisbon strategy was renewed in the shape of the New Lisbon Partnership for Growth and Jobs (European Commission, 2005) where 'knowledge and innovation for growth' have been determined as one of the three main areas for action. The contributions that universities are expected to make to the realization of the Lisbon goals were spelled out in a Communication from the European Commission: Mobilising the Brainpower of Europe.

The Modernisation Agenda (2007) highlights that education, research, innovation and the modernisation of higher education institutions are main pillars of the Lisbon Strategy.

Higher education in Europe is necessarily diverse. The same holds for the mechanisms used by the public authorities in EU member states to fund their higher education systems.

It is against this backdrop that we wish to look at higher education funding in Europe. For the European states, funding is a major steering mechanism for their higher education systems. Funding mechanisms are closely linked to general policy choices concerning higher education. As on all continents, in Europe governments remain the primary funding source for higher education institutions. And EU leaders cast a wary eye toward figures and trends showing that European investment in education and R&D, especially from private sources, is not pushing Europe towards parity with places like the USA but instead are showing an ever-widening gap. This has prompted the European Commission to call on member states to nearly double aggregate R&D investment and increase the share of industry sponsored research from 56% to 66% by 2010 (European Commission, 2002; 2005). This is easier said than done, as continued economic fluctuations have made it difficult for governments to provide incentives and subsidies that are capable of encouraging private investment in research and development. In the area of teaching, predominantly national policies towards cost sharing are sometimes met with scepticism due to fears of a decrease of access to higher education (Vossensteyn and Mateju, 2008).

The Bologna Declaration, Lisbon Strategy and Modernisation Agenda have not been the only influences on European higher education institutions. In many Western European countries a series of reforms were already underway in the 1980s and many current reform initiatives have their origin in this period. The changing role of the state *vis-à-vis* higher education institutions (i.e. in the form of enhancing institutional autonomy and stressing quality assurance and accountability) are well-known themes in the last two decades (Neave, 1988; OECD, 2003; Eurydice, 2000; 2008). Globalisation, internationalisation and privatization have all done much to shape the current situation. Some examples are the growing importance of international profiling, international consortia, tuition fees, external research funds and the emergence of private higher education institutions. If, however, one seeks a common thread that links these larger developments to the current state of European higher education reforms, then few would disagree that it is the growing recognition that higher education sectors are both remarkably complex and not immune to the pull of the market.

1.2 Trends in allocation mechanisms

We now turn to the mechanisms (the 'allocation models') that are used for determining the budgets that are distributed by the public authorities to the universities and colleges in the higher education system. Funding modes and funding models not only serve to allocate resources for given ends, they are increasingly being used as governance or management tools in situations where institutions operate in an environment characterized by an absence of competitive elements. Changes in funding mechanisms constitute a central package of measures related to public management reforms. At this point we stress that changes in funding mechanisms will often go hand in hand with changes in the other steering instruments. However, for this report we limit ourselves to the instrument of funding.

For the classification of funding mechanisms two questions may be used:

1. What is funded by the government?
2. How is it funded?

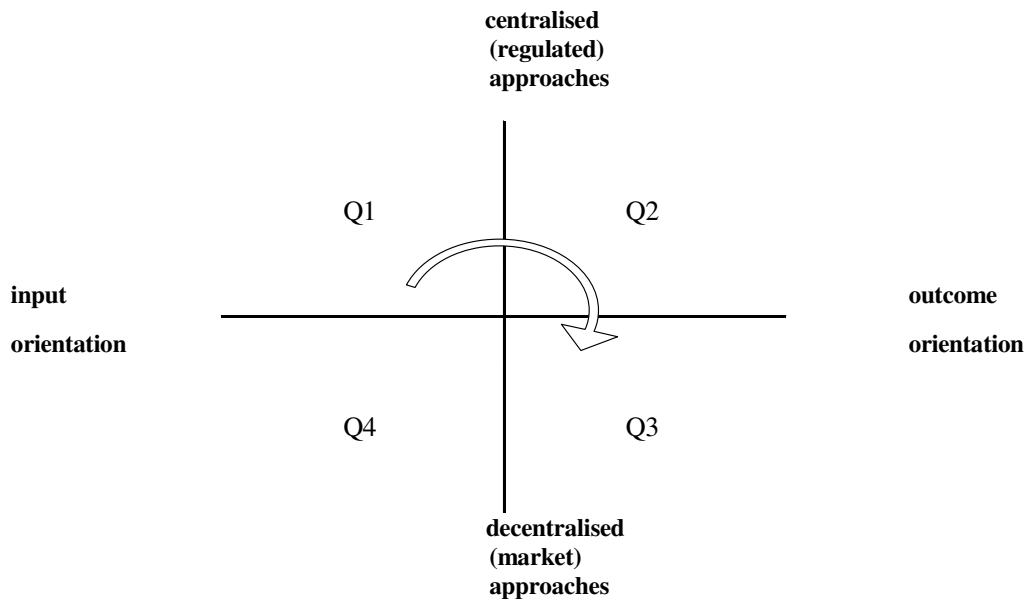
Question 1 can be rephrased as follows: What is the degree of output orientation in the public funding? When financial means are made available to institutions to cover distinct costs such as staff salaries, material means, building maintenance costs, investment, or so-called “costs to continue”, this is called *input funding*. If the budgets are driven by measures of activity such as the number of students enrolled in an institution, we also speak of input funding, because student numbers will largely determine the level of inputs spent in the instruction process. In contrast, in funding arrangements where institutional budgets are tied to specific teaching and research outcomes of the institutions’ activities we speak of *output funding*. Funding on the basis of output is believed to contain more incentives for efficient behaviour than input funding. If budgets depend on performance measures, there is reason to believe that those who receive the budgets will pay increased attention to their performance.

Question 2 relates to the issue of market orientation in the funding arrangements. One of the characteristics of market orientation is the degree of competition implied by the funding decisions. Stated differently: “Are funded student numbers or funded (research, degree) programs regulated (or planned) by central authorities or are the funding flows driven by the decisions of the clients (students, private firms, research councils/foundations)?” The answer to this question may be translated into a measure for the degree of centralisation, distinguishing a situation of intensive government oversight and regulation from a situation in which consumer and producer sovereignty is large. At the extreme end of regulation the government determines the institutions’ resources centrally, for instance by prescribing the exact numbers of students in different programs. In the deregulated case, individual decisions made by students and education providers drive the system. Here, institutions have considerable latitude to operate as they see fit and institutions have a large autonomy over how funding is procured and spent. In practical situations the degree of centralisation (or market orientation) will lie somewhere between the two extremes.

In figure 1 the vertical axis depicts the degree of centralisation/decentralisation and a horizontal axis expresses the degree to which governments are paying for the results (outcomes) instead of the efforts (inputs). We distinguish four quadrants (Q1, Q2, Q3, and Q4) to classify funding arrangements.

Observing the worldwide trends in allocation mechanisms we see a gradual clockwise movement from the ‘north-eastern’ quadrant (Q1) of Figure 1 towards the ‘south-eastern’ quadrant (Q3). There is an increased reliance on market-type co-ordination mechanisms in the HE sector and funding increasingly takes place on the basis of performance. The emphasis on competition and performance is expected to encourage higher education institutions to focus more on delivering value for money and responding to their various ‘clients’. Instead issuing directives from above, governments are leaving decisions more to the individual ‘agents’ (students, institutions) and provide them with incentives to do so. This marketisation trend is manifested, amongst other things, through increased competition for (both public and private) funds, the growing presence of project funding for research, and the introduction (or increase) of tuition fees.

Figure 1: Trends in funding mechanisms



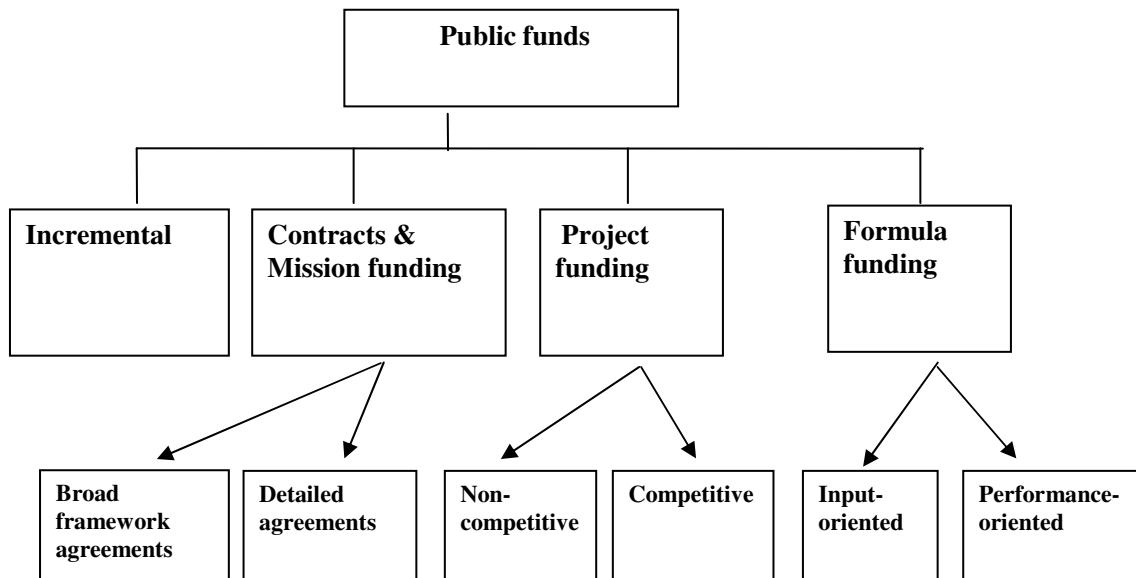
Where government appropriations are based on measures of institutional performance, one can distinguish two options:

1. budgets are based on actual results,
2. budgets are based on projected results.

An example of option 1 is where funding takes place according to a formula that is driven by the number of degrees or credits accumulated by students. An example that falls under the second option is the allocation of grants and contracts in a competitive process, such as through a research council that selectively awards project funds to proposals submitted by research groups. Yet another example that also is part of option #2 is the allocation of public funding in accordance with a performance *contract*. Performance contracts between individual higher education institutions (HEIs) and the relevant Ministry or Funding Council lay out institution-specific (say mission-based) objectives. The public funds that the HEI receives are conditional on their delivering specific performances. Depending on the contract regulations, there is a certain amount of monitoring as well as agreements on financial penalties if the objectives are not achieved. Contracts with institutions as a whole can be either very broad, based on framework agreements, but can also be more detailed. In the latter case they may become more similar to the traditional approach to funding where specific budget lines are negotiated with the public authorities in a system of line item funding.

Figure 2 shows four main types of funding: incremental (historical), contracts (incl. performance contracts; mission budgets), project funds (e.g. research council grants) and formula-based budgets. In practical situations, one may observe a mix of the various options.

Figure 2: Options for the public funding of higher education institutions



The various 'boxes' shown in Figure 2 are in place in most national higher education funding mechanisms. Surely, every country will have its own mix as a result of historical and political developments.

The chapters that follow contain information on the funding mechanisms that are in use in six higher education systems:

- Germany
- Netherlands
- Norway
- United Kingdom
- Sweden
- Canada (in particular: the province of Ontario).

These particular countries were chosen because they all recently introduced reforms in their funding models. It will be interesting to learn what the reforms look like and what the intended results are. We will be particularly interested in the design of the various 'boxes' and the changes that took place over time. Every chapter of the six that follow starts with a general introduction on the higher education system. This is followed by a section discussing the allocation mechanisms in place for the provision of operational funds to institutions. The third section of each chapter describes research funding.

2. Germany

2.1 Introduction

In Germany the 16 federal states – the *Länder* – are legally responsible for their own higher education system. Higher education policy is an aggregate of sixteen potentially different policies for higher education. German higher education is overwhelmingly publicly funded, and institutions have to follow the budgeting and accounting legislation of German public administration. These laws, although set by the individual states, are more or less similar across the country.

In 2007 there was a total of 383 higher education institutions spread throughout the Federal Republic of Germany. There are different ways to categorise the institutions, but usually the distinction is made between the research universities and the vocationally-oriented Fachhochschulen (or universities of applied sciences). At the moment, there are over a 100 universities in Germany and some 180 Fachhochschulen. The remainder of the tertiary institutions are colleges of art and some specialised institutions.

Projections on the future number of secondary school graduates enrolling in higher education show rapidly increasing demand of higher education. At the same time, the supply of study places is under pressure due to the ongoing transition to Bachelor and Master-programs. These programs require higher staff capacity than the traditional programs. To cope with this increased tension on the 'market' for study places, the federal government and the *Länder* agreed on a *Hochschulpakt 2020* (Higher Education Pact 2020). One of the measures agreed in this Pact is to increase the number of study places by 90.000 till 2010. Federal government and the *Länder* will spend about €1 billion on these new study places. The federal government funds half of the additional costs. The funding starts from autumn 2007 on.

The Framework Act for Higher Education (*Hochschulrahmengesetz*) of 2002 provided for all institutions of higher education in the Federal Republic of Germany that no fees were charged for higher education up. A constitutional court ruling in 2005, however, stated that the federal government was not allowed to forbid tuition fees in the Framework Act and the *Länder* governments were allowed to introduce fees in their own way. So far, seven *Länder* have decided to introduce tuition fees (Baden-Württemberg, Bavaria, Hamburg, Hessen, Lower Saxony, Northrhine-Westphalia, Saarland). In Lower Saxony and Northrhine-Westphalia (NRW) first year students started to pay 500 EUR per semester. In NRW the higher education institutions themselves decide if and which amount of tuition fees they charge. Baden-Württemberg, Bavaria and Hamburg introduced tuition fees in summer 2007, whereas in Saarland and Hessen students had to pay tuition fees from autumn 2007 on. All *Länder* started with 500 EUR per semester. Other forms of tuition fees such as tuitions fees for students with a very long study time are introduced also in nearly all *Länder* (exceptions are Berlin, Brandenburg and Schleswig-Holstein).

2.2 Funding

The government has traditionally had a strong role in higher education, as can be observed by the emphasis on supervision rights held by government and the public funding mechanisms. The notion of academic freedom is considered of paramount importance, however the strong emphasis on the research function of the universities means that academic scientists determine teaching and research, and play a major role in administering the internal affairs of higher education institutions.

In the majority of states, the budgets of HEIs are still heavily based on historical considerations. However, in recent years some states have started to take into account more objective factors such as enrolments or performance.

In the case of the former, the state subsidies for the individual institutions are included in the state law. The institutional budget is subdivided into expenditure categories (line items) and positions (for personnel, described in the so-called *Stellenplan*). The budget is an integrated budget for education and research. Teaching and research are not funded separately. Usually the budget is already subdivided according to the institutional structure, and the positions are already assigned to the departments and institutes. The budget thus predetermines the total expenditure process for the fiscal year.

Historically an institution's budget in Germany was determined by simply rolling-on the previous year's budget with possible modifications due to inflation. The assumptions behind this practice were that a university's cost structure was relatively fixed and that there was a status quo in the higher education sector. Although the amount of funding a university received was not founded on fixed criteria, the cost structure of a university was transparent in the sense that it was presented in a detailed form in the budget documentation. However, any changes in higher education policy or in the strategy of a higher education institution (e.g. to increase the size of its library) would clearly require negotiations to determine an appropriate increase to the budget. That is why this type of budget allocation is called in Germany discretionary-incrementalist funding.

In most German states recently formula funding has been introduced for increasing parts of the available budget, but until now it still relates to a small part of the budget (1-7%). On top of that, *Länder- governments* have given institutions increasingly more flexibility with regard to the (internal) allocation of funds according to their own discretion, and with fewer limitations fixed in advance. In many *Länder*, experiments have been carried out with block grant (lump sum) funding (*Globalhaushalt*) as a replacement for the traditional and rather inflexible allocation mechanisms.

Currently 14 of the 16 *Länder* apply performance-based formulae to determine some part of the state grant, which institutions receive (see table 1). In the other *Länder*, the remaining 80% of the state grant is still appropriated on the basis of discretionary-incremental decisions.

In the remainder of this section we will focus on the situation in the university sectors of the *Länder*.

Table 1: The share of the state grant allocated using formula (situation in 2006)

state	%
Baden-Württemberg	20
Bayern	1.5
Berlin	20
Brandenburg	95
Bremen	10
Hamburg	85
Hessen	Under review
Mecklenburg-Vorpommern	4
Niedersachsen	3
Nordrhein-Westfalen	20
Rheinland-Pfalz	95
Sachsen	1
Schleswig-Holstein	5
Thüringen	15

Some of the 14 states that have some form of formula funding had been experimenting in earlier years with funding formulae, allocating a small part of their (non-personnel) resources on the basis of output indicators. Rhineland-Palatinate, for example, operates two funding models – a basic budget distribution system and a separate distribution system for personnel costs which use both input and output measures.

The number of Länder using formula-based funding has increased quickly over the past six years from three in 2000 (including the Fachhochschulen in Niedersachsen) to 12 in 2006. Many of the Länder have subsequently increased the proportion of state budget allocated by formula since introduction. However, there is significant variation in German higher education. indicator-based funding is felt to have its limitations as an instrument for implementing public policy. This may account for the increasing use of *target agreements* (*Zielvereinbahrungen*; see below), which provide another instrument for the facilitation of performance-based funding, although they have a limited competitive dimension.

Formula-based funding can provide a procedure for allocating funds based on objective criteria, which are transparent and where the results are predictable: institutions with the same indicator values will, in general, receive the same funding. However, the criteria of predictability and transparency do incur disadvantages for flexibility. If a formula-based procedure is to offer predictability and transparency, the formula should be fixed in the mid-term and communicated to all the institutions which will be affected by it clearly and on time. This trade-off between predictability and flexibility is one of the reasons that the majority of German Länder has implemented formula-based funding for only a small share of the total state grant. In each of these three models with a formula-share of over 20% - Brandenburg, Hamburg and Rheinland-Pfalz – it is nevertheless possible to differentiate between two components:

- (i) a basic grant and
- (ii) a performance grant.

The basic grants tend to have the function of contributing to the transparency of the funding allocations and are often based on relatively stable or predictable indicators:

- in Hamburg 85% of the state grant is based on negotiated target values for the number of graduates by subject area. Currently there is no system of claw-back for institutions which do not meet the agreed targets.

- In Rheinland-Pfalz around 80% of the state grant is determined by developments in the number of academic personnel. Again, such developments normally occur in discussion with the state ministry for science.
- in Brandenburg 75% of the state grant is based on the developments in student numbers and the number of professors. The weighting of these two indicators is different for different subject areas: For humanities and social sciences the number of students determines 75% of this basic grant, whilst for natural sciences and engineering, which require comparatively more equipment for teaching provision, 40% of the basic grant is determined by the more stable indicator number of professors.

In 2003 the Hessen model of funding allocation was similar to the above mentioned models and differentiated between a basic grant (80%) and a performance grant (15%) for the allocation of in total 95% of the state grant. The basic grant was allocated on the basis of agreed target numbers of students. In fact, in an effort to further improve the transparency of the model, it was decided to implement a so-called “price model”, which affixed a set price to each unit of measurement – e.g. the number of students. Therefore, for each additional student, a university would receive a set amount of funding. The problem with this model was that the state grant was insufficient to cover an unexpected growth in the number of students, particularly because the grant for the sector was frozen at the rate for 2001.

In the context of a fixed and constrained state budget, the consequences of this model were that the increased number of students within a fixed budget led to each university receiving less money per student (i.e. a reduction in price). However, in competition between each other for a share of this fixed budget universities could only increase their share by increasing the number of students. This consequence contradicted the initial choice for a clear price model and the model was therefore put on hold.

A formula measures performance on the basis of changes in indicators. In this way, an institution is encouraged to invest in measures which will improve its performance, as it can anticipate a financial pay-off for this investment. However, institutions also compete with one another for this financial “reward” if they are funded on the basis of the same indicators (including weightings on indicators). Here, German practice shows two interesting examples of constructing a competitive field in the institutional allocations.

Berlin, with its three universities and five Fachhochschulen, has introduced an interesting variation on competitive funding. Within this system, the two higher education sectors do not compete with one another directly. Within each sector competition takes place within subject areas: in the university sector (i) within humanities and social sciences and (ii) within natural and engineering sciences and for Fachhochschulen (i) within social and business sciences and (ii) within technical sciences and design. The concept behind this is that, for example, the Technical University in Berlin cannot compete on the same benchmarks as the Humboldt University, with

the latter's focus on humanities and social sciences. Therefore, only the performance of the Technical University in the subject area of humanities and social sciences will compete with this subject area's performance profile at the Humboldt University. A further benefit of this system is that changes to a subject profile in an institution can be easily accounted for in the allocation model.

Schleswig-Holstein is a further example of a state with few institutions of higher education (over half of all students are matriculated at one university), which nevertheless wants to introduce competitive dynamics into its system. Instead of using the other institutions of higher education in Schleswig-Holstein as benchmarks for each other, it uses a national benchmark constructed by aggregating values for certain key indicators from institutions with similar profiles.

Often the object of formula-based funding is to reallocate funding on the basis of performance. The consequence of this is that there will inevitably be winners and losers. To prevent large shocks, many of the German *Länder* use tolerance bands of between 1% and 2% of the total budget. Any losses outside of this band will be capped under this system.

The choice and weighting of the indicators used in a formula determine the dimensions of performance and competition, which is implemented. One can differentiate between provision-based (say input-oriented), demand-oriented and success- (or output-) oriented indicators.

The set of indicators chosen can be seen to attempt to reflect the key tasks of a university. All of the funding models used reflect performance in the areas of teaching, learning and research. In general there tends to be a broad focus on teaching rather than research. This is particularly the case for Fachhochschulen. In Berlin, for example, 50% of the formula funding is based on teaching indicators and 45% on research in the university sector. In contrast this ratio is 80% to 15% for the Fachhochschulen. All of the Länder also include gender equality as a third area in their funding model. Usually such equality indicators will make up 2 or 5% of a university's formula-based budget, but in Baden-Württemberg, an exceptionally high share of nearly 16% is reached and in Hamburg, where the universities choose indicators to reflect both their profile and their potentials for improvement, it ranges between 10% and 25%. A further area of performance reflected in almost all formula models is internationalisation. This is most commonly measured by teaching-related indicators such as the number of foreign students.

The main indicators employed to measure achievements in teaching and learning are the number of students (sometimes only those students within a certain limited "standard" number of years of study)¹ and the number of graduates. For instance, in Nordrhein Westfalen, just these two indicators account for 50% of the formula-based budget share. Although some other indicators are also used, such as the number of first year students at universities in Lower Saxony, they are not common for all models. As far as research performance is concerned, the most important indicators are third-party-funding as well as the number of doctorates and *Habilitationen*.¹ It is not unusual for third-party funding (sometimes weighed against the number of professors) to make up about a third of a university's formula-based funds. Since only universities can grant doctors' titles, an indicator such as the number of doctorates (also weighed against the number of professors in some cases) only makes sense in this sector of the

¹ The *Habilitation* is a post-doctoral qualification giving the holder the right to be admitted to a university as a professor.

higher education system. Where they are used, they can determine between 5% (Bavaria) and 17% (Bremen) of a university's formula-based budget.

The use of output-related indicators such as the number of graduates may impose the danger of a loss of quality, for such an indicator could be seen as an incentive to make more students pass by lowering quality standards. So as to avoid such malfunctions and unintended consequences, specific measures to maintain quality standards may have to be introduced. The low share of grant allocated by formula in Germany does, however, mean that currently the incentive to decrease quality is relatively weak and further constrained by the continuing close relationship between state and individual universities.

The differences between subject groups – especially those in their costliness – are reflected in the funding models. In Bayern, for instance, the indicator for third-party funding is weighed 5:2:1 for the humanities, natural sciences and engineering, respectively. Female professors in the humanities, in natural sciences and in engineering, by contrast, are weighed 1:2:4. This way, the likelihood of the different subject groups to score on the distinct indicators is counterbalanced.

2.3 Contract funding; target agreements

Lump sum funding is in most *Länder* related to target agreements (called *Ziel- und Leistungsvereinbarungen*) in which higher education institutions and *Länder* governments agree upon certain institutional policies and goals. These agreements are contract-like agreements in which funding for achievement of institutional goals are laid down.

In the last few years there has been an increasing trend towards using a combination of formula funding and such individual performance agreements to enact higher education policy.

Nordrhein-Westfalen, which has the largest higher education system in Germany, was the first state to introduce both instruments at the same time. At their introduction, the performance agreements had the explicit purpose of supporting innovations and developments, which would contribute to reaching the state's goals for the sector as set out in the so-called "quality pact". Initiatives which were agreed between the state and individual universities received supplementary funding. Bayern, which has only recently completed a review of its whole higher education system entitled "Scientific region Bavaria 2020" has also introduced performance agreements to fulfil the same purpose in its region.

In Nordrhein-Westfalen the target agreements so far were not a resounding success. The instrument lacks teeth because no financial rewards or penalties are attached to the contracts and objectives are often left unspecified or unquantified. In addition, the communication about the contracts and their rules of the game was not perceived as very effective.

2.4 Research funding

The universities have traditionally formed the backbone of the German research system. The spectrum of research covered by universities ranges from basic to contract research. Both types are mostly financed by the state governments. The universities of applied sciences, which originally had no research mission, have developed increasingly into problem-oriented research performers, functioning as a link between science and regional industry.

The German universities are funded for their teaching and research tasks by their respective state government with a minor contribution by the Federal Government to the construction of R&D facilities. The state governments therefore provide the core institutional research funding in universities. The DFG is the German research-funding organisation which complements institutional funding for basic research with project-type funding. The mission of the DFG is to fund and promote all branches of science and the humanities. Funding is awarded on the bottom-up principle based on peer review. It sources its funding from the BMBF, the Federal Ministry of Education and Research (58%), and the Länder governments (42%). The DGF works on the basis of granting about 35% to projects without a predefined thematic priority. The eligibility requirements for DFG grants relate to excellence and the qualifications of the individual researcher.

A highly debated issue on federal level is the *Exzellenzinitiative*. With this initiative the federal government and the *Länder* created a competition between universities for additional research funding. Federal government and *Länder* will spend €1.9 billion on this initiative in the next five years (till 2011). 75% of the money is provided by the federal government. The funding is allocated by the *Deutsche Forschungsgemeinschaft* (DFG, German Research Council) and split into three project-based approaches. This "Initiative for Excellence" aims to strengthen the German universities' efforts in R&D and build up internationally visible centres of excellence. It has three project-oriented lines of funding:

- postgraduate schools for young scientists;
- clusters of excellence;
- funding of "Future concepts for top-class research at universities".

The institutions of higher education have been selected by an independent jury within the framework of a competition. A total of €1.9b will be available until the year 2011. The Federal Government will cover 75% of the total amount. After a heavy competition, nine universities, three in the first round and six in the second round of the initiative, were selected for funding of their future concepts. Additional universities receive funding for postgraduate schools and clusters of excellence.

This initiative for excellence is a cornerstone in the research funding of German universities. It does not only award prestigious project funds but introduces also a new feature of research funding. Up to date institutional funding such as infrastructure was not part of research project funds. In the 'Initiative for excellence' scheme additional funds for infrastructure will be part of project funding. This new feature is seen as a first step to transform research funding gradually

into a system where costs for infrastructure are included in the project funding. This transformation is also part of the *Hochschulpakt 2020*.

The increasing strive for excellence in German research and science policy has led to the promotion of clusters. The result of this competition is the funding of five clusters of excellence that have recently been identified (Top Cluster Competition). These clusters will receive about €200m for five years. The goal of the competition is to strengthen clusters that involve frequent collaboration and interaction between industry and science leading to higher innovativeness and competitiveness. The measure is part High-Tech Strategy (Hightech Strategy for Germany) which was initiated in 2006. The promotion of clusters is another attempt of German R&D and innovation policy to link academic research and industrial application by bringing together academic organisations with private firms.

3. The Netherlands

3.1 Introduction

In the Netherlands there are two main types of regular higher education, namely research universities and universities of applied sciences (*hogescholen*). The latter specialize in technical and vocational training, while the research universities focus on providing scientific instruction and conducting scientific research. Hogescholen award mostly bachelor's degrees (only some award master's degrees or the shorter associate degrees). There are 47 hogescholen and 14 government-approved research universities (including an Open University).

Since 2002, the higher education system in the Netherlands has consisted of a bachelor's and a master's phase. The universities receive basic funding for teaching and research from the government (the Ministry of Education, Culture and Science: OCW). Additional research funding is made available through competitive grants, most of which are distributed by the Netherlands Organisation for Scientific Research (the research council: NWO). Additional research funds come from contract research and EU framework programmes.

The ruling Cabinet has embraced the Lisbon objectives and recognizes that education and research are vital for the Dutch knowledge society and the knowledge economy. Illustrating the priority the government has given to research, it was agreed within the cabinet that unexpected additional income from natural gas, which is put in the fund for strengthening the economic structure (FES), would be allocated for circa 50% to education, knowledge and innovation.

In the Cabinet's policy programme one of the main policy objectives is to create an innovative, competitive and entrepreneurial economy. The main challenges for higher education and the policies to address them are identified in the Strategic Agenda for higher education, research and science (November 2007) of the Education ministry. The starting point of the Strategic agenda is that the current position of the Dutch economy and the Dutch research system is good, but fragile. Research policy will need to contribute to raising labour productivity by strengthening the link between education and knowledge institutions on the one hand and businesses, societal and governmental organisations on the other. Furthermore, entrepreneurship (e.g. start-ups, spin-offs) would have to be strengthened.

A related challenge is to stimulate top-level research and to create an ambitious learning and research culture in the Netherlands. Not only the quality of education and research should be improved, also the quantity of well-trained knowledge workers is a main challenge. Shortages are looming, especially in students and researchers in science and technology.

3.2 Brief description of funding flows

The research universities receive their funding via three funding flows. The first - the base funding – originates directly from the Ministry of Education, Culture and Science (OCW) and tuition fees paid by students. It is approximately 60% of total university revenue. The second flow of funds consists of research council funding and represents 10%. The third flow of funds

makes up the remaining 30%. In recent years the "first flow" funding was cut back (€50m less annually) by the new cabinet. This money is added to the NWO budget to support excellent individual researchers through competition-based funding (second flow).

The Netherlands Organization for Scientific Research NWO is responsible for allocating the second flow. NWO receives funding from the Education ministry and the Ministry of Economic Affairs (the latter supports the natural/technical sciences). NWO then awards project funds after reviewing the research proposals submitted by researchers. Competition for this type of prestigious funding is high.

The third flow of funds consists of a heterogeneous mix of revenues from activities such as contract research (approximately half of the third stream), contract teaching, consultancies, research commercialization, endowments and renting out university facilities. Clients are: private businesses, government, non-profit organizations and the European Union, as well as individual students and staff.

As far as the *first stream* of funding is concerned, each university receives a formula-based lump sum (block grant) for teaching and research. This lump sum is public funding allocated by the Ministry of Education Science and Culture (in Dutch: OCW). The lump sum allocation is based on measures of volume (student numbers, diplomas, turnover in competitive research council grants), prices (such as or tariffs per student) and historical considerations. The allocation mechanism is known as the *BAMA model*, named after the BA and MA degrees that were introduced from the year 2002 onwards. The BAMA model is largely formula-based; it distributes a given sum of money (set by Parliament) across the 13 research universities. The formula takes into account the relative performance of each university (as compared to the other universities).

The BAMA allocation consists of a *teaching* component and a *research* component, but this distinction is for calculation purposes only. In fact, the Executive Board of the university is free to use its own model in distributing the first stream funding (and the tuition fees received directly from its students) across teaching and research activities. This is the *lump sum* principle. The teaching component is 42% of the lump sum (excluding the Academic Hospital allocation), and the research component makes up the remaining 58%.

The *teaching component*, shown in the upper part of the table below, consists of the following parts:

- (a) new entrants allocation
- (b) diploma-based allocation
- (c) fixed amounts for each university: basic allocation

The relative shares of (a), (b) and (c) for the year 2007 are 13%, 61% and 26% respectively. For individual universities, these shares may differ due to their relative performance.

More than half of the teaching component is based on *performance*, as measured in terms of the number of (BA and MA) degrees granted. The rationale for this component lies in the belief that the diploma premium will encourage the university to get their students to complete their degree. There is a time lag of two years before a university sees its 'performance' translated into funding. The same holds for the number of new entrants (i.e. students that enrol for the first

time in either a BA or MA programme). This measure may also be regarded as a kind of performance indicator, as it reflects the attractiveness of the university to students.

The *basic allocation* consists of fixed amounts per university. Actual amounts differ across universities; they have a historical basis. Roughly, the large and relatively older universities receive a larger allocation compared to the smaller ones. The fixed allocations serve as a stabilising factor in the financial flows to universities.

To account for differences in the costs of training across disciplines, different funding rates (*tariffs*) are applied to the number of students (new entrants) and degrees. The tariffs (shown in the table below) make a distinction between three categories of programmes:

- 1) arts, humanities, law, social sciences, and languages (the low-cost programmes)
- 2) science, engineering, and agriculture (the high-cost programmes);
- 3) medicine (including dentistry and veterinary science).

Table 1: Funding model components and rates for the BAMA model (year 2007)

model compartment	tariff / base	share (in %)
teaching component:		
new entrants	€ 2,700 low € 4,100 high	13%
diplomas	€ 11,700 BA-low € 17,600 BA-high (excl. medicine) € 21,100 BA medicine € 5,900 MA-low € 8,800 MA-high (excl. medicine) € 31,600 MA medicine	61%
basic allocation	Historical	26%
<i>total for teaching component</i>		<i>100%</i>
research component:		
basic allocation	Ba/Ma diplomas € 2,700 (BA-low) € 4,100 (BA high) € 8,200 (BA-medical) € 5,400 (MA-low) € 8,200 (MA-high) € 16,300 (MA-medical)	19%
PhDs	PhD low: € 36,400 PhD high: € 72,700	13%
designer certificates	€ 60,800	
research schools	Historical	3%
top research schools	strategic choices	3%
Smart Mix	Performance in competitive research contracts (NWO and selected 3 rd stream contracts)	7%
strategic considerations	Historical	55%
<i>total for research component</i>		<i>100%</i>

The *research component* of the BAMA funding model consists of six parts:

- (a) an amount for each university depending on the number of BA and MA diplomas
- (b) allocation for dissertations and designer certificates (in Dutch: *ontwerperscertificaten*)
- (c) allocation for research schools (in Dutch: *onderzoekscholen*)
- (d) allocation for excellent research schools (in Dutch: *toponderzoekscholen*)
- (e) Smart Mix
- (f) strategic considerations allocation.

The relative size of each part is shown in the above table.

The first part – the basic allocation – consists of allocations that vary according to the teaching performance per university. This is to express the connection between teaching and research.

As part of their research budget, Dutch universities receive a performance premium for each postgraduate degree – i.e. PhD, designer certificate² – awarded (with a two-year lag). For PhDs, two funding rates apply. The same distinction between fields of science as used for teaching tariffs is used (see above). The rates for science PhDs are twice as high compared to social science PhDs. From 2009 onwards the performance premium will be uniform across all disciplines and there will only be one rate: 90,000 Euro for each PhD. Universities therefore will be incentivised to deliver more PhD degrees. Any additional resources this may require will be found in compartment (f).

From the early 1990s onwards, the establishment of so-called *Research Schools*, consisting of researchers and PhD students from different universities working in the same field, has been used as an instrument for the integration, concentration and proliferation of research. Part (c), the first of the two components for research schools, is allocated to the universities proportional to the sum of parts (a), (b), and (f). This allocation, which has existed from the year 1998 onwards, is meant to stimulate universities to establish accredited research schools. From the year 1999, the Minister of Education allocates funding to a limited number of research schools that are regarded as excellent (part (d)). Six schools – all of them in the natural sciences – receive extra funding for a limited period. The selection was made by the Minister after consultation of the Dutch research council (NWO). Although the Minister had planned to extend this so-called *depth strategy* to the social sciences and humanities, s/he abandoned this policy.

More than half of the research component is allocated under the heading of *strategic considerations allocations* (part (f)). It consists of fixed allocations³ per university, based on historical reasons. The name derives from the original plan to base research allocations more on the quality of a university's research and an assessment of the relevance of a university's research for society. However, this plan was never realised, partly because of the consequences

² A two-year degree awarded in engineering.

³ When from one year to another, there is a rise in the number of PhDs or designer certificates, the strategic considerations component is lowered in favour of the 'performance' part (b). The result being that the total research allocation is kept within the bounds set by Parliament.

this would have in terms of reallocations between universities. Another important reason was that a reshuffling of research funds would be a major intrusion on the university's autonomy.

The *Smart Mix* component (part (e)) is a new addition to the BAMA model, introduced in 2006 to 'dynamise research'. In 2007, an amount of € 100 million is taken out of the strategic considerations component and redistributed according to each university's success in terms of winning research council grants (from NWO – the second stream of funding) and selected competitive research contracts in the third stream of funding.

In 2004, a new funding model was proposed. It was suggested that the funding of universities, next to the number of degrees, was to be based partly on *learning entitlements*. Each student was to receive a fixed amount of learning entitlements, to be used freely to study at any university. Each student would receive 8 or 10 learning entitlements, each worth half a year of study. However, after long discussions and lots of criticism from the institutions, the proposal was scrapped by the cabinet in 2007. The student entitlements were to lead to a demand-driven system that was supposed to turn students into critical consumers and higher education institutions into responsive providers. However, the system turned out to be too complicated and was felt to lead to increased administrative costs.

Instead, the ruling cabinet has expressed plans to introduce a new funding model that will rely less on diplomas and mostly on numbers of enrolled students. In order to keep the institutions focussed on getting students to a degree, institutions will only receive funding for students that have not yet exceeded the normative time to degree (3 or 4 years for a bachelor, 1 or 2 for a master's degree). The model will award 80% of the teaching funds on the basis the numbers of enrolled students and BA and MA diplomas. The amount per student will be the same as the amount per diploma. However, there are weights to take into account the cost differentials between classroom-based subjects, laboratory-based subjects and medicine. The ratio between the three funding levels is 1 : 1.25 : 1.9. The model will apply to research universities as well as to *hogescholen*.

In other words, the new model will amount to quite some simplification. However, there are still some hurdles to be taken, as 20% of the funding is to be set aside for institution-specific budgets. This institution-specific budget is to be based partly on quality of teaching, but in addition is also meant to leave room for a number of additional policy objectives as well as to compensate individual institutions for any effects they may suffer due to the introduction of the new model. So far, it is unclear what the 20% will be based on and the introduction of the model is postponed until 2011.

The funding model for the *hogescholen* so far has remained largely intact from the early 1990s onwards. Until the new funding model will be introduced, the funds for *hogescholen* are determined on the basis of formula. The formula generates an amount of funds for teaching that looks as follows:

$$\text{amount} = \text{funding tariff} * \text{dynamic demand factor} * \text{enrolment}$$

There are two funding tariffs (for full-time students), one for programmes with a strong practical character and a 20% lower tariff for programmes with a social science character. In addition

there are special arrangements for students in performing arts, music, theatre and teacher training.

Until January 1998, part-time students were funded at a rate of 75 per cent. From that date on, the tariffs for part-time students have been raised up to the level of full-time students. The funding rates are not applied to the number of registered students, but to an estimate of the teaching load ('student demand'). This teaching load is a multiplication of enrolment and a so-called *dynamic demand factor*. The formula for the latter is as follows:

$$\text{dynamic demand factor} = [\text{DG} \times 4.5 + \text{DO} \times 1.35] / (\text{TG} + \text{TD})$$

where:

DG the number of degrees awarded (during previous year)

DO the number of students that have dropped-out (during previous year)

4.5 the normative funding period for graduates (4.5 years)

1.35 the normative funding period for drop-outs (1.35 years)

TG total period (in years), during which graduates have been registered before graduation

TD total period (in years), during which drop-outs have been registered

The dynamic demand factor can be interpreted as the ratio of the normative funding period and the actual registration period for graduates and drop-outs. In case graduates or drop-outs take more time before leaving the *hogeschoolen*, the operation of this factor implies that the *hogeschoolen* receives less funding. In case an institution would be able to bring down the time to degree or the time to drop out, this will only affect funding if the graduation (or success) rate rises simultaneously. This is due to the fact that total enrolment also decreases along with shorter periods of stay. A *hogeschool* thus has two options to raise its funding amount:

1. through a permanent rise in numerical success rates
2. through a rise in student intake.

However, both options bring along larger costs for the institution. In any case, the funding formula intends to stress performance, especially in terms of graduation rates.

3.3 Research funds and research policy

Apart from the research funds awarded as part of the first stream (core) funds of universities, the universities' research is funded through grants and revenues received from the research council (second stream funds) and from other public and private sources (third stream funds). Where the first stream funds are intended to allow universities to carry out curiosity-driven research, the second and third stream funds depend much more on external demands: policy objectives (research council; ministries) and demands originating from industry and non-profit organizations.

With respect to the policy demands we will now pay some attention to science and innovation policy, as this heavily determines today's universities' strategy and resourcing. The main aims of

research policy of the Ministry of Education, Culture and Science (OCW), as stated in the policy document "Science Budget 2004: Focus on Excellence and Greater Value", are:

1. increasing focus and concentration;
2. promoting the utilization of research results;
3. training and retaining researchers and other knowledge workers;
4. promoting top-quality research by encouraging competition;

To create focus and concentration (i.e. critical mass), three national themes (ICT, genomics/life sciences, nanotechnology) have been selected. Within these three themes, priority is given to the most promising lines of research. The researchers themselves determine what the promising lines of research actually are. Furthermore, the government aims to combine the "focus and mass" objective with "co-operation between business enterprises and knowledge institutions" in such a way as to introduce a system of "performance-related funding" for university research.

To achieve the objective of promoting the utilization of research results the research policy is aimed at expanding on current strengths in the Dutch knowledge system. Excellent partnerships are given more leeway (networks, consortia, "hotspots"). Furthermore, valorization will be a separate component within the new Higher Education and Research Act (WHW). Access to, and availability of, venture capital will be improved, in co-operation with financial institutions. Utilization is also promoted by the Bsik projects (investment grants to public-private research consortia funded with income from natural gas) and the *Leading Technological Institutes* (public-private partnerships for a period of four to six years).

For the training and retaining of researchers, the research council is an important funding mechanism. Project-based and individual funding is given by NWO and its affiliates STW and ZonMW. The largest scheme (€97m in 2005) is the Innovational Research Incentives Scheme that provides individualized research grants. The Innovational Research Incentives Scheme consists of three different personal subsidy forms, each of which is designed for a different phase in the scientific careers of researchers: (a) only recently awarded a PhD; (b) experienced researchers; (c) researchers on the brink of a professorship. The new government has recently decided to extend this scheme with €50m annually in the coming years, to give young, excellent researchers more opportunities.

The government will hold institutions explicitly responsible for good personnel policy (during administrative discussions). The "established posts" principle will be replaced by career principle. This is meant to strengthen the training and retaining of researchers and other knowledge workers.

The objective of promoting top-quality research will mainly be realized by encouraging competition. Part of this is the promotion of performance-based funding for university research (e.g. the Smart Mix instrument explained above) and the introduction of positive incentives for research co-operation with business enterprises.

The general objective of the *innovation policy* of the Ministry of Economic Affairs (EZ) is strengthening the innovation capacity of the Dutch economy. The main operational objectives of the innovation policy are:

- 1: protecting knowledge;
- 2: increasing start-ups that develop and apply technological knowledge;
- 3: increasing application of knowledge by SMEs;
- 4: increasing development and application of technological knowledge by industry;
- 5: strengthening the knowledge-base by co-operation between industry and the public knowledge infrastructure.

There are several overlaps between research policy and innovation policy, including the promotion of spin-offs from universities, strengthening the link between universities and SMEs, stimulating the co-operation between industry and public research infrastructure, and stimulating the participation of the Dutch industry in public (applied and fundamental) research, especially in specific key areas.

At the national level, three priority areas are defined for research: ICT, genomics; and nanotechnology. In addition, the research council NWO also has developed 13 multidisciplinary themes, for which thematic programmes were developed.

In Dutch innovation policy a “key area” approach is used to create focus and critical mass in a limited number of key areas that are important for the Dutch economy. For each of the “key areas” innovation programmes can be developed (in close collaboration with stakeholders). Current priority areas are: Food & Flowers, High Tech Systems & Materials, Water, Creative Industry, Chemical Industry, Life Sciences & Health, and Pensions and Social Security. In addition, there is an emerging key area: The Hague, Residence of Peace and Justice. ICT and Energy are recognized as “innovation axes”, which are important in all sectors of the economy.

4. Norway

4.1 Introduction

The higher education sector in Norway comprises 6 universities (including university hospitals), 5 specialised universities and 25 state university colleges. Unlike the universities, the university colleges are regionally based, having one administrative unit for a number of different sites offering different curricula. The colleges offer two to four year vocationally-oriented programmes as well as programmes corresponding to the first degrees offered by universities. They do not offer extensive provision at Masters or Doctoral level.

More than one fourth of all R&D takes place in the higher education sector, mainly within the universities and the specialised university institutions. The higher education R&D funds mainly come through the university operating budgets, with supplementary funding from the Research Council of Norway (RCN). In recent years, contract research has become more important.

Going back to the early 1990s, in the budget process, the Ministry of Education and Research made proposals for the university sector to the Parliament on the number of new positions in each subject field. If approved by Parliament, new positions were allotted to the institutions, which in turn employed qualified persons based on application and competitive procedures. An essential feature of this period was a relatively detailed involvement from the Ministry. Since then the system has been changed. There has been an overall movement towards block grants (see next section) which also affects staffing.

Although the state coordination of HEIs therefore has traditionally been strong in Norway, the *Quality Reform of Higher Education* (2000-2001) gave HEIs significantly more autonomy for managing and organising their activities. At the same time, the performance of HEIs is closely monitored by the central authorities. The *Quality Reform* has led to the recent introduction of a degree system taking into account the developments in the Bologna process. The new two-tier degree structure is a three + two-year bachelor and Master degree structure with few exemptions. Furthermore, the old doctorate degree will be replaced by a three-year Ph.D. degree.

4.2 Funding mechanisms

The financial system and allocation of funds to institutions has over time changed from a system where the budget was broadly based on the number of students and specified in much detail on expense categories (salaries, other current costs, scientific equipment etc.), to a new system where the institutions are free to decide for themselves on how to allocate their total block grant between types of cost. Higher education institutions have, in other words, taken over several responsibilities and tasks that traditionally were in the hands of the Ministry of Education and Research.

Along with the Quality Reform of the higher education system a new funding system has been introduced, by which the institutional block grants are calculated according to a new formula. Under the new system resources are distributed (in short) in the following way:

- a “basic component” (core funding), which on average is around 60 per cent of the total allocation;
- an “education component” covering on average about 25 per cent of the total allocation (31 per cent in university colleges and 22 per cent in universities) and based on the number of students credits obtained, the number of graduates and the number of international exchange students; and
- a “research component” covering on average 15 per cent of the total allocation (6 per cent in university colleges and 22 per cent in universities), which is partly a result-based allocation.

The new funding system was introduced to universities in 2002, and later expanded to include almost all higher education institutions (including private institutions, but not the National Academies of the Arts).

Over 90 per cent of funding is from public sources as there are no tuition fees in Norway. Much of the funding labelled as “external” also stems from public sources, even if the private sector has increased its share slightly during the latter years.

The new funding formula is a performance-related funding model introduced in 2002 as the starting year, based on performance in year 2000 (the budget for a given year is based on the performance two years earlier). In fact the percentages indicate the relationship between the three components in the year 2002. There will be variation from year to year and between institutions.

The basic component supports the need for stability and special priorities. Its level was set at the time of introduction of the model. For instance, special needs concerning a variety in disciplines and subjects, special needs for different regions and running expenses and maintenance cost for buildings. The basic components cover some parts of the expenses for teaching and research so that the higher education institutions are less vulnerable for fluctuations in the number of students.

About the education components: 40 per cent of the cost for the students is based on the credits the students produce. There is no upper limit (as opposed to the research component) in the way that the universities and the colleges can increase their revenues.

Study programmes are divided into six funding categories according to levels and types of studies concerned, equipment and human resources needed, etc. The table below shows the basic component (60%) and the education component (40%) combined. The latter depends on the number of credits produced by the students. The rates were introduced in 2002 and have later on been adjusted for inflation.

Table 1: Total of the basic and education components for the six funding categories in 2005 (in Norwegian Crowns, NOK)

Funding Category	programmes	Rates per full-time student, 60 credits, in NOK	weight
A	Clinical studies	255.000	4
B	Professional education in music, architecture and design	195.000	3
C	Master degree studies in natural sciences	130.000	2
D	Master degree studies (general) and lower level/bachelor degrees studies in expensive areas	95.000	1,5
E	Lower level/bachelor degree studies except for social studies and theoretical areas	80.000	1,25
F	Lower level/bachelor degree studies, social studies and theoretical areas	65.000	1

4.3 Research funding

The earlier funding system was seen to cause structural imbalances between the funding of research and education in HEIs respectively, as research funding was seen to be far too closely linked to education and student numbers, allowing for too discretion for the separate funding of research according to needs and considerations pertaining to research in particular. The new funding system to some extent separates the funding of research and education within the institutional block grants.

The research allocation in the institutional funding consists of a part allocated on the basis of performance and a part related to quality and strategic considerations, which includes funding of positions for doctorate students. Regarding the performance-related part of the research allocation, redistribution between universities is based on degree production specified by level (PhD, Master), funding from EU and from The Research Council of Norway (RCN). The number of higher academic positions (professors etc.) is also included. The latter is also included for colleges in addition to credit production and external cooperation. The table below shows the weights for the various indicators.

As opposed to the education component there is an upper limit on how the institutions may increase their revenues. The institutions that increase their revenues are the institutions that perform relatively best in comparison to the other institutions.

Table 2: Categories and weights for the indicators on research

Indicator	Universities	Specialised university institutions	University colleges
Doctoral degrees	0.3	0.3	
Master's degrees	0.1	0.1	
EU funding	0.03	0.016	
Research Council	0.17	0.184	
Professor, Assoc. Prof positions	0.4	0.4	0.4
External funding, contract research			0.2
Study points			0.4
total	1.0	1.0	1.0

The performance related research allocation is distributed between universities based on degree completion specified by level, and distributed between colleges based on credit production and external co-operation. Additional measures of performance for both types of institutions include the number of posts (e.g. professorships) and competitive funding attracted from the EU and the RCN.

In the general funding component, the research allocation is also based partly on strategic considerations. This strategic element was agreed upon in 2007 and rewards research of high quality and relevance and stimulates the institutions to develop research strategies that support the national objectives. Essentially it is rewards institutions for the number of publications they produce. Underlying this is a documentation system that serves as the basis for the research component of the budgets for universities and university colleges.

Publications are weighted according to publication form (articles, monographs) and publication channel (scientific journals, series, web-sites and book publishers). Both international publications and those in Norwegian are included in the bibliometric analyses. Some specified publications channels will be given more weight than others to create incentives towards quality in different areas of research. The relative weights are presented in table 3.

Table 3: Relative weights attached to types of publications important for research funding

Publication type	Level 1	Level 2
Scholarly books (ISBN)	5	8
Articles in series and periodicals (ISSN)	1	5
Articles in anthologies (ISBN)	0,7	1

A common documentation system for scientific and scholarly publishing was introduced. In this system, publications are registered on the individual and department level and can be aggregated on any other level. The budgeting model is based on aggregated counts on the institutional level. When aggregated, co-publications between authors/ departments/ institutions are shared between them in the calculation.

There is no distinction being made between disciplines. All disciplines relate to the definition of scientific and scholarly publications and to the same model described above, but there are three different sets of rules for the nomination of publications for level 1 or level 2. These sets of rules have been made for three major groups of disciplines. As examples, neurology and physics are in group 1, economics and mathematics in group 2 and history and sociology in group 3.

Next to the bibliometric criteria, external financing from other sources remains a part of the financing model for research (external co-operation) and will continue to be included. It now is also being considered to include patents and other indicators of innovation and commercialisation somewhere in the future.

Because the change to a performance measurement system is just being made, there is no hard information available on the outcomes in terms of changes in the relative funding levels between institutions. But is expected that the re-distributive character of the new funding model will be weak, at least in the beginning. First, it is important that institutions will get confidence in the new documentation system. The experience from research in the hospital

sector, where a similar model was introduced two years ago, is that there was an overall increase in the funding along with redistribution of funds.

As for potential problems with the new system, it can be stated that there have been problems on with the completeness and objectivity of the data from publishing before, but these problems have now been solved by using bibliographic data sources (such as the journal indexes from Institute from Scientific Information, but not only those) and authority records that standardise names and codes for publications channels. The new system has been costly to develop, but will not be costly to maintain.

Finally, higher education institutions have been supportive to the idea of the introduction of this new funding scheme. The system may look as relatively complex to administer but now (when) the system is running, it is not too complex or work-intensive at the central and the institutional level. It is important to note that this process makes part of a more widespread production of publication lists for several purposes (CV's, annual reports, applications, funding) into one common database with common rules. It takes one person per five thousand researchers to run the system, and the researchers themselves are being relieved from a workload that they had earlier on.

Apart from the research funds distributed on the basis of the formulas, there is an additional funding stream. This second source of research funding is competitive grants for proposals that are judged best quality by the relevant research community based on peer assessment through the Research Council of Norway (RCN). The RCN distributes public funding through more than 130 research programs and other activities with an increasing focus on large-scale programmes across traditional disciplinary boundaries. RCN allocates research funds for research programmes (strategic, targeted research efforts within a specified time-frame), for independent projects not affiliated with larger research programs, and for framework grants to research institutes to promote long-term professional development.

In addition, there are a few other ways of public research funding. First is the Centres of Excellence program supported by the Research and Innovation Fund, by which RCN selects and funds centres of excellence as a focus for quality research. Second is a government endowed research fund to boost stable and long-term multidisciplinary research. Third, in order to attract increased private R&D funding, the government provides tax credits in stimulating private investments for certain types of R&D projects. Fourth, the ministries are required to increase their research investments. Finally, RCN provides funds for large-scale strategic programs across traditional disciplinary boundaries stimulating stronger co-operation between research performers.

5. United Kingdom

5.1 Introduction

The Higher Education sector in the United Kingdom (UK) is largely composed of universities and is the main performer of basic and strategic research. In 1992, the former polytechnics were awarded university status and hence are often referred to as 'new' universities. At present there are 169 university institutions in the UK, counting separately the colleges of the federal universities of London and Wales (as several colleges have recently acquired university status, it is not possible to provide precise numbers). This chapter deals mainly with the system of higher education in England.

The debate on research-oriented versus teaching-oriented universities has been a recurrent theme over the years in the UK and has fed into discussions over the future of the RAE (research assessment exercise; RAE – see below). Debate has also focused on the increasing intensification of research in certain HEIs to the possible detriment of regional concerns and demands. What is clear is that the UK Higher Education sector comprises an extremely heterogeneous collection of institutions which range from large, highly research intensive, internationally renowned institutions to small, teaching-focused institutes which often serve particular regional or sectoral demands. In terms of research performance, various indicators are collated and published: however, the top three institutions in terms of most of these indicators are Cambridge University, Oxford University and Imperial College London - the so-called 'Golden Triangle'.

Universities in the UK are autonomous bodies, with charitable status, and are free to seek funding from a variety of sources. However, the majority of their funding comes via what is known as the dual support system. Under this system, the Higher Education Funding Councils (separate bodies exist for England, Scotland, Wales and Northern Ireland, with funds derived from ministries responsible for education) provide general funding, used mainly for academic salaries and research infrastructure, while the Research Councils provide funding for projects (including salaries of contract researchers), research training and centres on a competitive peer-reviewed basis. There are eight UK Research Councils. The other principal funding source for research is the charitable, non-profit sector, notably the Wellcome Trust, which is the largest single funder of medical research.

Shortly after the appointment of Gordon Brown as Prime Minister in June 2007, the role of science in innovation received further emphasis: the Department of Trade and Industry (DTI) was disbanded and many of its functions, including responsibilities for science and innovation, were transferred to the new Department for Innovation, Universities and Skills (DIUS). DIUS also has responsibility for further and higher education and skills, previously part of the Department for Education and Skills which was disbanded and replaced by a Department for Children, Schools and Families. DIUS works closely with the new Department for Business, Enterprise and Regulatory Reform (BERR), which assumed the other functions of the former DTI. DIUS now plays the lead executive role in research issues and includes the Government Office for Science (GO-Science), which replaced the former Office of Science and Innovation. GO-Science is headed by the Government's Chief Scientific Adviser and plays the lead role in improving quality of science in the UK, reporting directly to the Prime Minister and the Cabinet.

In recent years, greater emphasis has been placed on the 'Third Mission' of universities, i.e. greater engagement with businesses and local communities. To this end, the Higher Education Innovation Fund represents the main policy stimulus, although HEIs individually and collectively engage in a variety of 'outreach' activities and several regional and trans-regional consortia have been set up to address this activity.

5.2 Funding

The Department for Innovation, University and Skills (DIUS) is the major provider of teaching and research funds for the HEIs. This core funding is allocated in the form of block grants from the Higher Education Funding Council and their equivalents. The Director General of Science and Innovation (DGSi), located in the Department, is responsible for the allocation of additional competitive research funding via the Research Councils and, to a lesser degree, the Royal Society and Royal Academy of Engineering.

Institutions in England receive funds in the form of a grant from their funding council, the Higher Education Funding Council for England (HEFCE⁴). They also receive tuition fees. Full-time undergraduate students may receive assistance with their fees. Postgraduate students on taught courses pay fees to institutions mostly from their own funds. Students from outside the EU are generally expected to meet the full costs of their courses.

The funding councils provide funds for teaching and research. Funds for teaching and research are provided as a block grant. Institutions are free to distribute this grant internally at their discretion, as long as it is used to support teaching, research and related activities. For England, HEFCE divides the total funds between teaching, research and other funding. The breakdown of HEFCE funding available for 2007-08 is shown in Table 1.

Table 1: Breakdown of HEFCE funding available for 2007-08: total £7,137 million

Teaching	£4,510 million
Research	£1,415 million
Special funding	£449 million
Earmarked capital funding	£738 million
Additional funding for very high cost and vulnerable science subjects	£25 million

Most of these funds are distributed by formulae, which take account of the volume and mix of individual institutions' teaching and research. Just over 90 per cent of HEFCE teaching funds are allocated through its mainstream teaching funding method. The remainder consists of funds for widening participation and other recurrent teaching grants. HEFCE uses formulae to determine how most of the money is allocated between institutions, helping to minimise the accountability burden. The formulae take account of certain factors for each institution, including the number

⁴ Higher education funding is provided by Scottish Funding Council (SFC) in Scotland, Higher Education Funding Council for Wales (HEFCW) in Wales and the Department of Education and Learning Northern Ireland (DELNI) in Northern Ireland.

and type of students, the subjects taught, and the amount and quality of research undertaken (using the RAE).

The teaching funding method is based on the principle of similar resources for similar activities. For each institution the model calculates a level of 'standard resource' which reflects the number of students it has, the mix between different subject areas, and a number of institution-related cost factors.

There are four stages in calculating the mainstream teaching funds for each institution:

Stage 1 HEFCE calculates a **standard resource** for the institution. This is a notional calculation of what the institution would get if the HEFCE grant was calculated afresh each year. It is based on each institution's profile of students, and takes into account:

- the number of students
- subject-related factors
- student-related factors
- institution-related factors.

Stage 2 HEFCE calculates the **assumed resource** for the institution. This is based on the teaching grant that HEFCE actually paid to the institution for the previous year, adjusted for various factors such as inflation, plus HEFCE's assumptions of student tuition fee income.

Stage 3 HEFCE compares the **standard resource** with the **assumed resource** and works out the percentage difference between them.

Stage 4 If the difference between the standard resource and the assumed resource is no more than 5 per cent (whether that is plus 5 per cent or minus 5 per cent), then the HEFCE grant will be carried forward from one year to the next. For institutions outside the plus or minus 5 per cent **tolerance band**, their grant and/or student numbers need to be adjusted so that they move to within the tolerance band.

Categories of students which HEFCE does not fund through its allocations for teaching include:

- overseas students from outside the EU
- students whose funding is provided from other public sources
- postgraduate research (PGR) students. PGR students are funded only through the funding method for research.

Student numbers are counted in full-time equivalent (FTE) terms. A part-time student is measured by comparing their learning activity with that of a full-time student, so that each will count as a variable proportion of one FTE. Students who undertake practical work or industrial experience for a year outside the university or college (known as sandwich year-out students) are counted at the rate of 0.5 FTE per student for that year.

After the amount of funding is determined, it is provided in the form of a ‘block grant’ which institutions are free to spend according to their own priorities within HEFCE’s broad guidelines. Institutions are not expected to model their internal allocations on the HEFCE funding method.

Clearly there are factors such as the types of student, and the nature of the subject, that call for different levels of resource. To take account of these factors, the HEFCE attaches funding premiums to calculate the standard resource for each institution. They relate to:

- the subject
- the student
- the institution.

Subject-related factors

Different subjects require different levels of resource: some subjects need laboratories and workshops while others are taught wholly in lecture theatres and seminar rooms. HEFCE has defined four broad groups of subjects (price groups) for funding, and has set relative cost weights for each based on expenditure and student FTE data by cost centre. These weights were changed from 2004-05 to reflect responses to a consultation on the funding method in 2003.

Price group	Description	Cost weight
A	The clinical stages of medicine and dentistry courses and veterinary science	4
B	Laboratory-based subjects (science, pre-clinical stages of medicine and dentistry, engineering and technology)	1.7
C	Subjects with a studio, laboratory or fieldwork element	1.3
D	All other subjects	1

Student and institutional premiums

Having weighted the student numbers by their subject price group, the HEFCE then applies further weightings to take account of student or institutional factors. The student premiums which apply for 2007-08 are:

- **students on long courses.** Some courses are taught over longer periods than others within the year and so cost more. Courses that last for 45 weeks or more within one academic year attract a premium. This does not apply to courses in price group A, where the course length has already been taken into account within the cost weight
- **part-time students.** There are extra costs associated with part-time students. For example, an institution’s administration costs for two part-time students, each equivalent to 0.5 FTE, will be higher than for one full-time student
- **foundation degree students.** There are usually higher costs for foundation degrees associated with partnerships between institutions and employers.

The institutional premiums which apply for 2007-08 are:

- **London weighting.** The HEFCE pays a premium towards the higher costs of operating in London
- **institution-specific premium.** Some specialist institutions (defined as having 60 per cent or more of their courses in one or two subjects only) have higher costs
- **small institutions.** Small institutions (defined as having 1,000 FTE students or fewer) often carry disproportionately high central and administrative costs
- **old and historic buildings.** Institutions with old and historic buildings (constructed before 1914) have higher costs to cover, such as maintenance, refurbishment and heating.

The following table shows how the HEFCE applies the student and institutional premiums.

Calculated as:	
Student premiums	
Students on long courses	25% of the FTE weighted by price group
Part-time students	10% of the unweighted FTE
Foundation degree students	10% of the unweighted FTE
Institutional premiums	
London weighting	8% (inner London) or 5% (outer London) of the FTE weighted by price group
Institution-specific premium	Variable percentage (commonly 10%) of the FTE weighted by price group
Small institutions	Variable percentage of the unweighted FTE
Old and historic buildings	Variable percentage of the unweighted FTE

From 2008-09, the HEFCE has begun replacing the premiums with a system of targeted allocations. These are streams of funding designed to support important or vulnerable features of higher education, in accordance with key policy initiatives. The key difference between targeted allocations and premiums is that the targeted allocations will fall outside the tolerance band. This means that changes in student profile will have a much more direct and immediate effect upon grant levels. The new system will also make it easier for institutions to determine how much of their grant is associated with a particular targeted allocation.

There will be both *variable* and *fixed* allocations. Variable allocations recognise costs that vary according to volume of activity; fixed allocations recognise fixed costs. It is proposed to introduce targeted allocations to contribute towards the additional costs of the following areas of provision:

- part-time undergraduate study
- foundation degrees
- accelerated and intensive provision
- old and historic buildings.

The HEFCE has implemented the following measures:

- a. It has converted the existing part-time premium into a targeted allocation based on the existing cash equivalent sum, pro-rata to part-time undergraduate full-time equivalent (FTE) student numbers. This is a *variable* allocation, which tracks student numbers. Postgraduate taught (PGT) students do not attract the part-time allocation, as HEFCE already assumes that the additional fees charged by institutions meet the extra costs of part-time PGT students.
- b. HEFCE converted the foundation degree premium into a targeted allocation, based on the existing cash equivalent sum pro-rata to the relevant student FTEs. This is a *variable* allocation, which tracks student numbers.
- c. HEFCE has created a targeted allocation to recognise the costs of accelerated and intensive provision. This replaced the long-course premium and is based on the existing cash-equivalent sum pro-rata to the relevant subject-related FTE. This is a *variable* allocation, which tracks student numbers.
- d. HEFCE converted the old and historic building premium into an allocation based on its present cash value. This is a *fixed* allocation, which does not depend upon student numbers.

Targeted allocations

	Total 2008-09 allocation
Variable	
Widening participation	£364 million
Foundation degrees	£24 million
Part-time undergraduates	£43 million
Accelerated and intensive provision	£69 million
Fixed	
Old and historic buildings	£41 million
Institution-specific costs	£59 million
Non-exempt students aiming for ELQs in strategically important and vulnerable subjects	£31 million

In addition to its mainstream teaching funding method, the HEFCE makes separate allocations to recognise the additional costs of recruiting and supporting students from disadvantaged and non-traditional backgrounds, and disabled students. These allocations to widen participation in higher education recognise institutions' success in recruiting and retaining these categories of students. These allocations total £354 million for 2007-08.

The different elements to the widening participation allocations are as follows:

- **Widening access.** This allocation recognises the extra costs associated with recruiting and supporting undergraduate students from disadvantaged and non-traditional backgrounds who are currently under-represented in higher education.
- **Improving retention.** This allocation recognises institutions' broad mix of students according to the risk that they will not continue their studies.

- **Disabled students.** This allocation reflects institutions' success in recruiting and retaining disabled students.

The HEFCE draws up a funding agreement each year with each of the institutions it funds. The funding agreement is constructed in broad terms. It implies a weighted volume of teaching activity which is being funded against the resource being allocated. Institutions can vary their recruitment as long as the weighted volume of teaching activity is maintained within certain implied limits. So, for example, they may vary the balance of recruitment between full-time and part-time students or between different price groups.

5.3 Funds for research

The UK research system is essentially centralised, lead players being the Department for Innovation, Universities and Science (DIUS) within which is located the Chief Scientific Adviser's Government Office for Science (GO-Science). Some aspects of innovation policy are, however, devolved to the English regions, Scotland, Northern Ireland and Wales, whilst the latter three have separate arrangements for higher education funding. Scotland also has further autonomy in some aspects of research, particularly environmental, agricultural and biological sciences.

Overall, the Government's long-term objective for the UK economy is to increase the level of knowledge intensity (expressed as R&D as a percentage of GDP) from its current level of around 1.9% to 2.5% by around 2014. Interestingly, this implies that the UK Government is not committed the European Union's Barcelona target of 3% of GDP on R&D by 2010 (or at least recognises that it is not a realistic target – the stated 2.5% target is itself described as "ambitious").

Public research funds are provided under a dual support system. HEFCE provides funding to support the research infrastructure. It supports fundamental and 'blue skies' research in institutions and contributes to the cost of training new researchers. Its funds go towards the cost of the salaries of permanent academic staff, premises, libraries and central computing costs.

These general funds from the HEFCE also provide the foundation of strategic and applied work, much of which is later supported by Research Councils, charities, industry and commerce. This research council funding is the second stream of funds. The research councils provide responsive mode funding for specific programmes and projects (£1,251 million in 2004-05). This is calculated as a proportion of the full economic cost of the work to be done (90 per cent for new grants applied for from 2008-09). Responsive mode funding is very flexible and supports projects ranging from small travel grants to multi-million pound research programmes and from one-month to six years. The funding covers a wide range of activities, including research projects, feasibility studies, instrument development, equipment, travel and collaboration, and long-term funding to develop or maintain critical mass. The major beneficiaries of responsive mode funding are individual researchers or research teams at Higher Education Institutes.

HEFCE research funds are distributed selectively to HEIs that have demonstrated the quality of their research by reference to national and international standards. Quality is measured in a periodic Research Assessment Exercise (RAE). The RAE is the mechanism whereby the Higher

Education Funding Councils allocate block funding for the support of research (i.e. to meet infrastructural costs, etc.) in UK universities. After some 22 years, the HEFCE has announced that it intends to replace the RAE with a Research Evaluation Framework (REF) which will be based on a mix of panel review, bibliometrics and other indicators - depending on the subject area under consideration. The move has come in response to growing dissatisfaction with the former RAE and also to claims that it has now achieved its original purpose - to drive up the quality of research performed in UK universities. One of the major criticisms of the process is the enormous amount of staff time and resources that HEIs have to devote to the process of preparing RAE submissions.

The HEFCE has consulted and commissioned studies on the precise form that the REF will take. The final RAE submissions took place in 2007 and the allocation of funds based on these took place in 2008. The research funding allocation for 2008-09 is the last to be informed by the RAE. From 2009-10, the funding method will be adjusted to reflect the outcomes of the 2008 RAE. From 2011-12, the funding method will gradually incorporate the REF.

In the meantime some adjustments were made to the RAE. One of them was based on a review of the RAE by a review group led by Sir Gareth Roberts. Their report was published for consultation in May 2003 and led to the introduction of quality profiles instead of a single rating for quality (see below).

HEFCE funding for research in 2008-09 was £1,460 million and was based on the RAE 2001. The funding is allocated under two main headings:

1. quality-related research (QR) funding – with reference to both the quality and volume of research activity (£1,436 million)
2. capability funding (£22 million).

There are two stages to the allocation of mainstream QR funds:

- Stage 1: determining the amount provided for each subject
- Stage 2: distributing the subject totals between institutions.

The allocation method for mainstream QR funding is described below.

Stage 1 Determining the amount provided for each subject

Mainstream QR funds are divided between 68 subject areas (units of assessment). Each subject is assigned one of three **cost weights**, which have been calculated to reflect the **relative costs** of research in those subjects. These are multiplied by the **volume** of research in each subject to work out the total funding for that subject.

The three **cost weights** are:

		Weighting
A	High-cost laboratory and clinical subjects	1.6
B	Intermediate cost subjects	1.3
C	Others	1.0

HEFCE measures the **volume** of research in each unit of assessment using three separate components. These volume components apply for departments rated 4 or above in the RAE and are weighted as follows:

- **research-active academic staff** – $1 \times$ number of FTE research-active academic staff funded from general funds (including NHS funding for nursing and other subjects allied to medicine) and selected for assessment in the RAE
- **research assistants** – $0.067 \times$ number of FTE research assistants
- **research fellows** – $0.06 \times$ number of FTE research fellows.

The number of research-active academic staff is the most important measure of volume: it accounts for 94 per cent of the total. Research-active staff numbers are fixed between RAEs. The volume measures are updated annually.

Stage 2 Distribution of the subject totals between institutions

The 68 subject totals (for each unit of assessment) are distributed to institutions in proportion to the *volume* of research multiplied by the *quality* of research in the subject for each institution. The **volume** of research for each institution in each subject is measured in the same way as in Stage 1 above, but includes NHS-funded staff for all units of assessment. The **quality** of research is assessed in the RAE.

In the 2008 RAE, a quality profile shows the proportions of research activity in a submission judged to meet each of four 'starred' quality levels, where four star is the highest and Unclassified is the lowest. The definitions of the quality levels are:

Four star	Quality that is world-leading in terms of originality, significance and rigour.
Three star	Quality that is internationally excellent in terms of originality, significance and rigour but which nonetheless falls short of the highest standards of excellence.
Two star	Quality that is recognised internationally in terms of originality, significance and rigour.
One star	Quality that is recognised nationally in terms of originality, significance and rigour.
Unclassified	Quality that falls below the standard of nationally recognised work. Or work which does not meet the published definition of research for the purposes of this assessment.

The 2008 RAE used the same main principles of peer assessment as previous RAEs. There were 15 panels and 67 units of assessment. However a few significant changes were introduced:

- the results were published as a graded quality profile rather than a fixed seven-point scale. This allowed the funding bodies to identify pockets of excellence wherever these

might be found and reduced the 'cliff edge' effect where fine judgements at the grade boundaries could have significant funding impacts

- a formal two-tiered panel structure in RAE2008, to ensure greater consistency and international calibration
- explicit criteria in each subject to enable the proper assessment of applied, practice-based and interdisciplinary research.

In earlier RAEs, each institution was awarded a rating on a scale of 1 to 5* (five star) for the quality of its research in each unit of assessment in which it was active. In these exercises, the result for each submission was one overall grade. The new quality profile replaces the overall judgement of research for each department based on a seven point grading scale used in the previous exercises. The quality profile in use for the 2008 RAE shows the range of research activity and quality levels in a submission. The quality profile shows the proportions of research activity in a submission judged to meet each of four 'starred' quality levels, in multiples of 5 per cent (see below).

Example of a quality profile						
Unit of assessment (subject) A	Full-time equivalent staff submitted for assessment	Percentage of research activity in the submission judged to meet the standard for:				
		Four star	Three star	Two star	One star	Unclassified
		highest quality < ----- > lowest quality				
University X	50	15	25	40	15	5
University Y	20	0	5	40	45	10

The table below shows how the seven point ratings in the previous RAEs related to the quality funding weights in the allocation of research funds. Please note that this describes the situation in the recent past (up to the year 2008). Ratings 1, 2, 3b and 3a attracted no funding, while a rating of 5* attracted roughly four times as much funding as a rating of 4 for the same volume of research activity. As a result, funding of research is highly selective.

RAE ratings converted into funding weights for each unit of assessment

2001 RAE rating	Funding weights in QR model
3a, 3b, 2, 1	0
4	1
5	3.180
5*	4.036

In 2009 and 2010, the funding bodies will use the results of the RAE 2008 and the quality profiles that emerge from that to calculate funding allocations for research.

For the purpose of the 2008 RAE each academic discipline was assigned to one of 67 units of assessment (UOAs). Work submitted to the exercise was assessed by experts, drawn from HEIs and the wider research community. There was a two-tier panel system: 67 sub-panels of experts, one for each UOA, worked under the guidance of 15 main panels. Each main panel included broadly cognate disciplines whose subjects had similar approaches to research. This system provided a strategic overview of the work of the sub-panels and a more consistent approach both to setting criteria and to the assessment of work in related fields.

Main panels were made up of a chair, the chairs of each of the sub-panels within the main panel area, and a number of international and additional members. The international membership of the main panels ensured that international standards were maintained consistently across the exercise. Each sub-panel had a chair and on average about 15 other members, who had expertise that covers the full range of research in that subject area.

The main panels were responsible for:

- reviewing and endorsing the criteria and working methods to be used by the sub-panels
- deciding on the quality profile to be awarded to each submission
- communication and joint working with the other main panels.

The sub-panels are responsible for:

- preparing draft statements of relevant criteria and working methods
- undertaking the detailed assessment of submissions from HEIs
- making recommendations to main panels on the quality profiles to be awarded for each submission.

Panel members were nominated by subject associations and other stakeholder organisations, including users of research. They were appointed by the UK funding bodies. There were over 1,000 panel members. They were chosen for their standing in the academic and wider research community, their extensive research experience, and their understanding of the needs of research users and commissioners of research from both the public and commercial sectors.

The results of the RAE2008, published in December 2008, showed that 54% of the research conducted by 52,400 staff submitted by 159 universities and colleges is either 'world-leading' (17 per cent in the highest grade) - or 'internationally excellent' (37 per cent in the second highest grade). Taking the top three grades together (the third grade represents work of internationally recognised quality), 87% of the research activity is of international quality. Of the remaining research submitted, nearly all is of recognised national quality in terms of originality, significance and rigour.

To round up our discussion of research policy and research funding we mention that the UK does not generally tend to identify priority research programmes. As the UK Research Councils cover broad thematic areas, there is no real need for thematic funding programmes. However, multidisciplinary programmes that cross Research Council remits or which focus on specific strategic research priorities are covered. These cross Research Council programmes are:

- Energy research - towards a sustainable energy economy
- e-Science
- Basic technology
- Genomics/Proteomics
- Stem cells
- Brain science
- Rural economy and land use

6. Sweden

6.1 Introduction

The system of higher education consists mainly of universities and more specialized colleges. Since the 1990s a number of governance reforms, quality assurance and funding reforms have been implemented. Sweden is a relative late implementer with respect to the “Bologna” study structure, but has been in the fore-front when it comes to the modernisation of governance and quality assessment.

There are 14 state universities and 22 state university colleges (*högskolor*) in Sweden, as well as three private universities (Chalmers University of Technology, Stockholm School of Economics and Jönköping University). The clear majority of their funding is disbursed directly from the government through the Ministry of Education, Research and Culture. Additional R&D funding is secured in open calls from research councils, sector agencies, research foundation (semi-public and private) and the EU as well as from industry. Most universities and university colleges are in some form of financial difficulty due to reduced funding per student, reduced base funding for R&D and increased costs, most notably for offices and laboratories.

The 1993 reform reduced the detailed influence of central government but called for more planning, accountability, and control at the institutional level and therefore a stronger and more pronounced institutional governance. The internal devolution of authority, awaited by many academics, did not occur. Instead, the responsibility for those in leadership positions in universities and colleges increased. Collegiality and management in combination became the primary model of institutional governance, supported by a new network of interest groups consisting of the academic elite, scholarly organizations, and the business establishment.

With the return of the social democratic government in 1994, the political balance of power gradually began to change. The political representation was enlarged in the governing boards of the institutions. Rectors were replaced by people from outside (often industrial leaders or politicians) as chairman of the board. The “unholy” alliance between state and industry was strengthened at the expense of the academic elite. Oddly enough this did not meet with any big resistance until recently.

Swedish universities and university colleges have three missions: to educate, to perform research, and to interact with society. The latter, the so-called “third mission”, was added in 1977, and includes technology transfer (among other things), and is the subject of much debate. Higher education institutions are expected to also serve the local community and contribute to overall social development.

The growing reliance on external funding has diminished the room for internal collegial decisions. More and more funding for research is coming from strategic foundations, which were established after the conservative coalition government dismantled the large wage earners’ funds in the beginning of the 1990s. As a result, the gap is now widening between the “poor” and the “rich” parts of the higher education system.

Parliament and the government (through the Ministry of Education, Research and Culture) have the overall responsibility for higher education and research, and thus determine the regulations the universities and university colleges have to abide by, including objectives, guidelines and resource allocation. Several government agencies aid in the implementation of government policies. The Swedish National Agency for Higher Education (*Högskoleverket*) is responsible for higher education, while the Swedish Research Council is responsible for research.

The Bologna structure has improved international comparability of Swedish education in. The former degree system has been reformed and structured to fit the new three-cycle system. Higher education is organized as courses that can be combined into study programmes, leading to the general university degrees. There are a number of tertiary study programmes leading to vocational qualifications.

The creation of a new quality assurance system for 2007-2012 is in the process of being developed. This has five components: reviewing the quality assurance procedures, evaluating the courses and programmes, examining the entitlement to award degrees, conducting thematic evaluations and studies, and nominating centres of academic excellence.

6.2 Funding

Public higher education in Sweden is generally grant-aided and free of charge. However, students have to pay a registration fee to the Student Union.

The system of funding higher education was reshaped by two reforms in 1977 and 1993. In 1977 all post upper secondary education was brought together under the overall concept of higher education. Decentralisation of responsibility and “management by objectives” were central to the changes, which occurred in 1993. The state appropriations allocated directly to state universities and institutions of higher education for undergraduate education and for research and postgraduate studies represent about 65 percent of the resources of these institutions. The remainder consists of external funding for research and commissioned assignments. The major external sources of funding are public authorities such as research councils, sectoral bodies and local authorities.

As a result of the 1993 higher education reform, a new budgeting process was introduced for resource allocation for undergraduate education. Universities and university colleges are allocated grants on the basis of the number of enrolled students and what they have achieved, rather than on the basis of plans and forecasts, as used to be the case. There are varying amounts of remuneration for the various educational areas.

The annual budget is decided by Parliament (*Riksdag*) following a proposal from the Government. All HE institutions and the Ministry of Education, Research and Culture engage in a dialogue on their annual budget allocation.

Each institution receives an ‘educational assignment’ for undergraduate education, which specifies:

- the minimum number of degrees to be awarded during two three-year periods, with respect to master’s degrees and, in appropriate cases, specific professional degrees (currently in engineering, various teacher’s degrees and pharmacy) and preliminary goals for the number of examinations in these degrees for the following three-year period;
- the minimum number of annual full-time student equivalents for the fiscal year for the university or university college as a whole and, if required, for a specific field of education (currently technology and natural sciences);
- the maximum total remuneration for annual full-time students and the annual performance achievement;
- special assignments that may lead to specific, additional remuneration.

The criteria, the same for all HEI, are calculated in terms of full time equivalents (FTE) and study achievements (calculated in terms of annual performance equivalents for the students). One student enrolled on full time studies for one academic year equals one FTE student. One FTE study result is equal to one FTE student acquiring all the credits required during one year (40). Originally it was intended to allocate 60% of the total revenue for a specific field on the basis of FTE study results. Due to increases in the proportion based on the number of FTE students, the share based on FTE study results has decreased and today varies between 30% and 55%. Table 1 shows the rates for the year 2005.

Table 1: Funding rates in 2005 (in Swedish Kronor, SEK)

	Payment per FTE student	Payment for annual performance equivalent	Weight
Humanities etc.	17,217	16,958	1.0
Science, Technology	43,431	37,421	2.4
Pharmacy/Pharmacology	43,431	37,421	2.4
Odontology	48,241	41,783	2.6
Medicine	39,893	46,471	2.5
Nursing	53,908	65,572	3.5
Education	31,490	37,086	2.0
Other	36,441	29,602	1.9
Design	128,583	78,342	6.1
Art	182,547	78,372	7.6
Music	110,932	70,141	5.3
Opera	264,364	158,146	12.4
Theatre	255,635	127,329	11.2
Media	260,874	208,971	13.7
Dance	179,788	99,343	8.2
Physical education and sports	93,688	43,356	4.0

In the original system there were six unit revenue levels, but during the years the system has been refined and today there are 15 such funding levels, of which some comprise two or more subject areas. The humanities and social sciences have the lowest revenue levels, while the fine arts have the highest. It can be noted that most of the study fields classified in this manner are small, for example in the fine arts where several different funding levels apply. Almost half of all

FTE students are found instead in the humanities, social sciences, law, and theology, and close to one-third in the field of technology and natural sciences.

The university and university college annual funding amount includes all costs, including capital funding⁵. There is a ceiling sum (maximum funding) which constitutes the highest aggregate compensation for FTE students and annual performance equivalents permitted for the fiscal year. The HEI itself decides on the distribution of funds among faculties and other units. The budget allocation is a lump sum that the institution itself uses for whatever it has set as priorities for premises, teaching staff etc. Universities and university colleges receive provisional funds at the beginning of each budget year and the finalised amount is determined at the end of the year taking into account student numbers and accomplishments presented in the annual report for that budget year.

If an institution does not reach its agreed performance or enrolment ceiling, it does not receive the full funding. If an institution enrolls more students than is allowed for by the ceiling amount, no additional compensation is paid. Thus fluctuations in the number of students directly affect the funding of the institution, even in the same year. In order to mitigate these effects, institutions are allowed to carry over 10% of the ceiling amount to the following years, for use in case it then attains less than the ceiling amount.

There are a lot of changes underway that will affect the funding of HEIs in Sweden. Dan Brändström's report entitled "*Resurser för kvalitet*" (Resources for Quality) was published in the beginning of 2008. This report (almost 500 pages) includes a proposal for a new resource distribution system. It is proposed that in the future university allocations will be, to a considerable degree, based on qualitative measurements. The Resources Inquiry proposed that funds should be allocated jointly to both teaching and research, but for a longer period (four years) than now and that part of it should be based on cyclical quality reviews. The proposal was also distributed for consultation and the HE reactions were overall positive to a quality-based system.

In the final consultation round of the funding system investigation, the Swedish National Agency (Hogskoleverket, or HSV) put forward a proposal with regard to how the evaluations could provide the basis for a quality-based funding system.

The Resources Inquiry starts from the perspective that universities and other higher education institutions should remain largely autonomous in the sense that the State should guarantee the freedom of higher education. Basic funding should be secured and should be made independent of short-term political decisions at the same time. The Resource Inquiry's proposed model for the allocation of funding proposes that direct funding appropriations will be distributed according to the academic community's own criteria of what is good education and research and on the basis of students' own informed choices. It follows from this that the State neither can nor should govern how resources are distributed between higher education institutions. It is therefore proposed that the funding model is managed and quality assured by an academically well qualified intermediary outside the Government in form of a council, which the Inquiry calls the Higher Education Funding Council for Sweden (HEFCSwe). The wish of the Government and the Riksdag to steer resources to special areas would have to be catered for in the second part

⁵ Some HEI own their buildings and premises and some rent from the National Property Board.

of the system of dual support, i.e. via the research councils and other agencies, and via decisions on special commitments.

The competitive features based on various quality criteria in the distribution of appropriation funding are believed to operate in a positive way. Also the students' informed choices can work in this way. At the same time, the Inquiry is at pains to stress that competition and the quantified measurement of quality are not always possible in the context of education. Even if measurement is possible, it is perhaps not always desirable. Scope would therefore be provided for the type of evaluation, with the character of an improvement audit, that the Swedish National Agency for Higher Education has worked and is working with.

After a period of a strong move towards consolidation of the higher education institutions as "classic universities" in the "higher education system", the Resources Inquiry takes the view that it is time to encourage profile development and differentiation. The Inquiry has also made the assessment that a structural fund should be set up to support cooperation, profile development and concentration in the Swedish system of education and research. The purpose of this is for the higher education institutions to concentrate their education and research on their strong areas, areas where they are best placed to achieve international success.

The model for distributing funds to universities and other higher education institutions being proposed by the Inquiry is a coherent proposal that will help to increase quality in both education and research; strengthen the link between education and research; and provide better conditions for long-term planning by universities and other higher education institutions.

The funding system for education at undergraduate and advanced level will consist of a basic revenue per full-time equivalent (FTE) student and three different additional revenues depending on the teaching method, etc., but not what subject the course belongs to. The model will mean that teaching methods that increase quality and/or are especially resource-intensive, at both undergraduate and advanced level, will be able to receive additional revenues that must, however, be accommodated within each institution's resource frame for education. The basic payment will be enhanced in relation to the lowest revenue currently available so that the basic revenue will correspond to the base level that was applicable when the present system was introduced in 1993.

The quality of education at undergraduate level and advanced level will be enhanced by including a resource for a research link in the revenue for full-time equivalent students. This resource will be transferred from the higher education institution's research appropriation. The resource for the research link, which is included in the basic revenue per full-time equivalent student, will also strengthen the link between research and education. A quality-related allocation will be introduced for education at undergraduate and advanced level. It will consist of an additional supplementary revenue that enhances the quality of the education and will be awarded depending on the result of the evaluations of higher education institutions every fourth year. One important aspect of the evaluations of higher education institutions will be an assessment of the efforts made by the institutions to give their students the teaching and the other support they need to complete their studies and to do so within the normal study period to a greater extent than is now the case. The revenues for full-time equivalent study results will be abolished.

Unit revenues for full-time equivalent doctoral students will be introduced. This means that the resource allocation model will cover all three levels of higher education. The proposal will make the resource consumption for education at postgraduate level visible and will mean that future decisions by the Government and the Riksdag on changes in the scale of postgraduate education will be accompanied by increases in resources or reductions in resources.

In principle, the resources for education will follow undergraduate, advanced-level and doctoral students so that over time their choice of higher education institution will impact on the distribution of resources between these institutions. Quality and activity in university research will be rewarded by subjecting half the existing appropriation funding to competition and distributing it on the basis of quality and activity-based criteria. (see next section, below).

Four-year planning periods will be introduced. This means that the appropriations for the higher education institutions will be calculated for a four-year period, but will be adopted by the Riksdag each year. The block grant for each higher education institution will have an education frame and a research frame. Half of the education frame will be basic funding and the other half will be a results-based (i.e. quality-based) part. During the four-year period the appropriations will be fixed and will not be affected by the results attained. The same holds for the research frame (see below).

6.3 Research funding system

Sweden's total research and development expenditure amounted to around 3.88% of GDP (in 2005), 1% of which is of public origin. Therefore, Sweden fulfils the goal set by the EU to invest at least 3% of the GDP in R&D, and that the business enterprise sector should account for at least two-thirds of these investments.

Once every fourth year the government prepares a government bill, which points out the goals for the public research and the budget for the coming years. In the latest research bill the main goal for Sweden is to remain a leading research nation and to carry out research of high quality.

Apart from the government, two other authorities play an important role in the policy making. VINNOVA (the Swedish Agency of Innovation Systems) is a State authority that aims to promote growth and prosperity throughout Sweden. Their particular area of responsibility comprises innovations linked to research and development. The Swedish Research Council is an advisor to the Swedish Government on research issues. In addition, the Council has a strategic role as advisor to the Government on issues relating to research policy. It monitors and evaluates the conditions for basic research in Sweden, ongoing research, the researchers involved, and the methods of research funding and their results.

Universities and university colleges ultimately receive over 60% of the government's investments in R&D, of which 43% is directly disbursed from the government. The remainder of the government's investments in curiosity-driven R&D is managed by three research councils:

- Swedish Research Council (VR), supporting basic research in all fields of science;

- Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS)
- Swedish Council for Working Life and Social Research (FAS)

VR clearly dominates, with a budget approximately double that of FORMAS and FAS together. With few exceptions, grants from the research councils go to universities.

Curiosity-driven R&D is also funded by six semi-public research foundations. Of these the two dominant ones are the Swedish Foundation for Strategic Research (SSF; supporting research in natural science, engineering and medicine) and the Knowledge Foundation (KKS; supporting research at new universities and university colleges) and to a limited extent by sector agencies, such as VINNOVA (supporting research and development in technology, transport and working life).

All basic research funding from research councils and sector agencies, as well as most from semi-public research foundations, is allocated through peer-review systems.

The most recent research policy bill was presented in October 2008. This document states that the overall goal of the government's research policy is for Sweden to be a leading research nation, and then goes on to make a range of priorities. It covers the period 2009-2012 and in terms of additional resources, includes the largest allocation ever. With its €508m (€1 = SEK9.85), is it more than twice as large as the former bill. The largest increase will be made in medicine, technology and climate. The academic institutions will receive the largest portion of research funds from the government. This will be distributed in accordance with a new system in which quality will determine how much each university or higher education institution will receive. Quality will be measured by means of two criteria - publications/references to publications and external research funds. An important element of the reform of the appropriations system proposed in the Bill is that a third, major type of funding will be introduced: strategic investments.

The new funding model for research was based on the recommendations of the Resources Inquiry (see above). This Inquiry proposed a new model for the funding of research. Again, funds are to be tied to quality. Research quality is to be measured by publications, staff competence (including female professors) and external funding. A model that contains evaluations and indicators (so-called metrics) will be introduced. The competitive part of the research appropriation frame for each university will be distributed: based on quality evaluations of research, on field-normalised citations of international scientific production, by external funding, by the number of teachers with doctorates and by the number of women professors. Any additional fresh appropriations for research will be distributed on the basis of the same criteria.

When they are provided, appropriations for research at non-university institutions will be limited to cover one or more research profiles. The resources for a research profile are put at SEK 25 million. The obstacles to the development of cross-cutting education and research will be eliminated by abolishing education areas and research areas respectively as a basis for allocating funds for education and research.

Each higher education institution will be allocated one block grant consisting of resources for both education and research. Having one appropriation will lead to freer use of resources, which is necessary since education and research are interwoven in many ways.

The Swedish system is designed to be able to adjust the differences between research areas. The new Swedish model was compared to the recently introduced Norwegian research funding model. It appeared that the models differ in terms of incentives. The Norwegian system has extensive coverage and transparency but it is unclear whether quantity or quality is the priority. The Swedish model is not as transparent and, because of the limitations of the Thomson/ISI database, offers less coverage. However, it is the latter that gives the Swedish model a definite advantage: the use of field normalized citation rates. A citations indicator gives a clear quality incentive. The combination of articles and citation rate is hard to manipulate.

Turning to the other sources of research funds for HEIs, we mention some special programmes. The *Institute Excellence Centres* is a programme that is run jointly by VINNOVA, the Knowledge Foundation and the Swedish Foundation for Strategic Research (SSF). It began in 2005 with a first call for applications for planning grants. Research institutes should co-operate with universities, colleges and the business and industrial sectors within the framework of the programme with the aim of creating leading international environments for research, development and innovation activities in fields that are important to the future growth and competitiveness of Sweden. The programme will have a maximum budget of SEK 600 million over a period of six years. A maximum of SEK 300 million of this sum will come from VINNOVA, the Knowledge Foundation and SSF, while the rest will come from the companies involved. VINNOVA will provide a maximum of SEK 30 million per year and the Knowledge Foundation and SSF will each contribute no more than SEK 10 million. The Institute Excellence Centres programme is to run for up to 6 years. The Centres are funded in two stages: for 3 years based on the initial application and for an additional period of 3 years based on evaluation and renewed application. The partners of a Centre are industrial companies and research institutes in collaboration with a University/Institute of Technology. The parties contribute jointly to the centre's research programme, financially or in the form of active work. At present 8 Institute Excellence Centres are running.

Research and postgraduate training is funded by way of special grants from the national budget to the HEI. The resources are distributed in lump sums to four areas of research (depending on the competence of the institution) – humanities/social science, medicine, natural science and technology. A special grant for artistic development work is distributed to the university colleges of art.

The most recent research policy bill defines three prioritized research areas, namely life science, engineering and sustainable development, to which additional funds will be allocated to further reinforce previous bills' emphasis on support for these areas.

- The additional funds allocated to the area of life science (medical research) will be distributed through the Swedish Research Council (VR) and to a lesser degree the Swedish Council for Working Life and Social Research (FAS), which both use competitive calls and peer reviews.

- The additional funds allocated to the area of engineering (technological research) will be distributed through Swedish Research Council, VINNOVA and to a lesser degree SNSB (Swedish National Space Board), which all use competitive calls and peer reviews.
- The additional funds allocated to the area of sustainable development will be distributed through the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS), the Swedish Research Council and to a lesser degree VINNOVA, which all use competitive calls and peer reviews.

In addition to these prioritized research areas, the bill provides additional long-term funding for centres of excellence in both curiosity-driven and mission-oriented research, which is allocated through several research councils and sector agencies. Evaluation processes feature competitive calls using international peers. Following ramp-up, this funding will total SEK300m per annum from 2008 and onwards, and grants will be for up to SEK10m per annum per centre for a period of up to 10 years.

7. Canada: Ontario

7.1 Introduction

Canada is a federal state with legislative authority shared by the federal government, ten provincial governments and three territorial governments. In Canada, education is constitutionally the responsibility of the provincial governments - there is no ministry or department of education at the federal level. The federal government provides only indirect support to post-secondary education through fiscal transfers to the provinces and by funding university research and student assistance. Canada's three territories do not have the same constitutional status as the provinces and in many areas are subject to more direct control from the federal government. With respect to education, however, the federal government has delegated this responsibility to the territorial governments which in turn, cooperate with the provinces to deliver postsecondary programs. In fact there are 13 education systems in Canada with many similarities and some differences.

There are over 200 public and private institutions in Canada that grant degrees. The total number will rise in the next few years as Ontario's colleges of applied arts and technology begin to offer applied degrees. Many of these institutions grant degrees in all of their own programs.

Despite the Constitution's exclusive grant of powers to the provincial legislatures to "make Laws in relation to Education" – "In and for each Province" – the federal government in Canada has shown an interest in higher education since the early years of Confederation and especially, since World War I. The overriding goal of federal investments in higher education, particularly since World War II, has been to maximize universities' contributions to economic growth, competitiveness and social development in Canada as a whole. To this end, the investments have sought:

- to support growth in institutional capacity to provide access to growing numbers of students;
- to promote accessibility for students through student assistance measures;
- to develop university research and graduate education and, especially in recent years, to build internationally competitive research capacity in the universities;
- to promote Canada's interests internationally in relation to, and through, higher education.

In its 2002 Innovation Strategy the federal government described ambitious access policy objectives for the nation. Milestones of the federal innovation strategy are:

- Over the next decade, 50 percent of 25-64 year olds, including an increased proportion of individuals from at-risk groups, have a post-secondary credential (up from the current 39 percent).
- Admission of Masters and PhD students at Canadian universities increases by an average of 5 percent per year through to 2010.

Like the federal government, provincial governments tend to focus attention on the tremendous benefits that that completion of postsecondary education creates both for the individual graduate and for society as a whole. Recent policy statements of various provincial governments

have focused attention on the need to expand the capacity of their postsecondary institutions to enable them to take on more students.

Federal support for higher education is provided through the *Canada Social Transfer (CST)* to provinces, although there is no specific requirement for the provinces to direct the funding towards HE. The federal government also supports the higher education institutions indirectly through various federal programs. First we mention the three research granting councils: the Natural Sciences and Engineering Research Council (NSERC), the Social Sciences and Humanities Research Council (SHRC) and the Canadian Institutes of Health Research (CIHR). Federal research support also is provided through the Canada Foundation for Innovation (CFI), the Canada Research Chairs program, and the federal indirect costs of research program. Addressing students we mention the following federal support schemes: the Canada Student Loan Program (CSLP); grants for first-year low-income students; the Canada Millennium Scholarship Fund; the RESP program and Canada Education Savings Grants (CESG); the Canada Learning Bond; and tax credits for expenditures by postsecondary students.

The story of higher education in Canada over the past fifteen years is heavily influenced by three key factors: federal funding, changing demographics, and the adoption of a neo-liberal market-based philosophy in steering the higher education sector. In some provinces (and at the federal level) the government has used, or attempted to use, the funding mechanism to steer universities and colleges towards greater competition and improved performance as defined by government. At the provincial level, those efforts have evolved more recently towards greater emphasis on outcomes as delineated in performance contracts, service plans, and various agreements between the province and its post-secondary partners.

Public funding for universities is primarily focused on public institutions. Universities are highly autonomous; they set their own fees, admission standards and degree requirements, and have considerable flexibility in the management of their financial affairs and program offerings. Universities and community colleges derive about three-quarters of their funding from the provincial/territorial and federal governments (the largest share provided by the former). Government support varies widely by both level (college or university) and by institution. At the university level, tuition fees account for an increasing proportion of operating income, a trend that is likely to continue. These are much less significant at college level.

Tuition fees at most universities are subsidised, but vary widely according to province, institution, and program of study. Recently, an increasing number of degree programs, such as the executive master's in business administration degree, are entirely funded through student fees.

The remainder of this chapter is devoted to the province of Ontario, but the federal level will have to be mentioned once we arrive at the topic of research funding. Ontario is one of the most important provinces of Canada. It has 12 million inhabitants. 40% of all Canadians live in Ontario. 5 million of them in or around its capital, Toronto. Higher education in Ontario has a binary structure. There are 19 public universities (350,000 students) and 25 publicly funded colleges (Colleges of Applied Arts and Technology; 200,000 students). The colleges offer vocational programmes offer one-, two- and three-year certificates and diplomas, but – so far – no degrees .

Ontario continues to experience the greatest increase in demand for university opportunities in 30 years. Undergraduate and graduate enrolment increased by 74,000 full-time-equivalent (FTE) students from 2002-03 to 2006-07. There are many reasons for this enrolment surge:

- secondary school reform in Ontario allowed students to graduate from high school in four years instead of five and created a “double cohort.” The majority entered university in 2003-04, but some entered in 2002-03 and 2004-05,
- the population of 18-24 year olds is increasing,
- the percentage of 18-24 year olds in the population who attend university is increasing,
- more students are completing four-year rather than three-year university programs
- more students are staying in university.

Ontario has experienced a large increase of enrolments – in particular in the university sector. The expectation is that this will continue, despite the demographic decline. The increase of enrolments has led to quite some financial strain on the universities. This coincided with a rise in tuition fees. Former Ontario Premier Bob Rae, along with an advisory panel, was appointed in 2004 by the Ontario government to come up with recommendations to help improve the province's Can\$8.9-billion higher-education system. He delivered his recommendations to the Premier and the Minister of Training, Colleges and Universities in 2005 in his report, "Ontario: A Leader in Learning".

7.2 Funding of Higher Education

As in other provinces, the provincial operating grants by the Ontario government are intended to support general educational operations by universities and colleges. In the case of Ontario, the Ministry of Training, Colleges and Universities (MTCU) provides the operational grants. The grants tend to be used for operating support as well as capital.

The largest portion of the Ontario government's annual grants to universities has been distributed to individual universities using a formula. The formula uses two basic principles:

- revenue from government-regulated formula fees (standard fees) are pooled with formula grants to form a common “pot” for distribution among all universities, and
- the distribution of the “grants + fees” pot is based on a “weighted enrolment” approach, where program weights are applied to enrolments in different academic programs and levels to yield Basic Income Units (BIUs).

While there have been several adjustments and revisions to the formula over the years, mostly to reduce the formula's sensitivity to enrolment growth or decline, the two basic principles mentioned above continue to apply in the current formula. Each institution has an enrolment band (a ‘corridor’) to determine its share of formula grants. The corridor represents about 3% of an established enrolment level measured by BIUs (corridor midpoint). This corridor midpoint is fixed and does not vary from year to year. Associated with its corridor midpoint is the institution's fixed share of the formula grants. As long as the institution's five-year moving average” of BIUs remains in its enrolment corridor, the institution retains its share of the

formula grant. If an institution's moving average goes above the corridor, there is no additional grant; if it falls below the corridor, its grant will be adjusted downwards. Over the years, corridor midpoints have been adjusted (negotiated) to handle situations such as an increased enrolment in the system.

The Rae report mentioned above argued for a reform in the means by which the province distributes funding. The provincial college and university funding formulas were felt to be cumbersome, complex and out of date. The Ontario government was urged to work on a single transparent funding formula under which all students – apprenticeship, certificate, diploma, graduate and undergraduate – would be funded. Additional money would have to be made available through a set of 'envelopes' that would address particular objectives of public policy.

Over the past fifteen years the operational grants have been the subject of more 'earmarking' thus reducing an institution's truly discretionary funding. If the provincial government chooses to provide additional funding it is often in the form of earmarked funding for specific purposes such as increasing enrolment in specified areas, or performance-based funding. The share of formula grants has steadily dropped over the years as a result of the introduction of new forms of targeted grants, some temporary and some permanent (such as grants for research overheads, graduate waivers, equipment, faculty renewal, special needs and accessibility).

Ontario universities have full authority to establish their own tuition fee rates, albeit within government prescribed standards. At the same time, however, government has discretionary power to override this provision as was demonstrated in 2004, when a tuition freeze was announced for regulated and deregulated programs. Prior to the tuition freeze, government had established an annual standard or formula fee for every program (except for graduate programs, some professional programs, and computing and engineering programs). These fees are taken into account when operating grant entitlements are determined for each institution (see above). Any increase above the maximum rates approved by government will result in a reduction in the level of operating grants to that institution. Tuition fees in Ontario are between Can\$ 6,900 and Can\$ 16,800 for undergraduate and between Can\$ 5,650 and Can\$ 26,764 for graduate students.

The 2005 Ontario provincial budget announced the government's intention to make a significantly larger investment in postsecondary education to help increase enrolment in colleges and universities and to enhance the quality of the programs offered. To achieve this, the ministry of Education (MTU) signs multi-year plans with all institutions. Plans are developed with colleges and universities to ensure accountability for government investments. This funding framework is intended to allow long term planning and ensure accountability within the higher education sector.

The Ontario government released "Reaching Higher: The McGuinty Government Plan for Postsecondary Education", which provides a cumulative investment of Can\$ 6.2 billion in Ontario's higher education and training system by 2009-10. This multi-year *Reaching Higher* Plan outlines the government's goals and responsibilities for the higher education system related to quality, access, and accountability. The increase in provincial spending for higher education totals Can\$6.2, including:

- Can\$1.5 billion in new investments in student financial assistance
- Can\$4.3 billion in new investments to colleges and universities; and

- Can\$0.4 billion in new investments in other initiatives, including training and apprenticeships

By 2009-10 the government will be providing an additional Can\$1.2 billion in operating grants to colleges and universities, or 35 per cent more than the base in 2004-05.

Bilateral performance agreements are negotiated with colleges and universities to improve accountability. *Interim Accountability Agreements* (IAAs) were put into place for 2005-06 as a bridge to multi-year agreements for future years. The IAAs are a one-year agreement that confirms the commitments and results expected by government and each institution for the first year of the Reaching Higher investments. The government tracks the achievement of the Reaching Higher goals by means of annual discussions and reports completed by the institutions. Each Multi-Year Action Plan by a university outlines how the institution uses its operational budget to develop and strengthen its unique mission and objectives while contributing to the achievement of the Reaching Higher goals and results for access, quality and accountability. The release of the full amount of the institution’s allocation is conditional on the ministry approving the completed multi-year plan. The Ministry reviews the action plan annually to discuss progress being made on the commitments outlined in the plan. It recognizes that each institution has its own unique mission and this is reflected in the institution-specific performance indicators that an institution chooses to track progress.

7.3 Research funding

Universities conduct about one-quarter of all research activity in Canada. Research is funded by provinces as well as the federal government. The federal government is a principal supporter of university research and has established a comprehensive research strategy to position Canada in the forefront of the knowledge-based economy of the new millennium. The federal government promotes excellence in research through various initiatives (see the table below).

Table 1: Federal support for university research

People	Infrastructure and operating costs	Direct costs of research	Institutional costs
<ul style="list-style-type: none"> • Canada Research Chairs program • Canada Global Excellence Research Chairs • Other types of chairs • Vanier Scholarships • Canada Graduate Scholarships program • Scholarships, studentships, fellowships, and internships programs administered by the granting agencies • Awards 	<ul style="list-style-type: none"> • CFI funding for infrastructure and related operating costs • NSERC’s Major Facilities Access Grants and Research Tools and Instruments program. • Centres of Excellence in Commercialization and Research • CANARIE 	<ul style="list-style-type: none"> • All research grants from the granting agencies • Funding for the Networks of Centres of Excellence • Genome Canada 	<ul style="list-style-type: none"> • Indirect Costs program • “Overhead” on federal contract research

We already mentioned the three research granting agencies (the NSERC, the SHRC and the CIHR) that fund part of the direct costs of research. After the mid-90s, the federal government stepped up its commitment to higher education with the introduction of the *Canada Foundation for Innovation* (CFI), *Canada Research Chairs* (CRC) and Canada Millennium Scholarship Foundation (CMSF). It placed much greater emphasis on research and fuelled a major increase in research activity and added an expanded mandate to many universities and some colleges.

The Canada Foundation for Innovation (CFI) research fund was established in 1997 as a vehicle to fund the construction and operation of research infrastructure projects in Canadian universities. The CFI funds 40 percent of an approved project with the remainder to come from the province and the institution.

The Canada Research Chairs (CRC) program contributes to the ability of Canadian universities to attract and retain some of the world's most accomplished researchers. Since its inception in 2000-01, the CRC program has created more than 1,850 research chairs, including 584 that were awarded to leading researchers recruited or repatriated from abroad. The goal of the program is to support 2,000 researchers: 1,000 Tier 1 senior chairs and 1,000 Tier 2 junior chairs. Tier 1 chairs are tenable for seven years and are renewable, while Tier 2 chairs are tenable for five years and are renewable once only. The annual investment provided through the CRC program grew close to Can\$250 million in 2006-07. The allocation of Canada Research Chairs was, essentially, based on institutional shares of the granting council research grants with a floor provision to ensure every institution received at least one Canada Research Chair.

The indirect costs associated with federal research grants are not fully offset by the allowances, so the rest has to be financed from elsewhere, usually by provincial and tuition resources. This is the matching principle. In 2001, the federal government made a one-time payment to universities to fund a portion of the institutional costs of supporting research grants awarded by the three federal granting agencies. In 2003, this *Indirect Costs program* became permanent and by 2006-07, it provided Can\$300 million, or an overall rate of 26 percent of the funding received for eligible federal research awards. The allocation of indirect costs was linked to total institutional research grants with an added 'capacity-building' provision for smaller institutions.

More recently, the federal government has made additional investments in university R&D. These include the Centres of Excellence in Commercialization and Research program in 2007 and the Global Excellence Research Chairs in 2008. Under the former program, 18 centres of excellence were funded in fiscal 2007-08 at a level of Can\$15 million each over five years. An additional Can\$52 million is available for the creation of new centres of excellence in the 2009 competition. The latter initiative will allocate Can\$21 million over two years to establish 10 Global Excellence Research Chairs (with plans to provide another 10 chairs in the following two years). In keeping with the federal government's S&T strategy, these chairs will target the following four areas: the environment, natural resources and energy, health, and information and communication technologies. Each Canada Global Excellence Research Chair will receive up to Can\$10 million over seven years. The Centres of Excellence Program links university, industry, and government researchers across the country.

The provinces also make significant investments in research apart from the support provided through their operational grants (see above). In Ontario, the Ministry of Research and Innovation also supports research. This ministry was created in 2005 and has established the Ontario Research and Innovation Council.

The Ontario government introduced a variety of research initiatives, beginning in 1996 with the Ontario Research Development Challenge Fund (ORDCF). The ORDCF promoted and supported research excellence in the province by increasing the R&D capacity of Ontario universities and other research institutions through private and public sector partnerships. The ORDCF program was replaced by the new *Ontario Research Fund* in 2005.

The Ontario Research Fund Research Excellence (ORF-RE) program promotes research excellence in Ontario by supporting transformative, internationally significant research of strategic value to the province. The ORF-RE focuses on scientific excellence and commercialization and targets leading-edge research initiatives. The Ministry of Research and Innovation is investing Can\$250 million over the next five years through its Ontario Research Fund – Research Infrastructure program (ORF-RI). This new investment will enable institutions to apply for research infrastructure funding, which has the potential to leverage awards from the Canada Foundation for Innovation (CFI).

The Ontario Innovation Trust (OIT) was created in 1999 by the Government of Ontario to help Ontario's universities, hospitals, colleges and research institutes enhance the infrastructure needed for scientific research and technology development. It is now subsumed by the ORF. Ontario has consolidated its three research funds — the Ontario Innovation Trust, Ontario Research and Development Challenge Fund and Ontario Research Performance Fund, into the new Ontario Research Fund, as "one-stop shopping" for researchers that need to access funding. All provincial funding for research is now handled by the Ontario Research Fund.

8. Concluding observations

The issue of higher education funding has multiple aspects: who pays for higher education (including the topics of cost-sharing in higher education and external funding to universities), how public funding is allocated to universities, what incentives the allocation mechanism creates, and how much autonomy universities have in decision-making over financial and human resources.

Several funding models were presented in this paper. First they were considered abstractly and placed into a general categorisation, stressing the dimensions of performance orientation and individual (decentralised) decision-making. The higher education funding mechanism is an important ingredient in the wider spectrum of governance arrangements. Trends and practices in Europe increasingly point towards more market-based, or performance-oriented and decentralised types of funding mechanisms. European governments have shown a tendency to augment the direct funding of higher education institutions with competitive funding mechanisms and performance-based funding mechanisms.

Surveying the funding mechanisms in place across European higher education systems, we have shown that in most countries the allocation of direct appropriations occurs through a formula that uses a mix of input and – to a lesser extent – output criteria. Often student numbers are the most important criterion in the funding formula. Overall, we find that institutional budgets depend more on student choice and less on central planning, while for research budgets we observed that competitive funding has become a key allocation mechanism and accounts already for a substantial share of the universities' revenues. Some governments have, next to the above developments, started to work with contracts. However, the extent to which such moves towards performance contracts and performance-based funding have taken place naturally varies enormously across countries.

Through introducing performance-based funding mechanisms and more competition the governments provide incentives and try to achieve more differentiation in quality, funding and pricing in higher education. A mass higher education system is believed to require a greater reliance on decentralised decision-making by individuals and institutions.

In the previous chapters we have seen that quite a few of the countries use output measures (credits, diplomas, publications) as the basis for determining the size of the budget for the institution. All of them make use of funding formulas to calculate the size of public grants for teaching and/or ongoing operational activity and, in certain cases, research. The use of performance contracts can be observed in Sweden, Germany, and Canada.

Returning to figure 2 presented in chapter one, we conclude that all countries differ in the mix of the various funding options and the parameters they use as ingredients in their formulas and contracts. One can observe the presence of incremental allocations (or the remnants of this traditional type of funding), formula-based allocations, project funding and – increasingly – contract-based funding.

Obviously, the funding models that are in use in particular countries are the result of history and politics. What we do observe is that all six countries are revising their allocation models (or have recently done so). Germany is more inclined to move away from incremental approaches and makes use of formulas and contracts. The Netherlands is reducing the performance orientation in the formula for the teaching budgets and strengthening the performance orientation in the research budgets. Both Norway and Sweden have introduced a very performance oriented model for the funding of research. Sweden is considering introducing quality-based approaches in the funding of teaching and research. The UK is known for its selective funding of research, based on the research assessment exercise (RAE). However, the RAE will in the future be more metrics-based. Canada has increased the presence of competitive funding schemes and done alongside the introduction of multi-year contracts that have a stronger performance orientation.

A trend observed everywhere is the allocation of more earmarked funding, especially for encouraging access and research excellence and the setting up of centres of excellence on research areas deemed of strategic importance for the country. If we were to select two trends that have become more manifest in the six jurisdictions covered in this report we would have to mention the increased emphasis on outcomes and the gradual move away from lump sums towards targeted funding. It remains to be seen where and when this trend will end and how it will affect institutional autonomy and the institutions' ability to balance and meet multiple demands.

Note

A couple of errors on pages 27-28 (Norway) were brought to my attention. The first relates to the following section:

"In the general funding component, the research allocation is also based partly on strategic considerations. This strategic element was agreed upon in 2007 and rewards research of high quality and relevance and stimulates the institutions to develop research strategies that support the national objectives. Essentially it rewards institutions for the number of publications they produce. Underlying this is a documentation system that serves as the basis for the research component of the budgets for universities and university colleges."

However:

The strategic component is not connected to any performance indicator. The strategic component is based on decisions and political priorities.

The publication indicator was developed in 2003-2004 and introduced in the budget year 2006 in order to replace another indicator, "the number of higher academic positions" (see table 2 and the second paragraph of 4.3 on page 27, see also first paragraph on page 28.). The replacement was meant to increase the performance orientation in the research component and provide a better balance between education and research in the total funding model. The data from the publication indicator now cover five years 2004-2008.

The table 2 on page 27 is a mixture of the education and research components. There are only four indicators for the performance-based part of the research component:

Doctoral degrees: weight 0,3

EU funding: weight 0,2

Research council funding: weight 0,2

Publication points: weight 0,3

In table 3 on page 28, the 5 points for articles in series and periodicals on level 2 were proposed by a committee in 2004, but never implemented. The correct weight is 3, as indicated below.

Table 3: Relative weights attached to types of publications important for research funding

Publication type

Level 1

Level 2

Scholarly books (ISBN)

5

8

Articles in series and periodicals (ISSN)

1

3

Articles in anthologies (ISBN)

0,7

1

< end of correction >