CHANGES IN UNIVERSITY INCOMES AND THEIR IMPACT ON UNIVERSITY-BASED RESEARCH AND INNOVATION

FINAL REPORT

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Introduction

Higher education institutions are crucial to both the Lisbon strategy's objectives and the expanding European Research Area. The past decade has seen many countries develop or alter policies that shape higher education systems capacity to undertake research and institutions themselves have actively worked to develop more flexible organizational structures that will allow them to capitalize on changes in an increasingly dynamic research environment.

The project, "Changes in University Incomes: Their Impact on University-Based Research and Innovation" (CHINC) was commissioned by the Institute for Prospective Technology Studies[1] (IPTS) to explore the following four topics:

1. Actual changes in higher education institutions over the last 10 years in a select number of European countries
2. Institutional funding developments, in both real and relative terms, and particularly the composition of institutions' research income portfolios
3. Possible consequences of changes in funding institutions' research activities
4. The availability of institutional level data for conducting such analyses

A consortium of researchers from 11 countries participated in the study, which combined both quantitative and qualitative techniques in an effort to identify systematic and comparable evidence. More specifically, quantitative data was collected for a sample of 117 institutions and interviews were conducted with well-placed individuals in 97 institutions from the same group. The results from the CHINC study not only shed new light on changes in institutional funding, and their consequences, but also highlight what data can reasonably be collected. In the end, it points the way ahead towards establishing a purposive, European-wide system of key data on higher education institutions.

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[1] IPTS is one of a select number of Joint Research Centers supported by the European Commission.

Summary of the CHINC Project's Findings

1. CHANGES IN FUNDING AND THEIR CONSEQUENCES
(DETAILS IN CHAPTER 2)

- Our findings suggest that total income for most institutions in the sample increased, *in real terms*, between 1995 and 2003. In most cases, funding also grew faster than student enrolments.

- Changes in funding composition were evident but limited. Many institutions witnessed an increase in the share of grants and contracts and some a decrease in the share of general government allocations. The UK was unique in that government funds were not the major source of institutions' revenue.

- There is some evidence, based on PhD enrollments and numbers of academic staff that institutions' research capacity has increased.

2. CHANGES IN RESEARCH POLICIES AND RESEARCH PORTFOLIOS. MAJOR DEVELOPMENTS AT THE INSTITUTIONAL LEVEL OVER THE PERIOD 1994-2003
(DETAILS IN CHAPTER 3)

- Achieving focus and mass by rationalizing research activity (selectivity, critical mass, profiling)

- Creating "centers of excellence" as a result of the universities' rationalization and profiling policies; these centers are often inter-disciplinary institutes

- Using financial/budgetary instruments as ways to reach research goals and to enhance quality

- Strengthening the steering capacity of the university's central management (e.g. by means of adjusting the internal planning, budgeting and control cycle)

- The setting up of a support facility (or office) to help researchers apply for funds or commercialize their research findings

- Decentralization (devolving responsibility and making departments more autonomous when it comes to their management and resourcing) as a means to increase research performance and research income

- Human resources management (HRM) as an instrument that helps institutions achieve the right composition of academic staff. For instance, vocational HE institutions encourage staff to engage more in research as this also helps improve their teaching

- Improving research training (PhD track; graduate schools)

- Engaging in linkages with the outside world (region, industry, SME)

3. DATA AVAILABILITY

- Data availability varies significantly across countries, curtailing the abilities to conduct comparative analyses. Not surprisingly, countries with centralized data collection systems have more available and reliable data than countries where data collection is decentralized.

- The major "gaps" in the available data are to be found in capital costs or investments and most output indicators, including publications and emerging third-mission indicators. Their absence, in turn, severely limits the ability to identify institutions' contributions to research and innovation with any real precision. Despite the wealth of problems, our findings do however suggest it is possible to collect *limited* quantitative data on individual institutions suitable for cross-country analyses.

- Data on government funding and "total grants and contracts" was generally available. However, data on grants and contracts by source, especially from private sources, was not. This hampers analyses of institutions' interactions with private industry and consequently analyses of their role in innovation.

4. RECOMMENDATIONS

Obtaining comparable information on European higher education institutions is necessary for both monitoring and analyzing the dynamics in the European Research Area. In light of the fragmented information that is currently available and our analysis based on the findings from this study, we offer three specific recommendations:

1. Establish a European-wide system for systematically collecting data on individual higher education institutions' research activities that will help to inform policymakers, institutions themselves and other relevant stakeholders. Our proposal would be for this task to be carried out by a network of national centers with the relevant expertise.

2. Such a network should be given the responsibility to develop a standardized methodology as well as oversee the collection, validation and analysis of data related to European higher education institutions' research activities. In addition, the network should take advantage of ongoing research being conducted by organizations like the OECD and the PRIME Network of Excellence.

3. In order to build as complete a picture as possible, any future research should focus its efforts on three pillars of information:

   - **Information on national higher education and research systems.** Structured information on system-level characteristics is necessary for analyses of institution-level data. At the moment, the diverse array of national differences makes collecting such information crucial to conducting relevant research.

   - **Quantitative data and indicators.** A minimal set of comparable data must be identified and collected that provides information on several institutional characteristics, including: available resources and expenditures, tangible results for institutions three primary activities (education, research and public service) as well as core data on institutional characteristics (e.g., disciplinary mix and specialization).

   - **Qualitative information.** The role that context plays cannot be underestimated. Therefore it is also necessary to collect semi-structured information on policies, actions and strategies from key institutional actors so as to better understand how perceptions of internal and external developments shape Europe's research system.

1. Changes in European Higher Education and the CHINC project

European higher education and research has undergone profound changes over the last 10 to 20 years. International initiatives like the Bologna process, the creation of the European Research Area and the Lisbon strategy all provide demonstrable evidence of the magnitude such changes have had and are continuing to have. Nor is there a shortage of examples to be found at the national, regional and institutional initiatives. Today, higher education reform is dominated by a focus on institutions' varied stakeholders, links with business and the local community, government efforts to promote efficiency and pushes for innovation and social relevance.

Change has engendered numerous perceptions about the state of European higher education and research. Among these are:

- Decreasing public funding
- Increasing private funding
- Greater importance of student fees as a funding source
- Growth in project-based funding and competitive allocation of research funds
- Allocation formulas more often based on both inputs and outputs
- Higher education institutions increasingly pursuing third mission activities and behaving like corporations rather than nonprofits
- Reduction in funding for basic research and growth in applied research

Despite the wealth of studies on national higher education systems and often-cited statistics on both education and R&D activities, little systematic evidence at the European-level about the perceptions of such developments has been collected. What is known has tended to come from studies at the national level or of studies on innovative universities. What is missing are research efforts that take into account the wide

> The project *Changes in University Incomes: Their Impact on University-Based Research and Innovation (CHINC)* was done under service contract with the European Commission, represented by the Institute for Prospective Technological Studies (IPTS) of the Joint Research Centre.

variation in European higher education systems, how institutions behave as strategic units, the priority given to research and education and the diversity of institutional specialization. It would seem, based on the best information that the problem lies mainly in the lack of readily available, systematically collected and comparable data.

1.1. THE PROJECT'S GOALS

It was with this background in mind that the CHINC study was commissioned to investigate the following four basic topics:

1. The actual developments taking place in higher education institutions over the last 10 years, with respect to their research activities, in a selection of European countries
2. Developments related to the growth and change in the funding for research conducted in higher education institutions
3. The possible consequences that any changes in funding have had or will have on institutions' research and innovation activities
4. The availability of institutional level data suitable for undertaking such investigations

Developments in institutional funding have been discussed frequently in recent years (see Chapter 2). However, universities are complex organizations that perform multiple tasks with a common set of resources. As such changes in funding cannot be analyzed by considering isolated changes in personnel, students and research activities. In this regard, it was necessary to collect data that would be useful for establishing facts about how Europe's higher education institutions have developed in the context of these dimensions. We also sought to explore the effects that any changes in funding, real or perceived, have had.

Since cause and effect can be analyzed not only on indicators but on actions and strategic choices as well, the project also wanted to establish systematic information on institutions' priority setting, task organizing and internal allocation strategies. Finally, because we wanted to collect comparable data across different countries and systems, it was prudent to simultaneously evaluate the extent to which such a data collection exercise could realistically be undertaken. Overall then, the CHINC project can be best seen as a research project that aims to shed new light on changes in institutional research funding and their consequences. Yet it can also be seen as a feasibility study on what data can be collected in the current climate and what needs to collected if monitoring European higher education institutions' research activity is to become an ongoing task.

1.2. NATIONAL VARIATIONS

Even if the Bologna process is moving European national higher education systems towards greater homogeneity, variation is a fundamental characteristic that must be accounted for when drawing comparisons across countries. In particular, several key differences are particularly important:

- National versus regional governance (e.g. the importance of regions in Germany, Spain and Switzerland)
- Single vs. dual institutional systems (e.g. the differentiation between universities and *fachhochschulen* in Germany)
- The structure of the national research system (e.g. accounting for other public and private performers of R&D outside the higher education system)
- The structure of the national funding system and instruments used (e.g. existence of intermediaries and private charities, use of formulas, and competitive allocation schemes)

The CHINC project was structured to specifically account for these and other country-specific variations. For example, the choice to include Germany, Spain and Switzerland was based partly on the fact that regions play a prominent role in funding and governing institutions. Four countries were included that operate university and professional education sectors (Germany, the Netherlands, Norway and Switzerland). Moreover, places like France, Germany, the Netherlands and Norway have public or semi-public research laboratories and

Reports from the CHINC project and their abbreviated titles:

European Higher Education Institutions: Building a Typology of Research
  ("CHINC Typology report").
Changing Patterns of Higher Education Funding: Evidence from CHINC countries.
  ("CHINC Funding report")
Changes in European Higher Education Institutions' Research Income, Structure and Strategies.
  ("CHINC Strategies report")
Collecting Institutional Level Data from European Higher Education Institutions: Evidence from CHINC countries.
  ("CHINC Data report")

institutes outside the higher education sector.

The structure of the funding system is core to the study and given greater attention in Chapter 2. National variations were also addressed at the outset by also paying attention to more fundamental aspects like the balance between large and small nations, European Union members versus associated countries and the differences between northwestern, southern and central European States.

1.3. INSTITUTIONAL VARIATIONS

The unit of analysis in this project was the institution. Nevertheless, it is necessary to also examine the structure of the national system, institutions' histories and priorities. Institutional strategies, the freedom to set such actions and what possible measures can be used will vary according to an institution's mission, governance, accreditations status, funding model, level and number of qualifications awarded, range of disciplines offered, institutional size and research intensity (OECD 2005). Analyzing how structural features and changes are reflected in institutional actions ideally demands some framework or typology as a starting point. For the purposes of the CHINC project, a classification of higher education institutions that characterized the research portfolios of the institutions was developed. In our view, such a classification ought to be simple to operationalize and understand but still make it possible to draw distinctions independent of national systems, organizational variations and institutions' priorities. The typology developed for this study incorporated three dimensions:

Countries participating in the CHINC project

The Czech Republic	Netherlands
Denmark	Norway
France	Spain
Germany	Switzerland
Hungary	United Kingdom
Italy	

1. Research versus teaching orientation. (Intended to reflect institutions' mission.)
2. Research intensity. (Intended to reflect institutions' engagement in research.)
3. Disciplinary focus. (Intended to reflect the scope and type of research.)

The first dimension tries to capture an essential feature of the institutional mission; namely if the institution's primary focus is on teaching or research. In dual systems this distinction is clear but for more homogenous systems it is critical to identify. The second dimension captures the relative amount of research performed, what resources are allocated for the task and what research outcomes can be accounted for, the latter being usually measured by quantitative indicators based on PhDs awarded, publications and other output measures. The third dimension addresses institutions' broad disciplinary focus. It would not be fair to do a straightforward comparison between a technical university and one with a strong humanities and social sciences focus.[2]

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[2] See the CHINC Typology report for further information.

1.4. THE SAMPLE

More than 100 institutions were analyzed as part of the study. In the first phase of the project basic information was collected for a larger sample of almost 1000 institutions. Here the basic criterion for inclusion was the provision of educational programs with a minimum length of three years. From this group the final sample was assembled by selecting a mix of institutions that balanced institutions' program scope, the inclusion of both institution types from binary sectors and a mix of long-established and relatively young institutions.

Unfortunately, adequately accounting for the substantial variations in European higher education institutions is not possible by drawing information from approximately 100 institutions and the shortcomings are evident in our own sample. For example in Denmark, Germany, the Netherlands and Norway not all of the institutions are PhD-granting (which was the case for the other countries). This means that for the other countries, PhD institutions are over-represented in the sample. Institution size and specialization also proved difficult to adequately capture. The Spanish sub-sample is biased in that it has mostly large public universities and in Germany more weight is given to universities at the expense of the *Fachhochschulen*. Finally, Europe has a large number of technical universities, business schools, medical institutes and humanities schools that are under-represented in our sample.

1.5. METHODOLOGY

Changes in higher education institutions can be studied in several ways. We chose to use a mixed-method approach. This opens up the possibility for analyzing changes over time, hypothesizing causal relationships and evaluating individuals' perceptions about how changes had influenced institutions. Consequently, the CHINC project is based on three methodological *pillars*:

1. Time-series analysis of quantitative data - To analyze developments over time, the project team collected ten years' worth of institutional level data on 30 variables for 117 European higher education institutions. Though considerable gaps in some countries' data were evident, this information made it possible to track changes in the majority of institutions' student and staff counts, revenue, expenditures and publications. The findings based on this part of the project are reported in the *CHINC funding-report*.

2. Collecting information on changes in policy and system features – To study the factors behind the observed changes, the project drew on the relevant literature and produced descriptions of recent changes and trends in policies for the countries being analyzed. The network of national correspondents that formed the CHINC consortium each described their respective national systems and the actual implications of national policies. Utilizing the contextual knowledge of the national experts made it possible to draw valuable context-dependent explanations of observed changes.

3. Interviews with institutional leaders - Through interviews at 97 out of the 117 the institutions included in the quantitative sample the project investigated a number of difficult to quantify phenomenon: the reasons behind observed changes, effects of policies, institutional reactions, major restructuring efforts and strategies. The interviews covered five broad topics and were done with leading officials at each institution. The findings utilizing this methodology are reported in the *CHINC qualitative report*.

The CHINC sample	Total Number of Higher Education Institutions (large sample)	Detailed sample			
		No. of Institutions, Quantitative data	No. of institutions, qualitative data (Interviews)	Average No. of students	Average No. of PhD degrees
Czech Republic	64	10	6	15 397	115
Denmark	55	7	9	12 147	130
France	105	12	9	15 954	188
Germany	334	9	10	20 157	473
Hungary	66	7	5	14 095	68
Italy	77	14	7	35 485	119
Netherlands	72	8	8	16 379	198
Norway	44	10	8	8 357	119
Spain	66	16	10	40 823	246
Switzerland	19	12	15	7 064	229
UK	90	12	11	13 337	203
Total	992	117	98	19 828	191

The next chapter presents the findings regarding changes in institutional funding and discusses their implications. Chapter three presents what was found about strategic institutional responses based on interviews with the institutional leaders, and discusses the implications. The last chapter assesses our methodology and puts forward recommendations for future studies.

2. How has funding for higher education changed since the mid-1990s?

Funding is central to higher education institutions. Not only the overall level of resources individual institutions receive but also channels and ways through which it is allocated. For states, funding is a critical steering mechanism and the reforms that have been widely introduced in the last two decades have been designed to increase efficiency and promote competition.

In fact a number of changes have been introduced (Geuna, 2001; OECD, 2003). Some were actions against stagnant or decreased overall funding while others occurred as a response to decreases in the share of institutions' annual appropriations or increase in other sources like project funding, tuition fees and private contracts. Perhaps the primary evolution though has been a shift from government allocations based on historical and input-oriented criteria towards more accountability and performance-based mechanisms that give greater attention to outputs and efficiency (see for example Geuna 1999; Kaiser, et al. 2001; Benninghoff, et al. 2005). Overall many see such actions as a paradigm shift towards more competition and greater institutional autonomy (Amaral, et al. 2002; Teixeira, et al. 2004). There are however concerns that the movement towards a "market-like" system will have deleterious effects such as favoring short-term scientific projects over long-term results and the absence of both theoretical arguments and empirical evidence that such a strategy would enhance efficiency (Bonaccorsi & Daraio, 2006).

How higher education institutions have dealt with these pressures is addressed in the next chapter. Here the focus is on examining the quantitative evidence emerging from the CHINC project's data. The discussion below addresses a number of issues, but particularly pays attention to changes in the overall level of funding and shifts in the composition of funding, including evidence for a decrease in the share of government allocations, increases in grants and contracts and in private contract resources and in tuition fees. Finally, this section examines changes in research expenditures and higher education institutions' capacity to carry out research activities.[3]

Figure 1. Funding channels for higher education
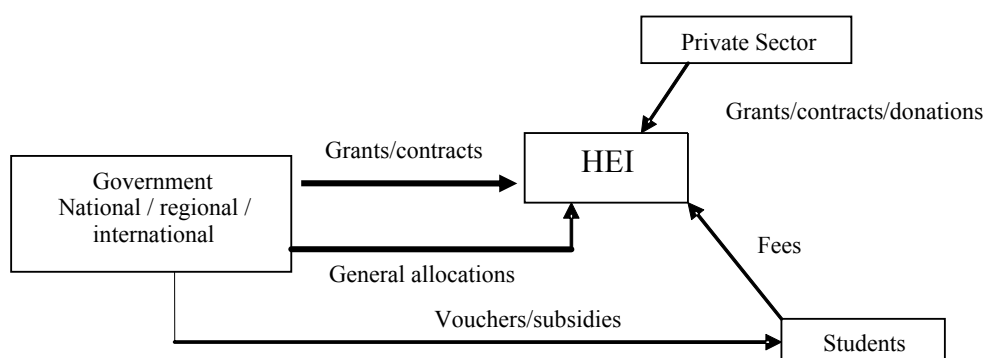
In a very simple way, one can distinguish between four major funding streams that channel financial resources into higher education institutions (Jongbloed, 2004; see Figure 1).

1) *Government allocations.* These are contributions from the state (both national and regional) that are allocated for the basic functioning of public institutions. Oftentimes such funding is

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[3] The reader should refer to the specific *CHINC funding report* for more detailed results and full methodological information.

distributed in a block-grant that can be internally allocated at the institution's discretion though in some cases this responsibility remains the purview of the state. As a rule, allocations do not distinguish between those for education and for research; however, the calculation of the amount usually does.

b) *Grants and contracts from the government.* This category constitutes revenues for research projects or other specific activities that are financed for a finite period and allocated directly to institutions' sub-units (e.g. laboratories). Examples include competitive grants from research councils, European framework programs and contracts from individual government departments. A large percentage of this funding tends to go towards research activities.

c) *Grants, contracts and donations from private companies, including private charities.* This category includes revenues from private industry and from philanthropic organizations. Again most of the funding is for research purposes.

d) *Funding directly from the students.* This includes tuition fees. It is useful to distinguish between fees for undergraduate students, which are in most cases fixed by the state, and fees for postgraduate education where institutions have more freedom to set their own rates.

2.1. CHINC DATA AND THEIR LIMITATIONS

Briefly, the following categories of financial data were collected in this project:

- The total revenues of the institutions and its breakdown in general government allocations, tuition fees, grants and contracts and other revenues. Institutions were also asked to provide a breakdown of grants and contracts in subcategories (including private contracts).

- The total expenditures of the institutions.

Note that investment income and capital costs were excluded because of comparability problems based on differences in legal status, ownership and accounting systems across institutions. In most countries data could be retrieved from databases maintained by national statistical offices or higher education institutions themselves.[4]

A number of comparability problems emerged during the course of the analysis. Examples included a lack of usable expenditures data in France (since permanent staff is paid directly by the ministry), problems with time series due to mergers and restructuring (especially in the newly integrated countries) and a lack of disaggregated data on grants and contracts (including private contracts). Also, collecting the data from a variety of sources meant that the quality and coherence of data varied: typical signs of problems included jumps in time series for aggregates like total expenditures or systematic and unexplained differences between total expenditures and total revenues.

Finally, the data we collected suffers from a number of comparability problems related to different accounting systems and practices (inclusion of student services, investments and capital costs accounting, coverage of university hospital costs) as well as differences in the national higher education systems and individual institutions (e.g., subject field mix). Disentangling these effects is not an easy task (see, for example Bonaccorsi, Daraio & Lepori, 2005 or Slipersaeter, et al. 2005). Another major issue affecting cross-country comparisons, particularly over time, was a *lack of deflators and purchasing power parities specific to the higher education sector.*

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[4] In Italy and Spain we used data collected by the rector's conference from individual institutions. In these cases some problems of coherency appeared (for example in time series). Finally, for Hungary and France data had to be collected directly from the universities and thus data problems are greater.

The project team adopted a two-fold strategy for addressing these problems and issues. First we choose indicators that are more robust against comparability problems, such as those avoiding direct comparisons of funding and cost levels between individual institutions (since these are directly affected by national differences in accounting systems, the lack of sector-specific PPPs and the different subject mixes within individual institutions). Second, we included a qualitative component to the methodology that would serve in part as a check on the quantitative results.

2.2. ISSUES, QUESTIONS AND ANSWERS

Did higher education funding decrease in the last years?

Our data do not support this conclusion. Among the 79 institutions for which time series data was available only 4 had a decrease of total funding between 1995 and 2003, while the average real increase (unweighted) was 3% per year. These results are consistent with the results from Conraths and Smidt's (2005) study.

Even if one considers the change in student numbers, more than two-thirds of the institutions witnessed a real increase in total per-student revenues over the time period (see Figure 2). These results are open to different interpretations: it is possible that funding cuts occurred mainly before the period under study. Another possibility is that for many institutions the times of increasing enrollments are over. Approximately one-third of the institutions saw a *decrease* in student numbers during this period and these are the institutions that increased per-student revenues (see Figure 3).

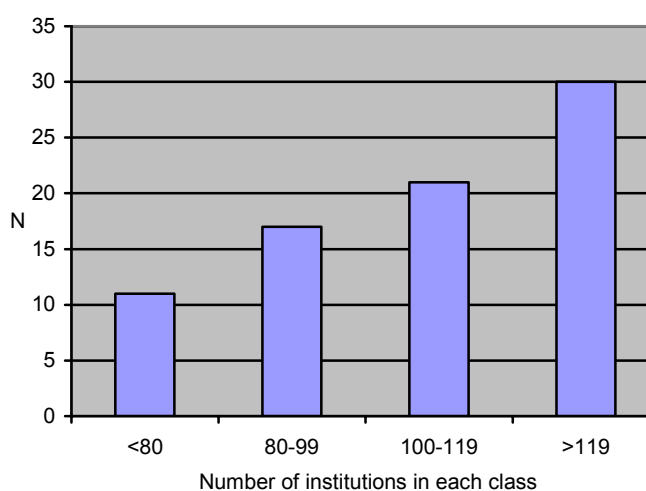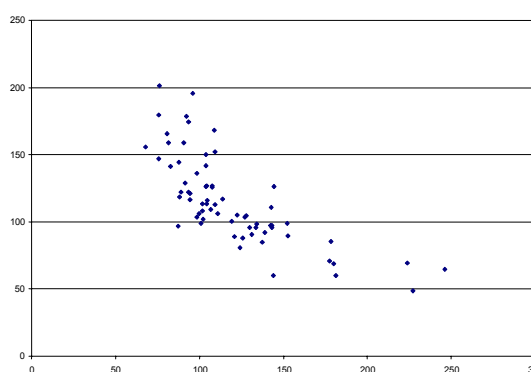Figure 2. Total revenues real per student 2003 1995 = 100.

Figure 3. Revenues per student vs. number of students

X axis: number of students 2003 (1995=100)
Y axis: total revenues per student at constant prices 2003 (1995=100)

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Are general government allocations becoming a less important source of funds?

The answer to this question is two-fold. First, for the majority of the sample, general government allocations remain the dominant funding source: for most higher education institutions, government appropriations represent between 60% and 90% of total revenues (see Figure 4). Note though that 10 of the 12 institutions below 50% are from the United Kingdom so there is a country bias present. Second, our data confirm the general trend of a decreasing *share* of government allocation. However, this tendency was found to be largely evident in institutions whose starting share was above 80%. For other institutions the decrease was on the order of around 10%.

Figure 4. Share of government appropriations as % of total revenues. Number of institutions in each category. Data for Italy for 2002.
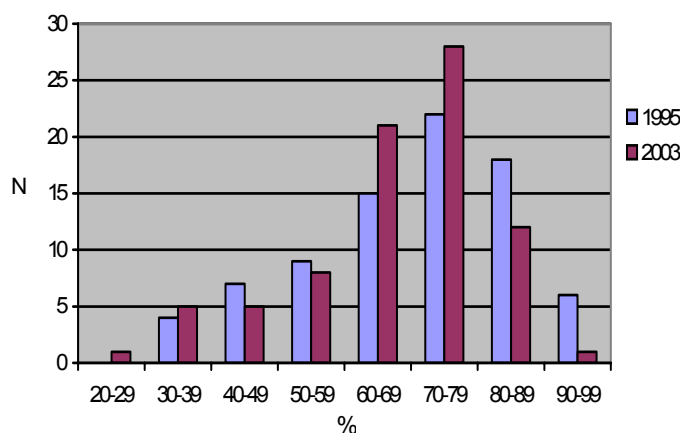
Are grants and contract funds becoming more important to certain institutions?

For grants and contracts the differences between individual institutions were quite large: some institutions earned more than a quarter of their total revenues here while others earned less than 10%. At the top of the list are several well-known research universities, like Cambridge and the Imperial College and a number of technical universities, but also some generalist universities. Moreover, the list includes institutions that range from very large to very small (see Table 1). If one assumes that proportion of grants and contracts to total income is roughly linked to research quality (provided the funding is competitively allocated), then there is no evidence that larger institutions are better research performers.

Table 1 Institutions with a share of grants and contracts above 25% (2003)

Name	Country	% Grants & Contracts	Students
Imperial College of Science, Technology	UNITED KINGDOM	43	7 365
Vysoká škola chemicko-technologická v Praze	CZECH REPUBLIC	42	2 229
University of Cambridge	UNITED KINGDOM	38	16 550
Universitet for miljø og biovitenskap	NORWAY	33	1 986
Technische Universität München	GERMANY	28	18 577
University of Aberdeen	UNITED KINGDOM	28	10 260
Université de Neuchâtel	SWITZERLAND	27	2 681
Ecole Polytechnique Fédérale de Lausanne	SWITZERLAND	27	4 707
Norges teknisk-naturvitenskapelige universitet	NORWAY	26	16 197
Ceské vysoké ucení technické v Praze	CZECH REPUBLIC	25	20 270

Perhaps the clearest observation is that there has been a general increase in almost all institutions' shares of grants and contracts. If the short time frame is taken into account the change is even more noticeable: more than one-third of the institutions for which data was available doubled their share of grants and contracts resources between 1995 and 2003.

Are tuition fees becoming more important?

The answer to this question, at least for the period considered here is no: practically none of the institutions in the sample saw a significant change in the share of tuition fees over the period. There are though distinct national patterns: the share of tuition fees in total revenues tends to be quite similar for institutions in the same country, while differences across countries are larger. The CHINC data includes some countries where fees are practically non existent, like Germany and Norway, and countries where they are set at low levels (the Netherlands and Switzerland. For some countries they account for more than 10% of the total revenues (Italy, Spain and UK), - countries which show considerable differences in their higher education systems. The major exception is UK, where the share of tuition fees varies between 13% and 33% and there is a negative correlation with research contracts. This can be interpreted as a sign of institutional specialization towards education – especially in domains where high fees can be charged – and more competitiveness for research funding.

Are private companies becoming a key source of funds for institutions?

This is the most difficult question given the scarcity of the available data; only five countries in CHINC could provide more or less complete information on private contracts (Germany, Netherlands, Norway, Switzerland and UK) and even for them quality and coverage of data is not considered to be good.

The available data show that private contracts are a becoming a significant source of revenue (exceeding 5% of the total) for a minority of institutions, mostly business schools or technical universities. This is not to say that private companies are not important revenue sources for specific academic domains, just that the available evidence is too sparse to draw such conclusions. Changes over time are even more difficult to assess since there are notable breaks in the time series (due to changes in definition and/or in methodology for collecting data).

Do we have signs of changes in research capacity?

Measuring universities' research capacity is difficult since different indicators can lead to quite different results (Slipersaeter 2005). Moreover, financial data cannot be readily used for this purpose since almost no higher education institution has an accounting system that separates research expenditures from other activities. In this sense, the procedure recommended by the Frascati manual using time surveys for breaking down personnel costs (OECD 2002) has to be considered more of a statistical artifact for "separating the inseparable" and getting to a rough measure of R&D costs than as a precise analytical tool for measuring research expenditures and for managing institutions (Godin 2005; Lepori 2005). It is also well-known that the quality of these data is quite poor in a number of countries (OECD 2000).

However, some of the CHINC data makes it possible to consider changes in research capacity. These include data on academic staff and on PhD degrees, the latter being one of the main indicators used in the Carnegie classification of American universities for identifying research-intensive universities (see the CHINC Typology Report).

The evolution of the number of academic staff shows a mixed picture. Most institutions in the sample had an increase in total numbers (in full time equivalents), but about 40% of the institutions witnessed a decrease of academic staff on a per-student basis. This could be interpreted as an indicator of a greater education workload. Comparisons with changes in revenues show that part of the additional funds likely have been offset by a parallel increase in the average real wages.

Data on PhD degrees are among the most interesting in to come out of the CHINC project. First the data show systematic differences in the average number of PhD degrees per undergraduate students between countries (table 2). This cannot be explained by differences

in research intensity alone, but probably by national patterns in higher education organizations - some countries treat PhD students as paid workforce - as well as data comparability problems. This shows the difficulties of using an indicator for comparing higher education institutions in such a diverse system as in Europe.

The data also show a correlation between the share of grants and contracts and the number of PhD degrees per undergraduate students (though the correlation's strength differs by country). Thus, increasing the share of grants and contracts has a much stronger impact on the number of PhD degrees in Germany, Switzerland and the UK than in the Czech Republic, Netherlands and Spain. Our hypothesis is that this is a signal of different research production structures. The former countries pay PhD students heavily from contract research while in the latter countries that funding is likely to pay in part for permanent staff [5] or temporarily hired researchers.

Table 2. PhD degrees per 100 undergraduate students All PhD awarding institutions in the country.

Country	PhD degrees per 100 students
Czech Republic	0,54
France	0,89
Germany	1,23
Hungary	1,99
Italy	0,25
Netherlands	0,50
Norway	0,46
Spain	0,46
Switzerland	2,67
UK	0,89

Over time, the number of PhD degrees increased in most institutions in our sample, both in absolute value and compared to the number of undergraduate students. However, this result has to be interpreted with some care because it could reflect to some extent the generalization of the PhD as access to academic careers rather than a real increase of research capacities. If combined with staff data, this information leads to the conclusion that, overall, research capacity increased in the sample of institutions examined here.

2.3. SUMMARY AND CONCLUSIONS

Data for the most recent years clearly show the coexistence of national patterns for some components and of institutional differentiation for others. Thus, the level of tuition fees is still essentially set at national level, even in countries like Italy and Spain where legally there is some room for differentiation. The major exception is the UK where the share of tuition fees varies quite substantially from institution to institution. Given that the UK is unique as the first European country to liberalize fees, one can hypothesize that differentiation will appear in the other European countries as well.

The UK is also exceptional in that it is the only country where the state is no longer the primary funder of higher education institutions (through general allocations) and where specialization is visible. Some institutions draw considerable funding from tuition fees and a small share of grants and contracts (consistent with an emphasis on education over research) while others display the inverse pattern with low revenues from student fees and high share of grants and contracts.

In the other countries, higher education institutions seem limited to increasing their revenues from grants and contracts when it comes to generating additional revenues. Differences in this respect are however quite large in all countries considered. Moreover, the data do display an (expected) correlation between the share of grants and contracts and the number of PhD degrees. This means that such funding is likely being used to increase research capacity vis-à-vis hiring additional PhD students.

The analysis of the evolution over time displays some interesting trends, even if the period (8 years) is considered short. Our data show that there has been no general decrease in the available resources (in constant prices and per student) over the period. The number of academic staff per student decreased for half of the institutions but increased for the rest,

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[5] In Spain contract funding can not be used for hiring permanent staff.

which is likely linked to a general increase in the number of PhD degrees granted per undergraduate student. These data lead to the hypothesis that there has been no general decrease of research intensity in European higher education institutions over the last decade, nor a shift towards education.

In addition, our data show a substantial rigidity in the resources relative to numbers of students: institutions with larger than average enrollment increases did not receive proportional funding increases. In contrast, those with decreasing numbers (as, generally, in Norway and Spain) kept a large part of their resources. In a setting where student fees are fixed and, in most countries, account for a limited part of revenues, trying to get more students does not seem to be a feasible revenue-generating strategy.

Finally, in all countries and for most institutions, changes in the composition of revenues have been rather limited. Though there has been some decrease in the share of government appropriations and an increase in grants and contracts, this shift has not substantially altered the distribution of institutions' funding pies.

To summarize, the data presents a much more differentiated picture between countries and between institutions and a less dramatic pattern of change in higher education funding than typically assumed. In real terms total funding increased between 1995 and 2003 and research capacity likely increased as well. Though in all countries there was a reduction of government allocations as a share of total revenues and a shift towards project funding, no country experienced more dramatic shifts than the United Kingdom did in the 1980s.

3. Institutions' perceptions about & strategies for coping with changing incomes

This section reviews the qualitative component of the CHINC project. It briefly reviews the methodology employed, main findings and potential implications of those findings in light of the study's broader mandate. In effect, the goal of this section is to fit the observations put forth by the respondents into the more general debate and scholarly literature on European academic research.

3.1. A BRIEF REVIEW OF THE QUALITATIVE COMPONENT'S METHODOLOGY

The questionnaire for the qualitative part of the study included 22 questions that were subdivided into five major components:

1. Research orientation and strategies
2. Information management
3. Trends
4. Policies
5. Future outlook

The project partners arranged and conducted interviews with relevant higher education personnel in their countries between June and September 2005. Where it was possible, interviews were arranged with institution managers and administrators in the highest possible research unit. This was done to ensure that whoever we talked to could provide an institution-wide view. The exact procedure taken by individual project partners varied. The standard or baseline approach was to contact potential interviewees, send them the survey in advance and then proceed to do either a face-to-face or telephone interview.

The broad scope of the CHINC project coupled with the diverse institution types we sought to characterize forced us to strike a delicate balance between desirability and feasibility. As a result our methodology, though conceptually sound, suffers from at least two important shortcomings. First the sample disproportionately favors institutions in smaller, wealthier countries at the expense of the larger and more reflective ones. Second, difficulty with identifying one common administrative and/or academic for the interview drove us to employ a loose

Examples on answers from the institutions to the question: "*Looking at the strategy's main objectives, what are the main means for achieving them?*"

1. University A, France: Attract best foreign talents thanks to a dedicated fund; offer of inter-university and multidisciplinary training; European doctoral school; "pôle de compétitivité" (the "pole de compétitivité" is a new gathering of research and development institutions (private and public) working towards new linked activity with funding support from the government).

2. University B, Germany: Strategic conferences (Klausur) of the "enhanced university rectorate" ("erweiterte Hochschulleitung"), which consists of president, vice-presidents, chancellor and deans of faculties.

3. University C, Netherlands: Appoint *lectors*. This is a special position (a kind of associate professor) around which a so-called knowledge circle is created that aims at stimulating knowledge linkages to SME, applied research, and incorporating entrepreneurship into the curriculum.

4. University D, Netherlands: Dedicated policies: e.g. faculty plans, focus & concentration in multi-disciplinary research centres, management-contracts between central board and faculties.

5. University E, Czech Republic: To get PhD students into research, a very good mean is our internal grant agency (1,5 mil CZK this year). Demand is higher than available funds. This year (2005) we increased the money for internal grants for students (50% up).

6. University F, Denmark: Control system (a management tool at all levels), including systematic collection of production data for research, external evaluations of departments, research centres and special research projects. Staff interviews at all levels concerning realized and planned research performance.

7. University G, Switzerland: We have a system of teaching load reduction for professors; the rectorate decides on allocation of means, based on scientific performance; for example for 50 weighted citations 1 hour reduction of teaching load is granted.

8. University H, Italy: Direct assistance in the preparation of proposals, in project reporting and project management.

9. University I, Netherlands: Creation of graduate schools (for post-graduate education), as well as creation of focus & mass in research (by means of identification of research themes and bundling of research areas).

structure where respondents were selected based more on their availability to participate and the project partners' unique networks relationships. In light of the differing institutional structures we examined, even within a single country the respondents' experience and familiarity with the type of questions asked varied significantly.

3.2. ISSUES, QUESTIONS AND ANSWERS

Overall, the findings from the qualitative part of the CHINC project are consistent with researchers' and policymakers' perceptions about the current and future state of the European Research Area. Most of the individuals that we interviewed recognize that while core government funding is likely to remain the dominant source of universities' research income, the portion of the funding pie is gradually declining and will continue to do so into the foreseeable future. That said, perhaps the most interesting find from this project is that perceptions about research incomes are not necessarily consistent with empirical observations. Most of our survey respondents believed that core government funding for institutions has decreased in the past ten years; an analysis of the available empirical data though would suggest that such funding has remained largely stable (in real terms).

Our findings suggest that higher education institutions' research portfolios have indeed changed since the early 1990s. On the input side, income from national research councils, private industry, the European Union and other national and international sources all have increased with varying degrees while government appropriations for research have remained fairly stable. On the output side, the responses point to growth in both interdisciplinary and applied research as well as commercialized research and, for some countries, patenting. This suggests that European higher education institutions are, as research on the topic suggests, becoming more tied to their industry stakeholders and conducting more research with an eye towards social relevance.

Perhaps the most salient aspects behind these changes are the forces that have created such a climate. The findings from the qualitative component of the study support the notion that changes in university incomes are tied to much broader changes in institutions' operating

> **Examples on answers from the institutions to the question:**
> *"Over the past 10 years did your institution introduce or modify existing incentives for generating external (i.e. competitive, third party, industry-based) research income for its faculties/departments/units?"*
>
> 1. University A, Switzerland: The "3:1 fund": for each CHF 3 received from external funds, the school adds 1 CHF for research.
>
> 2. University B, Switzerland: Reduction of teaching hours according to scientific performance is the most important incentive. Besides that the international rankings played an important role, as well as the international accreditations (EQUIS and AACSB).
>
> 3. University C, United Kingdom: The career structure for academics has been made much more flexible - incentives for doing research; sabbatical scheme; systemisation of staff management.
>
> 4. University D, Norway: Extra funding for researcher getting publications into top-ranking journals.
>
> 5. University E, Germany: The parameter "external funding" in the performance-oriented budget was increased from 7,5% to 10%.
>
> 6. University F, France: Carry out a 'cartography of competencies' of the units.
>
> 7. University G, France: Bonus-Qualité Recherche – BQR.
>
> 8. University H, Denmark: Wage bonus and/or increased time for research activities for some researchers.
>
> 9. University I, Czech Republic: The research teams keep a maximum of the grants. A small part is used for central activities or redistribution to other (small) weaker teams, which we need to support, but which are not so successful.

environments and the structural changes that have occurred as a result. Respondents believed that policy shifts at the national level, both from the government and from national research councils, have played a substantial role in shaping the current situation. In most cases the individuals we surveyed seem to believe that government policies have worked to the institutions' advantage either through more funding for post-graduate training (e.g., Germany) and investment (Czech Republic) or augmenting publicly-available funding for research (such

as the full-costing currently being put into place in the UK). In other cases, it has left the universities feeling abandoned by their patrons: the rapid expansion of the Czech research system in the 1990s was not accompanied by parallel increases in research funding and there are worries that the RAE is re-creating a dual system of teaching and research universities in the UK.

As the need to secure more external funding continues to gain importance, the competitive way in which it is allocated seems to be driving institutions to "profile" themselves to increase their likelihood of attracting such funding. The shifts respondents identified towards more interdisciplinary research offer the best example but the evidence can also be seen in the establishment of "centers for excellence," the merging of faculties and the creation of technology transfer or patenting offices. A perceived shift towards fewer permanent faculty positions and more temporary (contract-based) appointments is a practice that is much better suited to a dynamic and competitive funding environment than the traditional model, even if many scholars question whether the instability forces faculty members to abandon science for science's sake and to work more on projects that generate publications or commercially-useful results.

If we look to the internal financing mechanisms, it is evident that institutions are doing much to encourage not just more but higher quality research. Only approximately one-third of the respondents indicated that they used one of the more traditional funding approaches (i.e. historical, formula funding based on inputs or input-based negotiations). We found mixed (input- and output-based) funding models were the dominant mode of internal allocation and that a number of institutions, distributed quite evenly across the sample, relied on performance- and contract-based models. Moreover, all of the institutions in the surveyed countries have developed various incentive schemes to encourage external or competitively allocated income generation, especially allowing units to keep any earned income.

At one point during the interviews we asked respondents to identify what they believed to be the most important actions their institution has taken in the last 10 years with regards to research income, output, output quality, collaboration with private partners and research concentration in particular disciplines. The answers that were given arguably provide the most insight into the basic questions outlined in the CHINC project. First, the answers speak directly to how European higher education institutions have worked to change their research income portfolios while simultaneously maintaining or increasing output quality. Second, it is in many ways, an indirect representation of "best practices." The responses provided capture best the structural changes that have been the most successful, in the respondents' eyes, to achieving the goals addressed in the question.

In terms of increasing institution-wide research income what one mainly sees is significant

> **Examples of answers from the institutions to the question: "*In the past 10 years, what major changes have occurred in your institution's research activity and research training activities? Please indicate up to three major changes (e.g., adding, closing or merging research units or the creation of specialized interdisciplinary centres).*"**
>
> 1. University A, Hungary: Co-operative Research Centres have been formed. PhD students also participate in the research projects.
>
> 2. University B, Czech Republic: Institutionalisation of work teams (team and project-oriented research), getting the researchers together around the projects, regardless of their faculty or institute affiliations.
>
> 3. University C, Germany: Creation of new faculties (life sciences, business administration, sports science, computer science) and a central institute (medical technology) - all of them interdisciplinary.
>
> 4. University D, Italy: Department evaluations (self study and peer assessment) and a new financial system allowing the evaluation of the full cost of activities.
>
> 5. University E, Norway: First in the country to develop/implement a so-called "research school".
>
> 6. University F, Spain: Setting up our own measuring system of research activity.
>
> 7. University G, United Kingdom: New focus on selectivity in research (focusing on certain areas of strength for improvement in research).
>
> 8. University H, United Kingdom: The inter-disciplinary links between physical sciences and life sciences have been strengthened. In the Arts subjects, there has been the creation of many interdisciplinary research groups and centres.
>
> 9. University I, Netherlands: Creation of six spearhead research institutes.

institutional support, both strategically and logistically. The use of clear strategic targets (UK) and strategic plans (DK) are a good example of the former as are focusing on few specialized areas (NO) or making institutional decisions on which projects to pursue (HU). Logistically, it has been the creation of dedicated support structures (HU, I and UK) and the use of institutional funding to support activities (D, NO, CH and UK). Together both point to institution-level commitments to strengthen institutions' ability to compete more effectively for scarce competitively allocated funding. For securing non-government research income and collaborating more with private partners, similar patterns emerge. Many respondents cited the development of dedicated support infrastructure or the creation of an "atmosphere" that encourages individuals to seek out external funding. Particularly for industry-related issues, what one sees is a widespread establishment of technology transfer offices, the establishment of research centers and research parks and drawing industry leaders into universities' decision-making boards. For non-industry income, this includes support for grant writing, improving internal communication (e.g. helping researchers find opportunities) and establishing reward structures for individuals.

Many have raised concerns that the pressures to secure external funding or that tying academic advancement to individuals' research portfolios will drive faculty members to seek out "easy" projects or focus on quantity at the expense of quality. The responses, however, show that institutions go to great lengths to preserve or even increase research quality. Much of the work seems to be on the assessment side: explicitly evaluating research performance, using both internal and external evaluations and modifying assessment criteria. At the same time others seem to have taken a more incentive-based approach by rewarding the best performing groups with more funding (as respondents in the Netherlands and Spain indicated). These changes can all be seen as "internal" development features. The other main shift that is typical in more competitive input-markets (especially the United States) has been for institutions to invest in recruiting higher-quality staff.

3.3. SUMMARY AND CONCLUSIONS

Overall, the changes to European higher education institutions' research portfolios would suggest that marketization and diversification are progressively replacing Continental Europe's traditionally centralized model of distributing funding for university research. How is this likely to affect research in the coming years? What benefits may emerge? What costs will be incurred? What issues will it raise? Below we touch on four broad concerns based on the findings from the qualitative component of the CHINC project and attempt to tie them to the broader scholarly literature on the topics.

Institution specialization – The available evidence would suggest that specialization and concentration will be critical in the years ahead to institutions' abilities to attract more competitively allocated research funding. Consolidating resources and focusing on what one does best allows institutions to produce more research at a lower cost. This is no more than a classic economic example of realizing scale and scope economies. It does, however, raise questions about the types of higher education institutions that will emerge as a result.

As an institution's research becomes more specialized its academic offerings must also change in one of two ways: either by also becoming more consolidated or by maintaining diverse academic offerings and neglecting some fields at the expense of others. In the case of the former, specialization can jointly strengthen an institution's academic programs and research activities. On the other hand, Europe is dominated by public institutions and cutting down or shirking some programs at the expense of others is disconcerting. Specialized institutions force students to be more mobile, yet the available research shows that only a fraction of highly ambitious students are, for the most part, willing to take up post-secondary education far away from their parents' home (Jongbloed, *et al.*, 2004; Hoxby, 1997). In terms of research itself, one has to look no further than the United Kingdom to see the negative impact that strengthening

certain research programs has on weaker research programs in the same or even different institutions.

Internal restructuring – If one clearly discernable trend is in evidence then it is that European higher education institutions have entered a remarkable transformation phase. In an effort to embrace new stakeholders, be more responsive to external forces and to strengthen their fiscal foundations, universities are undergoing dramatic internal reorganizations through the merger of faculties, the creation of support offices and the establishment of inter-disciplinary research centers and institutes. The results from the qualitative study suggest that the move towards adopting or altering institutional structures is European-wide; no country-specific patterns emerge. In all likelihood these changes will create a system of institutions that is more flexible and more capable of responding to higher education institutions' increasingly unstable operating environment.

What kind of research? – As public funding becomes more competitive, scholars' worries that the need to secure new revenue streams will drive academic researchers towards more applied projects and less controversial research are not without warrant. The question is whether the balance currently being maintained or emerging is appropriate for the continent's needs. Though the European Union would like to see its share of industry funding for research increase substantially, at least two concrete obstacles remain: a historically poor relationship between industry and academe (caused mainly by the latter) and the fact that applied research grants tend to be smaller and of a shorter duration than basic funding. To the former, it is somewhat perverse that growing pressure on academic scientists to secure such funding is precisely what researchers argue have been the problems that have plagued industry/university partnerships (Cohen, *et al.*, 2002; Lee, 1996). To the latter, this form of funding introduces considerable instability into institutions that have long functioned under more stable funding conditions and will likely have a substantial impact on how higher education institutions evaluate the costs and benefits of pursuing some types of research over others.

Performance measurement and use – Academic scientists are increasingly being subjected to performance criterion and incentive schemes that are designed to enhance the quality and quantity of the research being done. In many ways, the efforts being adopted reflect the practices of American universities and this ought to help Europe better compete with its trans-Atlantic rivals. Yet it also raises a number of new concerns. Europe's academic scientists have long enjoyed an envious degree of job stability and autonomy to follow their own research agendas. Today that is changing as pressures to secure external funding force institutions to increasingly seek out self-sustaining faculty members. As funding grows tighter and performance measurements become more sophisticated, a career in academic research is likely to become more a series of performance-driven short-term appointments and based less on long-term tenured staff (Kaulisch & Salerno, 2005). How this will affect the historically strong social contracts between publicly-dominated higher education institutions and their respective states remains to be seen.

The findings from the qualitative component of the study raise several additional points. First, in some ways the "marketization" of European research has produced predictable results. Providers are specializing, merging and coordinating so as to better position themselves in the emerging European area. At the same time trans-national input markets, while still nascent, are also becoming more competitive and fluid as institutions realize how important talented researchers are to securing scarce funding. The second point is that despite policymakers' best efforts the European research enterprise is still, and will remain for the foreseeable future, a nationalistic endeavor. Universities find themselves restructuring to better compete in the loosely organized European Research Area but primarily operate under agendas that are still largely shaped by their respective states. While the chorus of voices in support of greater coordination between countries' national research councils is growing, a fractured system will remain as long as the funding is considered Dutch, Spanish or Estonian. The importance of such councils to higher education institutions' research activities is clearly evident in our findings and no country wants to see its taxpayer funding channeled to other countries while

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its historically prestigious universities become second-class citizens (Salerno, 2005). Finally, perceptions are not always a good fit with reality. European policymakers' concerns about brain-drain, reduced state funding and lower aggregate investment in research are real, but not so dire as to immediately threaten the continent's capacity for conducting world-class science. Our findings provide considerable evidence that states still provide strong financial support for their higher education sectors, institutions are better situated today than ever to compete in a dynamic environment and, most importantly, the same institutions are proactively implementing strategies to increase funding as well as maintain output quality and relevance.

4. Collecting information on higher education institutions

Higher education institutions are crucial to the European Research Area and the Lisbon strategy's ambitious goal: for Europe to be "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." To achieve this goal, the European Commission states that Europe *"… simply must have a first-class university system -- with universities recognized internationally as the best in the various fields of activities and areas in which they are involved"* (European Commission 2003).

Achieving this will depend on many factors and a host of coordinated actions at various levels that are beyond the scope of this study. However, without adequate information on the current status of the higher education institutions, the research and education systems they are embedded in and on the actions and strategies institutions themselves are pursuing, it will be difficult to develop the necessary policies.

Fortunately, in addition to the CHINC project, several actions have been launched the last several years that can contribute to collecting and organizing the required information:

- The *ERAWATCH project* launched by the European Commission/IPTS aims to provide a strategic intelligence service that supports evidence-based policy-making. One part of the project is to analyze recent evolutions in university-based research but focus on financing and networking trends.
- The PRIME Network of excellence is currently running four additional projects:
    - The *ENIP project* is exploring the available data and development of new indicators that enhance both the comparability of data across Europe and the interaction between the relevant actors. Within ENIP, ongoing projects are devoted to:
        - the development of indicators for higher education institutions
        - studies of developments within project funding
        - financial data from higher education institutions
    - The *ESTIP initiative* is attempting to build a European platform dedicated to "positioning indicators." Its role would be to fulfill functions similar those in the OECD's input-output model.
    - The *Aquameth project* is collecting micro-level data on individual universities for the purpose of conducting efficiency and productivity studies, as well as evaluation exercises.
    - The *Observatory of the European University* provides universities with tools adapted to the governance of research activities by elaborating and producing indicators for supporting universities' strategy and management processes.
- In 2005 the *European University Association* published a study on funding research and innovation for a sample of 39 institutions (Conraths & Smidt, 2005).
- The OECD-initiated project *Funding Systems and their effects on Higher Education Systems* seeks to investigate how funding systems, as seen by different stakeholders, influence the higher education institutions, their strategies and the impacts of the national funding systems upon higher education core tasks such as research and teaching.

These initiatives highlight both the importance and possibility of collecting information on European higher education institutions. Yet they also highlight the need for a coordinated data gathering and processing effort. Our experiences in the CHINC project reinforce the notion that there is pressing need to collect both quantitative and qualitative information on multiple levels. More specifically, any European-wide effort would benefit greatly from focusing on three pillars:

1. Information on national systems
2. Quantitative data and indicators
3. Qualitative information

In the next sections we assess each pillar based on the experience gained from the CHINC project, discuss problems encountered, explore several open issues and put forward a number of recommendations.

4.1. NATIONAL INFORMATION

The CHINC project involved a consortium of national correspondents. This made it feasible for the project to exploit available information on national systems. Project participants from each country created a national system report that identified the most important changes over the last 10 years and this background information proved useful for understanding and interpreting what emerged in later analyses.

In retrospect our decision to coordinate the efforts of national correspondents was highly beneficial and facilitated in many cases immediate access to a wealth of existing data. It also allowed us to cross-check our methodology as the partners routinely were able to spot points where data collection strategies could be misinterpreted in a particular national context. Hence data validation is key and we are uncertain how such an exercise could have taken place without so many country experts on hand. For a future larger scale data collection, considerable attention will need to be paid to data validation.

Thus we recommend establishing a European-wide system for collecting information and analyzing higher education institutions that is *built around a network of national centers of expertise*. In addition to regular and systematic collection of quantitative data, such centers should also systematically map national and institutional policy developments as well as opinions from representative stakeholders about their usefulness (see section 4.4 for suggestions on institutionalizing such a system).

4.2. QUANTITATIVE INDICATORS

The quantitative results generated by this project present a mixed finding. In one sense they are novel; this is one of the first times that data has been collected and analyzed for such a large sample of institutions across several countries over time. As shown in Chapter 2, this information leads to several interesting and unexpected conclusions about institutions' changes in funding levels and composition. At the same time, the effort positively demonstrates that it is feasible to collect data on individual institutions and create a rudimentary European-wide database. Such results can be credited to two elements: 1) defining a minimized set of core data that can be collected with reasonable effort, and 2) organizing the data collection procedure around national correspondents.

In another sense though, the number of data comparability and quality problems we encountered was remarkably high, which forced us to temper the implications of almost all of the findings. Perhaps most disturbing is that some data categories that are of great importance to both policymakers and higher education researchers simply cannot be collected at this point in time: in particular are capital costs, R&D expenditures and most output data, both for the academic and research side of institutions' operations. Finally, and not surprisingly, it was problematic to conduct cross-country analyses with the information we collected, owing to the substantial differences in data quality and quantity across countries.

Table 4 summarizes the main findings for the five categories of data collected during the CHINC project. Note that the identified problems are of variable order: some point to intrinsic differences in national systems (like the different treatment of PhD students) while others require a more in-depth validation of existing data (for example for financial data). Still others

address the development of data treatment practices to achieve better comparability or even require the development of new methodologies for data collection, as in the case of academic production.

Table 4. Data availability and problems by category

Category	Data availability	Main problems and open issues
Funding	Total funding and main subcategories are normally available for most HEI, in most cases also with time series.	• Total funding not available for France. • Data concerning subcategories are not always available and of sufficient quality (especially for private funds).
Expenditures	Total expenditures and repartition between personnel and functioning normally available.	• No usable data on capital costs and investments. • Lack of disaggregated data by subject domains urgently needed to take care of subject mix. • Total expenditures not available for France.
Personnel	Total personnel and some subcategories available for most HEI, but not always in FTE.	• Personnel categories are very difficult to compare between countries. • Treatment of PhD students different between countries.
Students and degrees	Most data are available without major problems.	There are some issues concerning definitions and counting (for example for student's numbers) which need to be assessed carefully.
Output	Limited data available. Only some countries have institution-level data on publications (ISI); data on other publications are scattered, while data on third-mission activities are of questionable quality.	• Availability and costs of ISI data for institution-level analysis. • Data on total academic output of HEI (especially concerning human and social sciences). • Practically no data on output of non-PhD awarding institutions.

The findings in the table above make a strong case for developing a platform of higher education data and indicators (at the institution level). This we see as a necessary investment for both research in this field and for policy analysis. In this regard the CHINC study's results are encouraging as they support such an activity's feasibility. This issue is closely related to the institutionalization of a European-wide information platform on higher education institutions; the long-term management, updating and quality assurance procedures behind the development of an indicators portfolio/information database requires a stable institutional structure.

However, before extending the sample we think that some investment is needed towards improving data quality and comparability. This does not necessarily mean collecting *better* data but checking more precisely the extent to which the comparability problems are affected by what is currently available. This is particularly salient for the financial data (income and expenditures), personnel data and that on student enrollments and degrees obtained. This activity should lead to the development of a set of methodologies and practices that will help resolve comparability problems, at least for case-by-case analyses.

In addition, some action is necessary for dealing with countries where data quality and availability is more problematic. This was particularly important for the CHINC project in the cases of France and Hungary, but also to some extent for Italy and Spain. Data collection in most countries will engender similar problems yet this should not discourage the use of incentives or development of strategies that seek to make data collection more uniform across Europe and up to a level that can facilitate analysis or inform relevant stakeholders.

Finally, it is possible to identify certain areas where improvement in data collection is a priority. One is securing information on capital the other is obtaining better information on academic production. Variations in national accounting procedures make achieving the former difficult (though some research conducted in the US has paid attention to this particular problem), though it may be worthwhile to conduct a small pilot study that develops simple

and uniform reporting practices. For academic production, widely-available publications information (such as that provided by ISI) is crucial given that it is the closest uniform metric for measuring research output that researchers have. Given the current push to construct "indicator baskets" (as is currently being done in Germany and United Kingdom) and not withstanding the many logistical problems from relying heavily on publication counts, researching the feasibility of developing a European-wide indicator basket of research outputs would be beneficial and well-received.

Recommendations

- Provide support for building a stable network tasked with collecting and managing institution-level data. This network should be responsible for developing common definitions, methodologies and data collection procedures in order to expand the sample.

- Launch exploratory exercises on funding data (especially on capital data) and on academic output indicators of whole HEI, in connection with the Observatory of European Universities and with ENIP with the aim of developing suitable methodologies for the collection of this kind of indicators.

4.3. COLLECTING QUALITATIVE INFORMATION ON EUROPEAN HIGHER EDUCATION INSTITUTIONS' RESEARCH PORTFOLIOS

The methodology behind the qualitative component of the CHINC project was designed to address two competing demands: 1) capturing as much institution-oriented contextual information about higher education institutions' research portfolios as possible to get behind the limited amount of quantitative data and 2) meeting serious logistical and financial constraints. While we were, by and large, pleased with the volume and quality of the information collected, the exercise was not without its difficulties. In this regard, an overall assessment of our approach might be that it was successful in providing what was necessary for achieving the CHINC project's objectives and limited in what it could have achieved. How then can the experience gained from this project inform future efforts to understand European higher education institutions' research portfolios and income generating strategies?

The strategy of surveying individuals' perceptions on a number of different yet integrated topics is a prudent one. While uniformly reported quantitative data is highly desirable for producing indicators and conducting statistical analyses, the fact remains that such information is simply not currently available. In this regard, interviewing well-informed individuals offers two important benefits. First, it allows researchers to understand why quantitative information gaps exist. We found, for example, that a large number of institutions had only recently established offices dedicated to collecting and analyzing such information. Second, it allows one to gain a better understanding of the complex structures and changes behind trends in the quantitative data. Again as an example, interviewees identified an array of what they believed to be major changes in their institutions' research activities over the past 10 years. Discovering through statistical analysis that a university has a radically different portfolio is important yet so too is knowing that the institution went through a consolidation phase, established a technology transfer office, invested in new interdisciplinary programs and recruited a number of high profile scientists. Where the goal is to gain a better understanding of something as complicated and nuanced as the academic research enterprise, contextual information like that gleaned from a qualitative study is unparalleled in its ability to inform for the purpose of designing effective policies.

Nevertheless, a number of drawbacks remain. Conducting face-to-face or telephone interviews may allow the researcher the flexibility to depart on relevant tangents, explore some topics in greater detail than others and draw meaning from the interviewees' non-verbal cues but it also

limits the number of individuals that can be surveyed. What is more, language and cultural differences mean that any large-scale study could not be done without a diverse team of international partners who are aware of the national public research system and the policies in place. We were fortunate to enough to be working in such an international partnership and, though difficult, in the end our goal of conducting 100+ interviews was accomplished. In retrospect, our target was perhaps overly ambitious given the time and financial constraints. From our standpoint it would have been more preferable to have interviewed multiple people at each institution. The questions we asked not only required detailed knowledge about multiple facets of a university's operations but also an understanding of those structures over time. It was clear from an analysis of the responses that in a good number of cases the interviewees indicated that they were unable to provide suitable answers.

A follow-up or future study on such a topic would also benefit greatly from a more detailed analysis of the type of questions used. To give several examples, at one point we asked respondents to characterize their institution's research ambitions on a scale ranging from "world-class research" to "primarily teaching oriented." For a large number of cases though, interviewees indicated that the responses varied by faculty (e.g. economics being world-class and engineering being regional). At the same time, with other open-ended questions the interviewees were first provided with examples to help clarify the question and focus the answers. In such cases though we found interviewees were often quick to suggest that our examples were reasonable answers to their own situation. The other major obstacle in developing the questionnaire was the balance between asking open-ended and closed questions. While the former gives the interviewee greater flexibility to go into depth or provide valuable contextual information, as a process it is time-consuming. The problem, of course, is that interviews must often be kept to reasonably short time periods (e.g., less than 45 minutes) and the types of people in the best position to answer questions about universities' research portfolios generally find it difficult to secure blocks of time for such activities. On the other hand, closed questions make it possible to secure much more information in the same time period and ensure that respondents provide specific the researchers with specific answers. The downside is that in some cases it becomes an exercise in putting square pegs into round holes; the answer fits but not very well. Even the inclusion of an "other" category in Likert-style questions does not always provide a useful avenue for escaping this trap. Again the question we asked about categorizing institutions' research ambitions offers a good example. Methodological problems like these are endemic to any qualitative study but a retrospective analysis of how they affected our specific work on European higher education institutions' research portfolios and capacities offers at least two solid suggestions for future research. One, striking the right balance between the open-ended and closed questions is crucial given the ethereal nature of the topic. Two, the ability to pilot the questionnaire and adjust its format accordingly would increase the likelihood of obtaining consistent and reliable responses across both institution types and different countries.

Thus, any future study that focuses on European research will have to strike a difficult balance between drawing on a representative sample and having the necessary resources to obtain the kind of in-depth information that is required. Yet it will also have to pay considerable attention to a number of temporal issues. We chose to look at a distinct 10-year time period based on various factors, though much weight was given to the likelihood of data being available, our desire to have enough observations to track any possible trends and what we perceived to be a fundamental shift in policy across many European countries in the early-1990s. While this time period served its purpose for the quantitative part of the project, in the end it complicated our qualitative analysis. Very few respondents fit what could be termed the "ideal profile" (e.g. over the time period was at one institution and held the same position); as a result, it was likely the case that responses and information about the last three to four years was more reliable than information related to the mid-1990s. What this would suggest is that future qualitative analyses would benefit greatly from focusing more on the recent past (up to four years) and on a less-diverse range of themes or topics.

Recommendations

- Provide the support to first run a pilot study of the questionnaire (or other survey instrument) in order to ensure that the responses are valid, reliable and offer information most appropriate for answering the main study's research questions.

- Conduct a small number of "institution-intensive" case studies that focus on aspects of universities' changing research incomes addressed in the qualitative questionnaire.

- Constrain the time period for a qualitative analysis to only the last two to four years.

- Give very careful consideration to the balance of open-ended and closed questions.

- Interview multiple individuals at each institution. This includes both university-wide administrators and heads of faculties/interdisciplinary research units.

4.4. HOW TO INSTITUTIONALIZE INFORMATION ON HIGHER EDUCATION INSTITUTIONS

Again we recommend the establishment of a European-wide system, built as a network of national centers of expertise, whose purpose should be data collection, monitoring and analysis. It would be, in effect, a valuable resource for policymakers and for establishing critical performance benchmarks. A first step towards such a system would be to expand the information collection to more countries and make it a European-wide network. Afterwards, considerable attention should be given to several logistical matters: defining variables and assuring their availability, developing routines for data collection and validation and creating policy-relevant indicators. In our opinion, any monitoring system will be as good as the quality of the data it can find and the indicators produced. At the start of this chapter, we identified several initiatives that are already working towards similar objectives. We believe the outcome of these initiatives, in conjunction with discussions initiated by European Commission, OECD and Eurostat to be an appropriate starting point for future efforts, but coordination must be strengthened. There is a risk that too many similar projects foster inefficiency. A discussion over how such coordination could be achieved should be given top priority.

The legitimacy of any network-based coordinated system will depend on transparent data collection and processing methods, as well as on the possibilities for all partners and stakeholders to use data for their own analysis. Such an effort is costly but so too is not having the information necessary for strengthening the research capacity of a region encompassing more than 4,000 higher education institutions and 400-million individuals.

Consolidated, transparent methodologies and dissemination routines will likely require an overarching coordinating institution that is well-connected politically. This will ensure that any analyses and advice is disseminated where it can be used most effectively. The suggestion for a European STI Indicators Platform (ESTIP) offers a useful starting point. The PRIME Network's position paper discusses several possible scenarios for a European indicators platform, of which several could very well meet such a mandate. Given that data must be collected from a wide variety of sources (national statistics offices, specialized research institutions, rectors conferences, the higher education institutions themselves), it is important that any model be legitimized by the majority of its participants and stakeholders.

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