4. DEVELOPING HIGHER EDUCATION

MAIN MESSAGES
Developing Higher Education

- About 19 million students were in 2006 enrolled in higher education in the EU, nearly 3 million or 18% more than in 2000.

- Nearly 4 million students in the EU graduated from higher education in 2006. This increase of 37% since 2000 is about twice that of the general student population (partly a result of the strong growth of second degrees caused by the introduction of the Bologna structure).

- 197 universities from 18 Member States were among the 500 leading universities of the world in 2007, according to the Shanghai university ranking. The top end of the ranking, however, remains dominated by the US.

- The EU spends 100 billion Euro less each year on higher education than the US.

- Public spending in higher education in the EU, at 1,13% of GDP, is close to US levels (1.32%) and well ahead of Japan (0.65%), but private spending on higher education in the EU, at 0.23% of GDP, is much higher in both Japan (0.76 of GDP) and the US (1.91%) .

- There are wide differences in public spending on higher education across the EU. In the Nordic countries it is over 2% of GDP, while in several southern and eastern European countries it is less than 1%.

- In 2006 there were about 200 000 more mathematics, science and technology graduates (+29%) than in 2000. This already exceeds the benchmark of a 15% increase for 2010. However, growth is even stronger in some major competitor countries. China had in 2006 already more than twice as many new tertiary mathematics, science and technology graduates as the EU.

- Although gender balance has been achieved for the field of mathematics and statistics, little progress has been made to reduce the overall imbalance in science and technology graduates. There continues to be a very low share of female graduates in engineering, manufacturing, construction and computing. However, women predominate in life sciences.

- 1.7 million students in the EU have foreign citizenship, twice the figure of 2000, the great majority of which are European. The share of students with a foreign citizenship increased by 4 percentage points since 2000.

- Over 600 000 EU students now study abroad, an increase of about 50% compared to 2000. ¾ of these study in another EU country.

- About 1.7 million students have taken part in the Erasmus mobility scheme since it started in 1987. Participation in Erasmus continues to increase, currently at 3.2% a year.

One important instrument with which the EU complements the work of Member States on higher education is Erasmus, which supports and encourages Europe-wide mobility of students and teachers. Erasmus celebrated its 20th year in 2007. It facilitates the recognition of studies abroad by supporting several initiatives, including the European Credit Transfer System (ECTS), the Diploma Supplement and the network of National Academic Recognition Information Centres (NARIC).

In 1999 ministers from 29 European countries signed the Bologna Declaration (today 46 countries are participating in this process), with the aim of establishing a European area of higher education by 2010.[29]

The growing attention given to higher education is reflected in a series of Commission Communications in recent years on:

- the role of universities in the Europe of knowledge (June 2004) (European Commission, 2003a);
- mobilising the brainpower of Europe: (April 2005) (European Commission, 2005a);
- delivering on the modernisation agenda for universities (May 2006) (European Commission, 2006c);

EU Ministers confirmed their commitment to modernising universities in the Council Resolution on modernising universities for Europe's competitiveness in a global knowledge economy of 23 November 2007.[30]

In addition a Communication on the EIT was adopted:

- the European Institute of Technology: further steps for its creation (June 2006) (European Commission, 2006d).

The European Institute of Technology (EIT) is a new flagship project of the Commission which aims at reinforcing the innovation capacity of Member States and the Community. It addresses several issues already highlighted in the modernisation agenda, notably the fragmentation of the European higher education and research system, the lack of excellence in certain areas and the low level of involvement of business in education and research. It is expected to boost Europe's innovation capacity by supporting full integration of the knowledge triangle (innovation, research and education) and pooling resources from universities, research organisations and business partners. While the EIT is not meant to address issues exclusive to higher education, the EIT's governance, working methods and relationship with business are expected to inspire change for the better throughout Europe.

There are currently several quantitative EU objectives relating to higher education:

- *The benchmark of an increase in the number of mathematics, science and technology graduates by at least 15% by 2010 (compared with 2000) while at the same time reducing the gender imbalance (European Council, 2003a).*

- *The objective of investing 2% of GDP in higher education (currently 1.3%), put forward by the Commission. (European Commission, 2006c).*

- *The goal of 3 million Erasmus students by 2012 (Decision of November 2006 on an action programme in the field of lifelong learning) (European Council, 2006c).*

The Barcelona objective of spending 3% of GDP on research and development by 2010 has implications for higher education, since about 22% of R&D spending in Europe goes into university-based research. In 2006 R&D spending had reached 1.84%.

In March 2008 the European Council called for the removal of barriers to the free movement of knowledge by creating a fifth freedom based on

-Enhancing the cross-border mobility of researchers, as well as students, scientists, and university teaching staff

-making the labour market for European researchers more open and competitive, providing better career structures, transparency and family-friendliness,

-further implementing higher education reforms (European Council, 2008a, p.5).

The first sub chapter looks at quality at institutional level, while the next three subchapters analyses the core indicator on monitoring progress of higher education reforms by looking into graduates of higher education as wells financing of higher education and student mobility.

4.1 Quality of higher education institutions

4.1.1 Two international university rankings

The quality of higher education institutions is a permanent concern for education policies. The Council Recommendation 98/561/EC of 24 September 1998 on European cooperation in quality assurance in higher education (European Council, 2006d) has led to the creation of the European Network (now Association) for Quality Assurance in Higher Education (ENQA) in 2000. Quality assurance was also among the action lines of the Bologna process launched in 1999. In 2005, Bologna Ministers meeting in Bergen, Norway, adopted the European Standards and Guidelines for Quality Assurance in the European Higher Education Area, which provided the basis, together with a new Recommendation, of Council and Parliament (European Council, 2006d), for the establishment of European Quality Assurance Register in Higher Education (EQAR) in March 2008.

At the same time international rankings have evolved in recent years, receiving growing media attention.
There are currently two worldwide university rankings: the *Academic Ranking of World Universities* (ARWU) from Shanghai's Jiao Tong University, released for the first time in 2003 (latest ranking all areas: August 2007, by subject field: February 2008) and the World University Ranking (WUR) from the Times Higher Education Supplement (THES), first released in 2004 (latest ranking: autumn 2007).

In the *Academic Ranking of World Universities* institutions are ranked on their academic and research performance, based on the number of Nobel prize winners, highly cited researchers, articles published in Nature and Science, articles in the expanded Science Citation Index (SCI) and the Social Science Citation Index (SSCI), plus a composite indicator of academic performance weighted by the size of the institution.[31] In the THES *World University Ranking (WUR)*, the opinion of scientists and international employers plays a crucial role. Around 5,101 researchers and employers are asked to indicate the best universities. This "peer review" counts for 50% in the total score of each university. In addition, the following other criteria are applied: research impact in terms of citations per faculty member, staff/student ratio, percentage of students and staff recruited internationally. Both the ARWU and WUR assessments of research performance consider only academic research output (i.e. scientific articles and other academic publications covered in the SCI, SSCI and ESI). This means, in particular, that, regardless of the correctness of either ranking of academic research performance, both ignore any output of research activities other than publications (including all commercial output, such as patents, and all non-commercial non-academic output, such as advice to policy-makers).

Table 4.1 shows the performance of countries in these two international university rankings, focusing more specifically on the Shanghai ranking. In 2007, according to the ARWU, EU-27 had 197 of the top 500 universities, while 166 were in the United States and 32 in Japan. Germany and the United Kingdom had the highest numbers of top institutions in Europe. Out of the new Member States only Poland, Hungary, Czech Republic and Slovenia have universities in the top 500. Considering the number of relevant institutions, the Netherlands, which has only 13 comprehensive universities but 12 institutions on the list, Sweden (11 out of 17) and Denmark (4 out of 9) perform particularly well. Europe has a solid base of medium to good quality universities and a higher share of its 4 000 higher education institutions (which include around 700 universities[32]) in the top 500 than the USA (in 2005 the USA had 4 387 higher education institutions, of which 413 awarded doctorates).[33] This picture is confirmed if the number of universities in the top 500 is related to the number of tertiary students (as shown in table 4.1). The EU has slightly more top 500 universities per 100 000 students than the United States and Japan. Denmark, Austria, Sweden and the Netherlands perform particularly well on this point. (See table 4.1).

However, if only the top 200 or top 100 universities are considered, the performance of the European higher education system lags behind the United States. Out of the top 100 universities, 54 are located in the United States and only 29 in the EU. The USA leads especially in terms of institutions at the very top: it has 17 of the ARWU top 20 universities. Top of the list comes Harvard University, a private institution, which had endowment assets of $ 25 billion in 2005, making it the richest university in the world. Stanford University in California (endowment assets in 2005: $12 billion) is ranked third.

The EU has only two institutions in the top 20: Cambridge, ranked fourth, and Oxford, ranked

tenth. Japan has one (Tokyo University, ranked 20th).

Table 4.1: Results of two university rankings, 2007 (ARWU and THES)

	Academic Ranking of World Universities (ARWU)			World University Ranking (THES)
	Number of universities in the top 500	Number of universities in the top 500 per 100 000 terti. students	Number of univers. in the top 100	Number of universities in the top 100
EU-27	197	1.05	29	34
Belgium	7	1.77	0	1
Bulgaria	0	0	0	0
Czech Rep.	1	0.30	0	0
Denmark	4	1.75	1	1
Germany	41	1.79	6	3
Estonia	0	0.00	0	0
Ireland	3	1.61	0	1
Greece	2	0.31	0	0
Spain	9	0.50	0	0
France	23	1.04	4	2
Italy	23	1.13	0	0
Cyprus	0	0	0	0
Latvia	0	0	0	0
Lithuania	0	0	0	0
Luxemb.	0	0	0	0
Hungary	2	0.46	0	0
Malta	0	0	0	0
Netherlands	12	2.07	2	4
Austria	7	2.77	0	1
Poland	2	0.09	0	0
Portugal	2	0.54	0	0
Romania	0	0	0	0
Slovenia	1	0.87	0	0
Slovakia	0	0	0	0
Finland	5	1.62	1	1
Sweden	11	2.60	4	1
United K.	42	1.80	11	19
Croatia	0	0	0	0
FYR Maced	0	0	0	0
Turkey	1	0.04	0	0
Iceland	0	0	0	0
Liechtenst.	0	0	0	0
Norway	4	1.86	1	0
Japan	32	0.78	6	4
USA	166	0.95	54	37
China	25	0.11	0	3
India	2	0.02	0	0
Russia	2	0.02	1	0

Data source: http://www.arwu.org/ http://www.thes.co.uk/

Additional note: The number of students enrolled refers to 2006, Source: UNESCO, Eurostat.

The ARWU ranking by broad subject field (see table 4.2) reveals that in 2008, in medicine and natural sciences the EU takes similar shares of the top 100 or so institutions, but its share is lower in engineering and social science.

Table 4.2: Ranking of world universities by broad subject fields (ARWU), 2007

	Number of universities in the:				
	Top 106 ENG	Top 104 SOC	Top 106 LIFE	Top 108 MED	Top 110 SCI
EU-27	22	17	26	32	30
Japan	7	1	3	2	7
USA	48	72	62	62	60
Australia	4	3	4	3	1
Canada	6	6	5	6	2
China	9	1	0	0	0
India	1	0	0	0	0
Russia	0	0	0	0	1

Data source: University of Shanghai, http://ed.sjtu.edu.cn/ARWU-FIELD.htm

Additional notes :
SCI: Natural Sciences and Mathematics.
ENG: Engineering/Technology and Computer Sciences.
LIFE: Life and Agriculture Science.
SOC: Social Sciences
MED: Clinical Medicine and Pharmacy

4.1.2 Limits of existing rankings

There are considerable differences between the ARWU ranking and the *WUR* ranking (see Chart 4.1 in appendix). The United States hosts only 57 of the top 200 universities in the *WUR* ranking compared with 88 in the ARWU ranking. There are even greater differences in terms of specific institutions. For instance, the university of Oslo ranks 69th in the ARWU ranking but 188th in the *WUR* ranking.

University rankings apply a wide range of criteria for measuring excellence. There is still no clear consensus about the indicators that should be used to measure the "quality" of HEIs. Quality of teaching is not taken into account in the ARWU ranking and the assessment of research activities focuses mostly on academic research output.[34] Social sciences and humanities are at a comparative disadvantage as academic research performance is measured bibliometrically. The bibliometric methods used are often not up to state-of-the-art standards in bibliometric practice (Van Raan, A.J.F., 2005 and European Commission, 2007b, Section 3.3.2 of the annex). The weight assigned to each indicator is arbitrary (see Table A 4-1 in annex). For all these reasons, caution is needed with interpretation of these results.

In response to these critics, the Centre for Higher Education Development (CHE) offers an alternative to the two worldwide rankings. Indeed, the CHE provides an assessment of German-speaking universities in Germany, Austria and Switzerland, which takes account of the diversity in terms of languages, subject areas, profiles,

student services, research and teaching quality of the institutions.[35] The CHE ranking does not (i) rank institutions, but rather departments, (ii) weight or aggregate individual indicator scores. Moreover, programmes are not listed in a numerical order but placed in 3 categories (top, intermediate, and bottom). [36]

In addition, in May 2006 the International Ranking Expert Group (IREG) established the *Berlin principles* on quality and good practice in HEI ranking. The Berlin principles consist of 16 descriptive principles and symbolize the beginning of a system of evaluation of ranking indicators.

In the long term the OECD project to set up a PISA type skills assessment for higher education students (a feasibility study on this is being carried out in 2008) will provide additional material for assessing the quality of output of universities as regards teaching.

Ranking activities should furthermore consider that there is a variety of types of higher education institutions. The European Commission currently has a a research project on the typology of higher education institutions.

Some researchers have shown that spending on higher education correlates with the incidence of top ranking universities. The impact is even bigger if there is a certain level of autonomy for institutions.

4. 2 Investment in higher education

Rising participation rates and hence a growing number of students in tertiary education and the goal of a higher quality of institutions imply a need for a proper funding of higher education. The Commission has proposed the goal of investing 2% of GDP (current level: 1.3%) in higher education (public and private combined).

Table 4.3 shows public expenditure on tertiary education institutions as a percentage of GDP in 2004 (for all activities, including both education and research). Total public investment in higher education in 2004 was around 1.13% of GDP in EU-27. In Denmark, Sweden and Finland total public spending alone already surpasses the goal proposed by the Commission of investing 2% of GDP (from all sources) in higher education. On the other hand the share is below 0.8%% in Italy, Latvia, Malta and Romania.

Spending on higher education is more strongly affected by participation rates than compulsory education (where all pupils of a cohort participate in education, while in tertiary there are strong differences in the shares of young people participating). Public spending on higher education, as a percentage of GDP, in the EU increased by 0.08 percentage points between 2001 and 2004. Total public expenditure on higher education as a percentage of GDP increased in 12 EU countries while decreasing in 13. The biggest increases were in Greece and Cyprus.

Table 4.3: Public expenditure on tertiary education as a percentage of GDP (2001, 2004)

Country	Public		Of which direct public spending	Of which on R&D In % of direct spending
	2001	2004	2004	2004
EU-27	1.05	1.13	0.95	
Belgium	1.34	1.29	1.09	30.1
Bulgaria	0.82	0.81	0.72	3.0
Czech Republic	0.79	0.95	0.89	17.5
Denmark	2.71	2.53	1.75	26.1
Germany	1.10	1.16	0.95	36.2
Estonia	1.03	0.88	0.87	0
Ireland	1.22	1.11	0.94	29.7
Greece	1.17	1.46	1.26	17.9
Spain	0.97	0.97	0.90	:
France	0.99	1.21	1.12	34.5
Italy	0.80	0.78	0.65	55.8
Cyprus	1.14	1.48	1.09	12.5
Latvia	0.89	0.68	0.58	20.5
Lithuania	1.34	1.06	0.88	:
Luxembourg	:	:	:	:
Hungary	1.08	1.02	0.86	20.5
Malta	0.88	0.55	0.23	0.0
Netherlands	1.27	1.35	0.98	35.1
Austria	1.35	1.42	1.14	33.4
Poland	1.04	1.15	1.13	15.8
Portugal	1.03	0.84	0.79	:
Romania	0.79	0.70	0.65	:
Slovenia	1.45	1.35	1.01	15.3
Slovakia	0.82	0.99	0.88	9.7
Finland	1.99	2.07	1.71	33.4
Sweden	2.03	2.09	1.47	43.4
UK	0.81	1.02	0.77	17.8
Croatia	:	0.82	0.78	:
FYR Macedonia	:	:	:	:
Turkey	1.17	:	0.91	:
Iceland	1.08	1.41	1.08	:
Norway	1.85	2.43	1.42	26.4
United States	1.48	1.32	0.54	:
Japan	0.55	0.65	1.05	:

Source: Eurostat (UOE data collection). Spending on the tertiary level includes R&D spending at universities.

Additional notes:
Direct public expenditure does not include transfers to private entities. If public and private spending are added up, it is preferable to use direct public expenditure (instead of total expenditure) to avoid double-counting.
For more country specific notes see: http://epp.eurostat.ec.europa.eu/portal/page?_pageid=0,1136184,045572595&_dad=portal&_schema=PORTAL

Public investment accounts for more than 85% of the amount spent on tertiary education institutions in Europe. Cyprus and Latvia are the two EU-27countries with the lowest share of public funding: up to 60% of the amount invested in higher education institutions there comes from private sources. Conversely, in Denmark, Greece, Malta and Finland higher education institutions are almost entirely funded by public resources.

Table 4.4: Private and total expenditure on tertiary education as a percentage of GDP

Country	Private payments to educational institutions	Household payments	Total private	Total private plus direct public
	2004	2004	2004	2004
EU-27	0.23	0.11	0.35	1.30
Belgium	0.12	0.17	0.28	1.37
Bulgaria	0.51	0.26	0.77	1.49
Czech Republic	0.16	0.11	0.26	1.15
Denmark	0.06	0.76	0.82	2.57
Germany	0.15	0.05	0.19	1.14
Estonia	:	:	:	:
Ireland	0.20	:	:	0.94
Greece	0.03	0.05	0.08	1.34
Spain	0.29	:	:	1.19
France	0.21	0.08	0.29	1.41
Italy	0.28	0.14	0.42	1.07
Cyprus	1.19	0.14	1.33	2.42
Latvia	0.67	0.40	1.07	1.65
Lithuania	0.46	:	:	1.38
Luxembourg	:	:	:	:
Hungary	0.23	:	:	1.09
Malta	0.02	:	:	0.25
Netherlands	0.29	0.07	0.35	1.33
Austria	0.08	:	:	1.22
Poland	0.42	0.06	0.48	1.61
Portugal	0.13	:	:	0.92
Romania	:	:	:	:
Slovenia	0.33	:	:	1.34
Slovakia	0.20	0.27	0.48	1.08
Finland	0.07	:	:	1.78
Sweden	0.19	:	:	1.66
UK	0.33	0.17	0.50	1.27
Croatia	:	:	:	:
FYR Macedonia	:	:	:	:
Turkey	0.10	:	:	:
Iceland	0.11	:	:	1.19
Norway	:	:	:	:
United States	1.91	:	:	2.45
Japan	0.76	0.04	0.80	1.85

Source: Eurostat (UOE)
Additional notes:
ISCED 5-6: tertiary education.
Direct public expenditure does not include transfers to private entities. If public and private spending are added up, it is preferable to use direct public expenditure (instead of total expenditure) to avoid double-counting. Data for Poland combine ISCED levels 1 and 2 and ISCED levels 3 and 4.
For more country specific notes see: http://epp.eurostat.ec.europa.eu/portal/page?_pageid=0,1136184,045572595&_dad=portal&_schema=PORTAL

Member States show great differences in the share of public spending on higher education going to research and development. Those Member States that show high overall levels of R&D spending show also high shares of R&D in investment on higher education. The large Member States and the Nordic countries often show R&D shares of above 30%.

While public investment in tertiary-level education in EU-27 is only slightly below the level in the USA it is nearly twice as high as in Japan. However, private investment in higher education is much higher in both the USA and Japan. As a result, total investment on higher education institutions in Europe (for all activities, including both education and research) is far below the level in the United States (245%).

4.3 Graduates in higher education

The emerging knowledge based society requires a high supply of highly skilled people. High private returns to tertiary education evidenced by high wage levels and low graduate unemployment rates for tertiary graduates as a whole show that there is still a strong demand for tertiary graduates (especially in the field of science and engineering, but also in other fields like languages and economics) in the economy.

It is thus not surprising that **higher education graduates** has been identified by the Council Conclusions of May 2007 as a field to be covered by core indicators for measuring progress in education and training.

Whilst analysing available Eurostat statistics on graduates, it should be noted that the total number of graduates and the growth rates double count graduates at various degree levels and also include the impact of the introduction of short-study cycles (if only first-degree graduates were considered the compound growth rate for 2000-2006 would be a few percentage points lower). Double-counting of graduates has already been a problem before the introduction of Bologna in some countries because of the specific features of the educational system. With Bologna double counting will be more systematic and statistics become more comparable. Since both first, second and third degrees are included (the second degrees currently account for about 20% of graduates, new PhDs for 2%), the data on graduates cover the total number of graduates during the year concerned, not the number of first-time graduates.

General student population trends

The student-age population has declined slightly in the recent past (-1.4% between 2000 and 2006),

with large differences in trends between Member States. In 2006 about 32 million people in the EU (49% female and 51% male) were between 20 and 24 years old, the typical tertiary student age bracket.

Table 4.5: Tertiary students (2000-2006)

	Number of tertiary students (in 1000)			Growth per year
	2000	2005	2006	2000-06
EU-27	**15920**	**18530**	**18783**	**2.8**
Belgium	356	390	394	1.7
Bulgaria	261	238	244	-1.2
Czech Republic	254	336	337	4.9
Denmark	189	232	229	3.2
Germany	2055	2269	2290	1.8
Estonia	53.6	67.8	68,3	4.1
Ireland	161	187	186	2.5
Greece	422	647	653	7.5
Spain	1829	1809	1789	-0.4
France	2015	2187	2201	1.5
Italy	1770	2015	2029	2.3
Cyprus	10.4	20.1	20,6	12.1
Latvia	91	131	131	6.2
Lithuania	122	195.4	199	8.5
Luxembourg	2.4	:	2,7	2.0
Hungary	307	436	439	6.1
Malta	6.3	9.4	8.9	8.3
Netherlands	488	565	580	2.9
Austria	261	244	253	-0.5
Poland	1580	2118	2146	5.2
Portugal	374	381	367	-0.3
Romania	453	739	835	10.7
Slovenia	84	112	115	5.4
Slovakia	136	181	198	6.5
Finland	270	306	309	2.3
Sweden	347	427	423	3.3
United Kingdom	2024	2288	2336	2.5
Croatia	:	135	137	:
FYR Macedonia	36.9	49.4	48,4	:
Turkey	1015	2106	2343	15.0
Iceland	9.7	15.2	15,7	8.3
Liechtenstein	0.5	0.5	0,6	:
Norway	191	214	215	2.0

Source: Eurostat (UOE)
Number of students = total number of full-time and part-time students.
DE, SI: data exclude ISCED level 6. 2000: RO: Data exclude ISCED level 6; MK: Data exclude ISCED level 5A second degrees and ISCED level 6; BE: Data exclude independent private institutions and German-speaking community; CY, LU, LI: most students study abroad and are therefore not included. MT, UK: growth for 2000-2005

Many Member States reported an increase over this period, but southern European countries (where birth rates dropped in the 1980s) and some of the new Member States recorded a decrease.

Southern European countries and many new Member States (where the number of births dropped sharply after 1989) will see a further decline in their student-age population up to 2010. Despite the slight decline in the number of young people in the EU, the increase in the tertiary education participation rate and in the number of students from outside Europe studying in the EU (currently nearly 0.8 million) led to growth of 17.8% in the number of tertiary students in the EU over the period 2000-2006 or, on average, 2.8% per year. In 2006 the number of students increased by 1.2%, less than in previous years, to 18.7 million (of whom 55% were female). In 2005 there were 4.1 million new entrants to tertiary studies in the EU, compared with 3.7 million in 2000 and with a one year cohort in the student-age bracket of about 6.4 million.

4.3.1 Higher education graduates: Core indicators

The number of tertiary graduates has increased in the EU 27 since 2000 by 37% or 5.4% per year and hence nearly twice as fast as the general student population.

Table 4.6: Tertiary graduates (2000-2006)

	Number of tertiary graduates (in 1000)			Growth per year
	2000	2005	2006	2000-06
EU-27	**2873.4**	**3753.5**	**3938.5**	**5.4**
Belgium	68.2	79.6	81.5	3.0
Bulgaria	46.7	46.0	45.4	-0.5
Czech Republic	38.4	55.1	69.3	10.3
Denmark	39.0	49.7	47.5	3.3
Germany	302.1	343.9	415.3	5.4
Estonia	7.7	11.8	11.5	6.9
Ireland	42.0	59.7	59.2	5.9
Greece	:	59.9	:	:
Spain	260.2	288.2	286.0	1.6
France	508.2	664.7	643.6	4.0
Italy	202.3	297.6	279.5	6.6
Cyprus	2.8	3.7	3.9	5.7
Latvia	15.3	26.1	26.4	9.5
Lithuania	25.2	41.5	43.3	9.4
Luxembourg	:	:	:	:
Hungary	59.9	73.7	69.8	2.6
Malta	2.0	2.7	2.7	6.2
Netherlands	76.9	106.7	117.4	16.5
Austria	25.0	32.9	34.8	5.7
Poland	350.0	501.4	504.1	6.3
Portugal	54.3	70.0	71.8	4.8
Romania	67.9	156.6	174.8	17.1
Slovenia	11.5	15.8	17.1	6.8
Slovakia	22.7	36.3	40.2	10.0
Finland	36.1	39.3	40.6	2.0
Sweden	42.4	57.6	60.8	6.2
United Kingdom	504.1	633.0	640.2	3.9
Croatia	:	19.5	20.7	:
FYR Macedonia	3.9	5.7	6.5	8.9
Turkey	190.1	271.8	373.4	11.9
Iceland	1.8	2.9	3.4	11.2
Liechtenstein	:	0.13	0.13	:
Norway	29.9	31.9	33.5	1.9

Source: Eurostat (UOE)

One of the reasons for this is the Bologna Process with a higher share of students taking second degrees. In the field of MST for example, the number of second degree graduates from academic programmes (ISCED 5 A) has more than doubled since 2000 to reach about 133 000 in 2005, while the number of first degrees in this period grew only by 16%.

As regards the overall number of graduates growth was particularly strong (more than 10% per year) in the Czech Republic, The Netherlands, Romania and Slovakia.

The number of tertiary graduates per 1000 young people aged 20-29 has increased in the EU by about 30% in the period 2000-2005 to reach about 56 today. Countries with a high number of graduates per 1000 young people (> 80) include Ireland, Lithuania and the UK.

Table 4.7: Tertiary graduates in third countries

	Students (1000)		Graduates (1000)		Growth per year, %
	2000	2005	2000	2005	2000-05
Belarus	460	529	77.6	102.0	5.6
Moldova	:	119	16.9	16.1	-1.0
Russia	8020	9 020	1190.6	1813.3	8.8
Ukraine	2130	2 605	424.6	470.8	2.1
Armenia	:	87	11.4	12.0	1.0
Azerbaijan	:	129	24.8	31.6	5.0
Georgia	:	174	21.4	24.0	2.3
Algeria	:	717	:	91.8	:
Morocco	276	367	27.3	48.2	12.0
Tunisia	180	315	19.6	28.6	7.9
Libya	290	375	:	:	:
Egypt	:	2 495	342.3	:	:
Lebanon	:	166	14.4	25.7	12.3
Palest.	:	127	11.6	12.6	1.7
Israel	256	311	62.4	76.7	4.2
Australia	845	1 015	168.9	250.5	8.2
Canada	1 221	1 327	225.1	:	:
Korea	2 838	3 210	493.0	608.0	4.3
India	9 404	11 777	:	:	:
China	7 364	21 336	1776	2400	6.2
Mexico	1 963	2385	299.1	380.4	4.9
Brazil	2 781	4 275	348.0	564.0	10.1
USA	13202	17488	2151.0	2639.0	3.5
Japan	3982	4085	1081.4	1067.9	-0.2
EU-27	15 920	18 530	2873.4	3753.5	5.5
World (Mio)	103	137.9	:	:	:

Data source: Eurostat, UNESCO, data on graduates: China: data for 2006 instead 2005 and ISCED 5A only, Ukraine, Armenia: 2001 instead 2000, Egypt 2002 instead of 2000, Canada: 1999 instead 2000, Algeria 2004 instead 2005

The comparison with other countries shows an even stronger growth in graduates in emerging economies like Russia, China and Brazil. This is partly a result of a strong growth in the tertiary student population.

The world tertiary student population has grown by a third since 2000 to reach 138 million in 2005. Since 1950 (6.5 million, of which 40% in the US, 1900: only 0.5 million world wide, 1960: 12.1 million, 1970: 28.1 million, 1980: 51 million, 1990: 68.6 million) it has grown by a factor of 20. Growth has been particularly strong in China, where the number of tertiary students has tripled since 2000 (in 1950 China had only 120 000) to reach 23.4 million in 2006. China now has more students than the EU or North America and the four BRIC countries (Brazil, Russia, China, India) have more than the EU, North America and Japan combined. Today developing and emerging minorities represent the majority of tertiary students worldwide.

Table 4.8: Tertiary graduates by ISCED level, 2000-05

	Number of tertiary graduates Per 1000 population aged 20-29/25-34			
	ISCED 5 and 6 (/population 20-29)		ISCED 6 only (/population 25-34)	
	2000	2005	2000	2005
EU-27	**43e**	**56e**	**1.1**	**1.3**
Belgium	51.4	61.4	0.8	1.2
Bulgaria	38.1	40.9	0.3	0.5
Czech Republic	22.4	37.0	0.6	1.1
Denmark	54.0	77.9	1.0	1.3
Germany	31.0	35.7	2.1	2.6
Estonia	34.0	60.0	0.6	0.7
Ireland	70.4	86.9	0.9	1.2
Greece	:	37.1	:	0.7
Spain	39.5	43.8	0.9	0.9
France	64.3	:	1.2	1.2
Italy	24.8	41.6	0.4	:
Cyprus	28.6	30.9	0.1	0.0
Latvia	46.7	78.2	0.1	0.4
Lithuania	51.8	86.7	0.9	0.7
Luxembourg	12.1	:	:	:
Hungary	37.5	48.1	0.5	0.7
Malta	36.9	45.3	0.1	0.1
Netherlands	36.1	54.4	1.0	1.3
Austria	24.1	31.9	1.4	2.0
Poland	58.1	77. 8	:	1.0
Portugal	30.5	45.1	1.6	2.5
Romania	19.4	45.8	:	1.1
Slovenia	39.0	53.6	1.0	1.2
Slovakia	25.4	39.4	0.6	1.2
Finland	56.3	58.1	2.7	3.1
Sweden	38.0	53.9	2.5	2.4
United Kingdom	66.4	83.5	1.3	2.0
Croatia	:	31.6	:	0.6
FYR Macedonia	12.2	17.7	0.1	0.3
Turkey	14.7	20.3	0.2	0.2
Iceland	42.7	68.4	0.0	0.3
Liechtenstein	:	30.0	:	0.8
Norway	48.9	56.6	1.0	1.3

Data source: Eurostat (UOE)
For more country specific notes see:
http://epp.eurostat.ec.europa.eu/portal/page?_pageid=0,1136184,0_45572595&_dad=portal&_schema=PORTAL

However, the EU in 2005 still had over 1 million more tertiary graduates than either the US or China. Given the strong growth in student numbers China might, however, overtake the EU in the coming years to become world's leading producer of tertiary graduates (China already leads in terms of MST graduates). Russia, Japan and India are other countries that produce more than 1 million graduates per year. Unfortunately for India precise data are lacking, but it is believed to produce around 2 million tertiary graduates per year.

The number of tertiary graduates is also growing quickly in North African and Middle East countries. Though in absolute terms, number sin these countries are still small. Growth is less strong in neighbouring countries to the east of the EU (except Russia), partly a result of demographic trends with a shrinking cohort size and of emigration.

Table 4.9: Tertiary 5A graduates 2005 by first and second degree

	Number of tertiary graduates (in 1000)		Growth per year 2000-2005, 5A	
	5A First degree	5A Second degree	First degree	Second degree
EU-27	**2209.2**	**834.4**	**4.3**	**12.3**
Belgium	24.7	13.4	1.8	9.8
Bulgaria	25.5	16.0	2.9	-3.5
Czech Republic	38.4	5.3	8.5	9.2
Denmark	31.2	10.0	5.5	2.8
Germany	197.8	16.4	2.1	:
Estonia	5.8	1.5	13.2	17.1
Ireland	26.5	12.2	6.4	10.3
Greece	35.2	5.5	:	:
Spain	195.9	:	-1.1	:
France	273.5	180.2	-1.8	25.9
Italy	291.3	:	12.8	:
Cyprus	0.67	0.13	7.6	27.9
Latvia	15.0	6.8	2.2	:
Lithuania	19.2	8.6	13.3	6.1
Luxembourg	:	:	:	:
Hungary	57.2	10.3	4.0	-2.1
Malta	1.5	0.48	5.9	-1.4
Netherlands	90.0	13.8	5.2	22.8
Austria	21.9	0.63	7.7	37.7
Poland	287.6	202.2	6.7	8.2
Portugal	50.3	2.4	1.8	:
Romania	97.6	44.2	9.7	:
Slovenia	6.2	0.9	4.7	9.4
Slovakia	27.1	6.3	6.1	:
Finland	36.5	0.66	5.2	1.2
Sweden	46.0	3.5	6.2	36.2
United Kingdom	306.4	176.0	2.6	9.5
Croatia	9.7	0.97	:	:
FYR Macedonia	5.1	0.2	9.3	12.3
Turkey	150.4	27.6	4.8	22.0
Iceland	2.5	0.29	11.2	23.6
Liechtenstein	0.13	0	:	:
Norway	25.0	5.1	2.2	10.7

Source: Eurostat (UOE)
For more country specific notes see: http://epp.eurostat.ec.europa.eu/portal/page?_pageid=0,1136184,045572595&_dad=portal&_schema=PORTAL

The number of graduates has also expanded in Australia, where more and more mobile students from Asia study and graduate (in 2005 390 000 Chinese students studied abroad).

The number of ISCED 6 graduates per 1000 young people aged 25-34 is relatively high (> 2.0) in Germany, Portugal, Finland, Sweden, Austria and the UK. Breaking down data on the number of ISCED 5A graduates by first and second degree gives and indication on the impact of the move to the Bologna bachelor/master degree structure. ISCED 5A second degrees, a typical result of the move to the BA/MA structure increased by over 78% since 2000 compared to only 23% for first degrees. Countries with a strong growth of ISECD 5A second degrees include Austria, Sweden, the Netherlands, France and Cyprus. Countries where the first degree of ISCED 5A showed a strong growth in the same period include Italy, Estonia and Lithuania.

4.3.2 Graduates in mathematics, science and technology – EU Benchmark for 2010.

European benchmark (European Council, 2003a)
The total number of graduates in mathematics, science and technology in the European Union should increase by at least 15% by 2010 while at the same time the level of gender imbalance should decrease.[37]

Science and technology are vital to the knowledge-based and increasingly digital economy. The issue of increasing the intake to these studies, particularly to technological fields, has been emphasised on numerous occasions. The Council underlined the importance of this goal in May 2003 when it adopted the benchmark of increasing the number of mathematics, science and technology graduates by at least 15% by 2010. Furthermore, it underlined that education of an adequate supply of science specialists was all the more important in the light of the goal set by the Barcelona European Council of increasing overall spending on research and development (R&D) to 3% of GDP by 2010 (European Commission, 2003b). The European Council declared that "special attention must be given to ways and means of encouraging young people, especially women, in scientific and technical studies as well as ensuring the long-term recruitment of qualified teachers in these fields."(European Council, 2001b). Studies have been launched by the Commission to identify good practice.[38]

The number of tertiary MST students has increased by more than 29% since 2000.[39] Growth has been particularly strong in Malta, Poland, Lithuania, Romania and Cyprus.

For some countries, however, the number of MST students stagnated or even declined. The latter was the case in Austria (due to introduction of tuition fees in 2001/02 and breaks in series), Ireland and Bulgaria. In Japan the number of MST

students declined by 1.6% in 2006, in the US it increased by 1.1%. In the EU MST students accounted in 2006 for nearly a fourth of the total student population.

Table 4.10: Tertiary MST students (2000-2006)

	Number of tertiary MST students (in 1000)			Growth per year
	2000	2005	2006	2000-06
EU-27	**4000e**	**4595**	**4514**	**2.5**
Belgium	74.6	64.5	68.8	-1.3
Bulgaria	64.5	63.3	63.2	-0.4
Czech Republic	74.5	98.1	77.4	0.6
Denmark	38.3	43.0	41.5	1.4
Germany	587.2	696.9	708.2	3.2
Estonia	11.4	15.3	15.3	5.0
Ireland	45.3	42.1	41.0	-1.6
Greece	:	208.0	93.6	:
Spain	525.1	540.0	522.5	-0.1
France	:	:	522.5	:
Italy	433.2	476.1	475.8	1.6
Cyprus	1.8	3.6	3.9	13.4
Latvia	15.1	19.2	20.0	4.8
Lithuania	33.4	48.6	48.0	6.2
Luxembourg	0.4	:	0.6	6.8
Hungary	65.7	77.7	77.6	2.8
Malta	0.7	1.3	1.4	12.3
Netherlands	80.8	87.3	85.3	0.9
Austria	73.9	59.0	61.2	-3.1
Poland	285.2	417. 2	477.3	9.0
Portugal	102.2	112.1	107.4	0.8
Romania	124.2	184.9	191.3	7.5
Slovenia	19.7	23.8	24.2	3.5
Slovakia	38.1	47.9	50.3	4.7
Finland	97.9	116.3	115.4	2.8
Sweden	106	110.6	109.8	0.6
United Kingdom	477.4	509.8	510.5	1.3
Croatia	:	32.2	32.4	:
FYR Macedonia	12.0	12.6	12.4	0.5
Turkey	301	450.6	488.2	8.4
Iceland	1.7	2.3	2.4	6.1
Liechtenstein	:	0.1	0.16	:
Norway	26.9	34.9	33.5	3.7

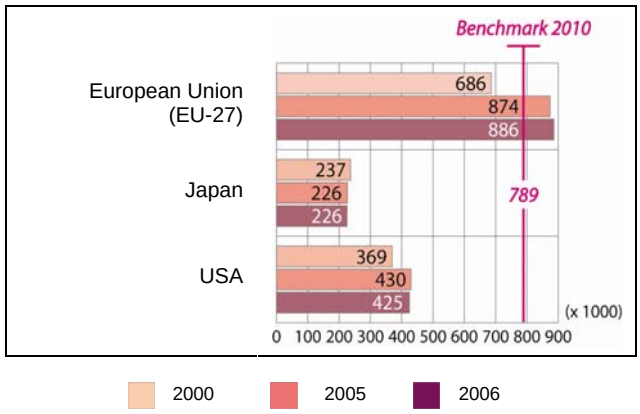
Data source: Eurostat (UOE)

Additional notes:

Number of students means the total number of full-time and part-time students Austria: Break in time series in 2003; before 2003 Austria reported students studying more than one field in each of the fields in which they were enrolled, leading to double-counting; since 2003 students have been allocated to only one field. The EU total for 2003 includes Greece (with 2002 data).

As a result of the growth rate of 4.4% per year since 2000, EU-27 had already achieved the growth aspect of the benchmark before 2005. After strong growth in previous years, the increase decelerated somewhat in 2006, the total reaching about 886 000 graduates. Taking 2000 (i.e. the 1999/2000 academic year) as the base year (when there were 686 000 graduates), the target growth of 15% implies an absolute increase of some 100 000 graduates by 2010 or of about 10 000 graduates per year. However, up to now much higher growth rates and an increase of 200 000 MST graduates have been achieved.

Chart 4.1: Total number of tertiary (ISCED level 5A, 5B and 6) graduates in mathematics, science and technology, 2000-2006

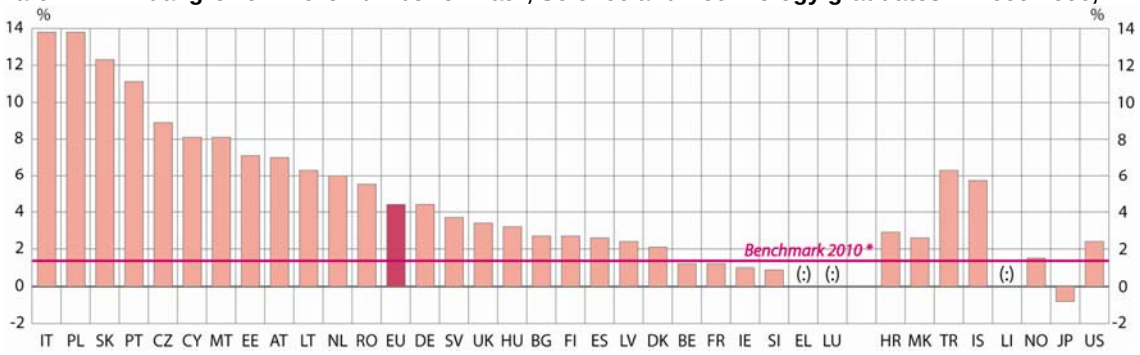


Data source: Eurostat (UOE)

In 2006 Cyprus and Poland showed the strongest growth in the numbers of MST graduates (>20%), followed by the Czech Republic, Austria, Germany and Hungary. Despite the general positive trend, Denmark, Ireland, Estonia, France and Latvia showed a considerable decrease (-5% and more) in numbers in 2006. However, the number of MST graduates is rising particularly fast in emerging economies like China, where it has more than quadrupled since 2000 to nearly 2 million in 2006 (Chinese figures also include ISCED 4 and hence are somewhat overstated). The availability of a large pool of MST graduates in low-wage countries is having a growing impact on high-technology industries worldwide and increasingly affecting the comparative advantage (relative abundance of highly skilled workers) of developed countries.

The average number of graduates in mathematics, science and technology (ISCED levels 5A, 5B and 6) in the EU was 10.2 per 1000 inhabitants aged 20-29 in 2000 and 13.0 in 2006. Related to a one-year age cohort, this implies that about 13% of young people take a degree in MST (the real figure is about 15% lower because of double-counting of graduates at various levels). Relative growth was slightly stronger than the absolute growth in the number of graduates, because the size of the population aged 20-29 declined slightly over this period. Ireland, France, Lithuania, Finland, Sweden and the UK showed a relatively high number of MST graduates, with over 15 per 1000, whereas Hungary and Greece recorded only 5.8 per 1000 (Malta and Cyprus have only limited university systems).

Chart 4.2: Annual growth in the number of Math, Science and Technology graduates in 2000-2006, in %



Date source : Eurostat (UOE)
* Benchmark 2010 expressed as average annual growth (15% in the period 2000-2010 = 1.4 % per year)

Table 4.12: Graduates in MST

	Number of graduates (in 1000)			Per 1000 inhabitants aged 20-29	Growth in graduates per year	Growth in graduates
	2000	2005	2006	2006	2000-2006	2006
EU-27	686.2	873.5	886.1	13.0	4.4	1.4
Belgium	12.9	14.1	13.8	10.6	1.2	-2.0
Bulgaria	8.1	9.7	9.5	8.5	2.7	-2.4
Czech Republic	9.4	13.2	15.6	10.0	8.9	18.8
Denmark	8.5	9.4	8.6	13.8	2.1	-8.1
Germany	80.0	93.5	103.7	10.7	4.4	11.0
Estonia	1.5	2.4	2.2	11.2	7.1	-6.3
Ireland	14.5	16.8	15.3	21.4	1.0	-8.8
Greece	:	16.3	:	5.8	:	:
Spain	65.1	78.5	75.9	11.5	2.6	-3.3
France	154.8	179.0	166.3	20.7	1.2	-7.1
Italy	46.6	88.9	:	12.4 (05)	13.8	:
Cyprus	0.3	0.4	0.5	4.3	8.1	27.0
Latvia	2.4	3.3	3.0	8.9	2.4	-8.0
Lithuania	6.6	9.0	9.5	19.5	6.3	4.7
Luxembourg	0.1	:	:	:	:	:
Hungary	7.2	7.9	8.7	5.8	3.2	10.8
Malta	0.2	0.2	0.3	5.0	8.1	:
Netherlands	12.5	16.9	17.6	9.0	6.0	4.3
Austria	7.5	10.1	11.3	10.8	7.0	11.7
Poland	39.2	70.8	85.4	13.3	13.8	20.5
Portugal	10.1	18.7	19.0	12.6	11.1	1.7
Romania	17.1	35.3	35.6	10.5	5.5	0.8
Slovenia	2.6	2.9	2.8	9.5	0.9	-4.4
Slovakia	4.7	9.4	9.5	10.3	12.3	0.9
Finland	10.1	11.8	11.9	17.9	2.7	1.0
Sweden	13.0	15.3	16.1	15.1	3.7	5.3
United Kingdom	140.6	139.8	138.7	17.8	3.4	-0.8
Croatia	:	3.5	3.7	6.0	2.9	5.6
FYR Macedonia	1.2	1.3	1.4	4.3	2.6	7.3
Turkey	57.1	76.5	82.4	6.2	6.3	7.7
Iceland	0.4	0.4	0.5	11.3	5.7	14.0
Liechtenstein	:	0.1	0.05	10.4	:	-17.9
Norway	4.8	5.1	5.3	9.3	1.5	4.0
United States	369.4	429.7	424.8	10.3	2.4	-1.1
Japan	236.7	226.4	225.8	14.4	-0.8	-0.2

Source: DG EAC, calculations based on Eurostat (UOE) data

Average annual growth calculated on the basis of years without breaks and for which data were available.
The EU total for 2006 includes an estimate for Greece and Italy (same figure used as in year before), therefore the totals might not correspond to those in the tables following this one.

Additional notes:
BE: Data for the Flemish community exclude second qualifications in non-university tertiary education; the data also exclude independent private institutions (although the number is small) and the German-speaking community.
EL: No data available for 2000-2003. EU total includes an estimate for Greece for this period.
CY: Data exclude tertiary students graduating abroad. Over half of the total number of Cypriot tertiary students study abroad. The fields of study available in Cyprus are limited.
LU: Luxembourg had in the reference period no complete university system, since most MST students study and graduate abroad.
HU: 2004: Changes in data collection on graduates by fields led to breaks in the time series.; AT: 2000: ISCED level 5B refers to the previous year.
PL: Data for 2000 exclude advanced research programmes (ISCED level 6).
RO: 2000 data exclude second qualifications and advanced research programmes (ISCED level 6). There is therefore a break in the series in 2004.
SE: 2004: Changes in data collection on graduates by fields led to breaks in the time series.
UK: National data used for 2000; LI: 2003-2004 data exclude tertiary students graduating abroad. The fields of study available in Liechtenstein are limited.

Since the number of MST students increased up to 2006, the number of graduates will probably continue to increase in the next few years. However, long-term demographic trends, especially the strong decline in birth rates in the new Member States after 1989, might also pose the risk of stagnation or decline in the number of MST students and graduates after 2010, despite the increase in higher education participation rates.
In 2006 growth in the number of MST graduates already slowed to 1.4%, while growth in student numbers decelerated to 0.8%. A further deceleration in coming years is likely.

Growth in graduates by field.
Growth since 2000 has been very strong in computing (nearly 80%), while engineering, manufacturing and architecture showed medium level growth rates. Growth was slow in mathematics and statistics and in life sciences (Table 4.13). In physical science there has been even a slight decline in the number of graduates since 2000.

Table 4.13: Growth in the number of graduates by field (EU-27)

ISCED fields	Graduates (in 1000)		Growth (in %)
	2000	2006	2000-06
Life sciences (42)	91.6	92.5	1.0
Physical science (44)	86.9	82.2	-5.4
Mathematics, statistics (46)	37.5	43.9	17.2
Computing (48)	83.9	151.0	79.9
Engineering (52)	264.4	301.7	14.1
Manufacturing (54)	32.0	46.1	44.1
Architecture, building (58)	88.8	111.9	26.0

Data source: Eurostat; in the case of physical science and computing, no data are available for Romania. Includes estimates for Greece for 2000 (see tables A4.1- A4.5 in the Annex)

However, it has to be taken into account that computing has also some of the elements taught in physical science and in mathematics. The low growth or decline in these fields can partly be attributed to a shift to informatics. There is also a trend to new interdisciplinary studies difficult to classify that impacts on the growth of certain fields.

Table 4.14 shows the growth in MST graduates by type of programme. The academic programmes requiring an ISCED level 5A second degree grew strongly between 2000 and 2006, partly a result of the Bologna process, while the number of new PhDs increased only moderately

In 2006 some 44 000 or about 5% of MST graduates in the EU were ISCED level 6 (PhD) graduates, compared with 20 600 in the USA (4.8%) and only 6 300 in Japan (2.8%). This was an increase of over 29% compared with 2000.

The increase in MST graduates has, however, not been reflected in sufficient employment of researchers in many Member States, as a by no means negligible share opt for a non-science and non-engineering career or for jobs in other countries (European Commission, 2005b, p. 12). It is hence important to create conditions conducive to a thriving research environment in Europe and to avoid a loss of European MST graduates to other sectors of the economy and other parts of the world.

Table 4.14: Growth in the number of MST graduates by type of programme

ISCED field	Graduates (in 1000)		Growth (in %)
	2000	2006	2000-2006
Academic programmes, all first degrees (5A)	452.4	547.2	21.0
Academic programmes, second degree (5A)	56.8	138.1	143.4
Occupation-oriented programmes, first qualification (5B)	1313	149.9	14.2
Occupation-oriented programmes, second qualification (5B)	2.1	0.4	-81
Second stage leading to an advanced research qualification (6)	34.4	44.4	29.1

Source: Eurostat (UOE), Note: PHD/Doctorate in 2006 represented 94% of all ISCED 6 degrees

Despite the high number of new MST PhDs produced by the EU, the EU has fewer researchers on the labour market than the USA, both in absolute terms and as a proportion of the total labour force (1.30 million researchers in EU-27 in 2006 or 5.6 per 1000 labour force, compared with 1.39 million in the USA or 9.3 per 1000 labour force – European Commission, Forthcoming). This is partly a result of the comparatively high amount of financing available for research activities and higher education in the USA compared with the EU and partly of the less attractive career prospects (European Commission, 2004a) (in 1999 about 116 000 EU-born science and engineering (S&E) employees were working in the USA out of a total 3.5 million S&E employees) (European Commission, 2003c, p. 46). This seems to indicate a need for further efforts fully to tap the potential offered by the increasing numbers of MST graduates. Reaching the spring 2002 Barcelona European Council objective of spending 3% of GDP on research and development by 2010 would imply a significant increase in the resources for research and research posts and hence an increased need for researchers. In 2006 the EU countries spent on average only 1.84% of their GDP on R&D, compared to 3.2 % in Japan (2003) and 2.67% in the USA (2004).

Gender imbalance among graduates in MST

The share of female MST graduates shows the level of gender balance. Bulgaria and Estonia, have the highest share of female graduates (>40%) while the biggest increases (> 5 percentage points) since 2000 have been in Estonia, Cyprus, Hungary and Slovakia. At EU level the female share of MST graduates increased slightly, from 30.7 % in 2000 to 31.6% in 2006. Since there was little change in the share of female MST students over the period 2000-2006, no significant improvements in the gender balance in MST graduates (who will be drawn from these students) are likely in the next few years. However, the share of women amongst MST students is lower than amongst MST graduates, implying a lower dropout rate for women. The share of female MST students has hardly changed since 2000 (EU-27: 2000: 29.6%, 2006: 29.8%). There are considerable differences within countries between the shares of female MST students and of female MST graduates, implying differences in dropout rates between men and women and also between countries.

Table 4.15: Females as a proportion of all MST graduates

	Females as a proportion of all MST graduates		
	2000	2005	2006
EU-27	30.7	31.3	31.6
Belgium	25.0	27.3	26.5
Bulgaria	45.6	41.1	41.2
Czech Republic	27.0	27.4	26.5
Denmark	28.5	33.9	34.1
Germany	21.6	24.4	28.6
Estonia	35.7	43.5	42.9
Ireland	37.9	30.5	29.1
Greece	:	40.9	:
Spain	31.5	29.6	30.0
France	30.8	28.4	27.9
Italy	36.6	37.0	36.1
Cyprus	31.0	38.1	35.9
Latvia	31.4	32.8	32.4
Lithuania	35.9	35.2	31.6
Luxembourg	:	:	:
Hungary	22.6	30.0	27.9
Malta	26.3	30.1	25.9
Netherlands	17.6	20.3	18.4
Austria	19.9	23.3	24.5
Poland	35.9	363	39.2
Portugal	41.9	39.9	39.7
Romania	35.1	40.0	38.6
Slovenia	22.8	26.2	25.7
Slovakia	30.1	35.3	34.8
Finland	27.3	29.7	28.5
Sweden	32.1	33.8	34.4
United Kingdom	32.1	30.8	30.8
Croatia	:	32.7	35.3
FYR Macedonia	41.6	46.9	46.0
Turkey	31.1	28.5	29.8
Iceland	37.9	37.2	:
Liechtenstein	:	28.6	19.6
Norway	26.8	26.0	28.4
United States	31.8	31.1	31.3
Japan	12.9	14.7	14.6

Data source: Eurostat (UOE)

Gender imbalance is especially pronounced in engineering (18% female graduates) and computing (20%) and, to a lesser extent, in architecture and building (36%), whereas in mathematics and statistics there is gender balance since 2000. On the other hand, in the field of life sciences women clearly predominate (62%).

While males predominate in MST, it should be added that there is an imbalance in favour of women in the student population as a whole (in 2006, 55% of tertiary students in the EU were female, who thus outnumbered men by 1.9 million). This imbalance is even more pronounced among graduates – 56.7% of graduates in EU-27 were female in 2000 and their share increased further to 58.9% in 2006.[40] The high share of women in other fields shows that there is clear potential to increase the female share in MST too.

Table 4.16: Percentage of female graduates by field

ISCED field	% female graduates		Countries with the highest female graduates (2006)
	2000	2006	Highest 2
Life sciences	61.2	62.1	Cyprus 83.3 Latvia 79.0
Physical science	38.9	44.7	Bulgaria 64.0 Poland 63.7
Mathematics, statistics	49.4	51.2	Latvia 81.0 Poland 72.7
Computing	23.9	19.6	Bulgaria 49.9 Finland 35.5
Engineering	15.6	18.3	Romania 32.9 Bulgaria 32.2
Manufacturing Processing	40.7	46.2	Denmark 86.7 Lithuania 79.9
Architecture, building	32.1	35.6	Greece 49.6 Italy 45.4

Data source: Eurostat (UOE)

4.4 Mobility of higher education students

Student mobility contributes not only to personal development and fulfilment but also to enhancing competence in fields like languages and intercultural understanding and, hence, to employability on an increasingly international labour market. Moreover, student mobility helps to develop European citizenship and European awareness. By increasing understanding of cultural and linguistic diversity, it promotes creation of a European Area of Education and Training.

Bearing in mind the potential of mobility as an economic and social good, the conclusions of the Lisbon Council of March 2000 specifically requested measures to foster the mobility of students, teachers, trainers and research staff (European Council, 2000a, paragraph 26).

In 2001 a joint recommendation by the European Parliament and the Council acknowledged the positive contribution made by mobility to society as a whole and called for increased political cooperation to eliminate obstacles to movement.[41] The recommendation was followed up by substantial action, at both Community and national level, and has led to a series of positive results (European Commission, 2004a).

The Community puts its policies on education into practice through the various channels of its mobility programmes, especially the Erasmus scheme, which has supported over 1.5 million students to date, and the Leonardo da Vinci scheme for vocational training. Mobility has also been an important feature in major recent policy initiatives like the Bologna process, which is intended to create a European Higher Education Area (an objective set for 2010) and to have a demonstrable positive impact on the mobility of higher education students in Europe.

However, the need to increase the level of mobility for learning purposes should not detract attention from the *quality* of mobility. The Erasmus University Charter and the Erasmus Student Charter were introduced in 2003 to enhance the organisational arrangements for the mobility of students. The Working Group on Mobility produced a draft charter on the quality of mobility in summer 2004, which was developed into a formal Commission proposal for a recommendation in September 2005 (European Council, 2005a), as called for by the Education Council in November 2004. The recommendation consists of ten guidelines, addressed mainly to the sending and receiving organisations responsible for mobility.

The 2006 Joint Interim Report of the Council (European Council, 2006d) and the Commission on Implementation of the Detailed Work Programme states that despite some promising moves, for example on the quality of mobility, there are not enough national strategies on mobility. The main source of support continues to be from EU programmes. In addition, countries generally tend to promote mobility for incoming more than for outgoing students (European Commission, 2006b). In a broader context, the Kok Report (Kok, 2004) on progress towards the Lisbon goals also concluded that disincentives to mobility persist in Europe, among them administrative and legal impediments, under-funding of universities and the problem of recognition of qualifications. Efficient ways to promote mobility should draw on the well developed European instruments to facilitate recognition (ECTS, Diploma and Certificate Supplement and study levels compatible with Bologna) and provide information on all relevant aspects of mobility via the Internet (Lanzendorf et al., 2005).

One cause for concern is that the EU might attract and retain fewer talented minds because of such disincentives. With this in mind, EU Ministers of Education have already set the objective of turning the EU into "the most favoured destination of students, scholars and researchers from other world regions."(European Commission, 2002b). To this end, in 2006 they adopted the ERASMUS Mundus programme to improve the quality of higher education and promote intercultural understanding through

cooperation with third countries (European Council, 2003b and 2003c).

The analysis which follows will analyse mobility on the basis of four indicators:

- *Foreign students enrolled in tertiary education (ISCED levels 5 and 6) as a percentage of all students enrolled in the country of destination, by nationality (European country or other countries);*
- *Percentage of students (ISCED levels 5 and 6) from the country of origin enrolled abroad (in a European country or other countries)*;
- *Inward mobility of Erasmus students; and*
- *Outward mobility of Erasmus students.*

The indicators are restricted to geographical mobility because at the moment it is difficult to find suitable data to construct indicators for areas such as the quality of mobility. Nevertheless, the above-mentioned indicators yield useful information on, for example, the disparate student mobility levels of individual EU countries, the relative attractiveness of host countries within the EU and the level of demand from both students and teachers/trainers for Erasmus places.

The first two indicators focus on mobility, as reflected in the UOE data, the other two on mobility under the European programmes. The two data sets are, to a certain extent, complementary, since exchange programmes and short stays abroad, such as Erasmus and Leonardo, should, in principle, be excluded from the UOE data collection if they last less than one year. However, the indicators selected for monitoring progress on mobility suffer from a number of significant shortcomings, which are listed below. Data are, however, expected to improve in the medium to long term.

In the past the UOE[42] data collection focused on tertiary students with foreign citizenship.[43] However, this is not the same thing as mobile students. Firstly, many tertiary students with foreign citizenship are not really mobile students, since they may have lived all their life in the country where they are studying.[44] Consequently, a country with a liberal naturalisation policy may have a lower percentage of "foreigners" enrolled in its institutions. Second, a growing number of families live outside the country of which they are citizens; therefore students with home citizenship can now also be classified as "incoming" and, hence, mobile students.[45]

The two indicators on mobility under the European mobility programmes obviously do not cover the full range of mobility. Most mobility under the Erasmus programme is regarded as credit mobility, as it is temporary and takes the form of going to another country to gain knowledge and experience to add to that learned at home. By contrast, degree mobility is aimed at gaining a degree abroad.[46]

In response to these deficiencies, the Commission has established strategies to improve the accuracy and completeness of the data. In the short term, a new study is gathering more comprehensive information on mobility in 32 European countries (Kelo, Teichler and Wächter et al., 2006). In 2005 the UOE data collection was revised to make it possible to identify "physical mobility" (i.e. non-resident students) more accurately and, in some cases, to combine these figures with "cultural mobility" (i.e. non-citizens). The first results from this exercise, based on data from 2003/2004, have been available since spring 2006. These more accurate data on mobility will continue to be collected in UOE, and more and more countries will be able to submit the data once their national data collections have been adapted to this new request. However, there are still many gaps and more complete data will not be available until the medium term.

4.4.1 International student mobility

Foreign students in higher education

About 1.7 million students with foreign citizenship were enrolled in tertiary education in EU-27 in 2006 (the 2005/06 academic year). This compares with 788 000 in 2000. The average annual increase over the period 2000-2006 was 13.4%. Growth in the number of foreign students was faster than growth in overall student numbers.

An increasing share of tertiary students in Europe comes from outside Europe. The number of students from China grew six-fold from fewer than 20 000 in 2000 to 113 000 in 2006, while the number of students from India quintupled at the same time. One reason for the growth in the number of overseas students is the more restrictive visa policy introduced in the USA after 2001.

Table 4.17: Foreign tertiary students as % of all tertiary students (ISCED levels 5 and 6) enrolled in the country (2000-2006)

	Foreign tertiary students as % of all tertiary students		Non-resident tertiary students as % of all tertiary students	Annual growth in number of foreign tertiary students
	2000	2006	2006	2000-2006
EU-27	5.0	8.9	:	13.4
Belgium	10.9	11.9	6.3	3.3
Bulgaria	3.1	3.7	:	1.7
Czech Rep.	2.3	6.3	5.1	24.7
Denmark	6.8	8.4	5.3	6.8
Germany	9.1	11.4	:	5.7
Estonia	1.6	3.2	1.4	16.4
Ireland	4.6	:	:	:
Greece	:	2.5	:	:
Spain	1.4	2.9	0.7	12.3
France	6.8	11.2	10.8 (05)	10.4
Italy	1.4	2.4	:	11.8
Cyprus	19.4	27.4	25.1	18.6
Latvia	6.6	1.1	1.1	-21.3
Lithuania	0.4	0.6	0.6	14.7
Luxembourg	:	42.2	:	9.7
Hungary	:	3.3	2.8	:
Malta	5.6	7.2	0	10.5
Netherlands	2.9	6.4	4.7	17.3
Austria	11.6	15.5	12.0	4.4
Poland	0.4	0.5	:	10.9
Portugal	3.0	4.7	:	7.3
Romania	2.8	1.4	:	-1.1
Slovenia	0.9	1.2	0.9	10.2
Slovakia	1.2	0.9	0.8	1.7
Finland	2.1	2.9	:	8.2
Sweden	7.4	9.8	5.0	8.4
UK	11.0	32.5	14.4	22.7
Croatia	:	0.6	2.5	:
FYR Maced.	0.7	0.4	0.4	-4.7
Turkey	1.7	0.8	:	1.3
Iceland	4.2	4.6	:	10.0
Liechtenstein*	:	:	:	:
Norway	4.6	6.7	1.9	8.6
Japan	1.5	3.2	2.9	13.9
United States	3.6	:	3.3	:

Source: For EU, EEA and acceding countries: UOE data collection. For other countries: UNESCO Institute of Statistics

Additional notes: DE, SI: Students in advanced research programmes (ISCED level 6) in these countries are excluded.
RO 2000: data exclude ISCED level 6.

The number of students from other parts of the world varies between countries. In Cyprus, France, Malta and Portugal more than 80% of foreign students come from outside the EU, while the corresponding figures in Austria, the Czech Republic, Estonia and Greece were under 40%.

There are several reasons for the high proportion of students from other parts of the world studying in EU-27. Firstly and most importantly, the indicator analysed is students with foreign citizenship and not mobile students *per se;* many of these students may have lived all their life in the country where they are studying (see section on quality of data). Another reason could be the wide variety of teaching languages in Europe, attracting students from all over the world. Finally, students from former colonies of European countries may study in the former colonial countries with which they have cultural and historical ties and whose language they share.

Table 4.18: Main countries of origin of non-national students in the EU

	Foreign students in EU-27 (in 1000)		
	2000	2005	2006
Total	787.9	1201.0	1690.4
Europe	383.8	496.2	566.3
- EU 27	315.8	395.7	449.5
-other Europe	68.0	100.5	116.6
- of which Russia	12.5	24.0	27.7
Africa	134.2	203.0	241.3
Morocco	38.2	48.6	47.9
Algeria	14.9	23.7	23.2
Nigeria	3.5	10.2	19.3
Asia	183.0	348.9	376.1
China	18.6	109.2	113.5
India	6.6	25.0	33.1
Japan	10.7	12.3	12.7
America	63.0	95.2	110.4
USA	22.7	27.1	29.8
Canada	5.8	7.9	10.1
Brazil	6.8	9.7	11.3
Oceania	2.9	3.9	7.4
Australia	2.1	2.9	5.3

Source: Eurostat (UOE collection

Higher education students enrolled outside their country of origin

In 2005, world wide 2.7 million students (slightly more than 2% of all students) were enrolled outside their country of citizenship, of whom 2.3 million (84%) were studying in the OECD area. The United States received most foreign students (in absolute terms) with 22% of the total. However, the share of the United States in total foreign students reported to the OECD decreased by 3 percentage points between 2000 and 2005. The UK (12%), Germany (10%), France (9%), Spain (2%), Belgium (2%), Italy (2%), Austria (1%), Sweden (1%) and the Netherlands (1%) account for a combined total of 40%. Australia is in fifth place with 6%. Together, these countries host nearly 68% of all foreign students (OECD, 2007a, pp.298-305).

For most EU countries, the majority of outgoing students are enrolled in another EU country (see Table 4.19). The only exception is the UK, where the majority of students studying abroad are studying outside the EU. In 2006 on average about 3% of EU students were studying abroad, with four out of five in other EU countries.

Table 4.19: Percentage of all tertiary students (ISCED levels 5 and 6) enrolled outside their country of origin

	Students (ISCED levels 5 and 6) studying in another EU-2, EEA or Candidate country - as % of all students		
	2000	2004	2005
EU-27	2.1	2.2	2.3
Belgium	2.4	2.6	2.6
Bulgaria	3.2	8.6	8.7
Czech Republic	1.3	1.8	1.8
Denmark	2.7	2.5	2.3
Germany	1.8	1.9	2.2
Estonia	2.5	3.5	3.6
Ireland	9.4	8.5	8.7
Greece	12.4	7.3	5.9
Spain	1.1	1.2	1.1
France	1.8	2.0	2
Italy	1.7	1.6	1.5
Cyprus	46.5	54.8	56.5
Latvia	1.3	1.6	1.7
Lithuania	1.8	2.3	2.6
Luxembourg	74.5	:	:
Hungary	1.7	1.5	1.5
Malta	8.2	8.4	7.8
Netherlands	1.9	1.8	1.8
Austria	3.8	4.7	4.4
Poland	0.9	1.2	1.3
Portugal	2.3	2.7	2.9
Romania	1.5	2.4	2.3
Slovenia	2.2	2.1	2.0
Slovakia	3	8.2	8.6
Finland	3.2	2.9	2.7
Sweden	2.7	2.2	2.2
United Kingdom	0.6	0.6	0.4
Croatia		6.9	6.3
FYR Macedonia	6.2	10.4	11.9
Turkey	3.3	1.8	1.6
Iceland	16.9	15.5	17.0
Liechtenstein	:	34.5	76.6
Norway	4.7	4.7	4.7

Source: Eurostat (UOE)

Additional notes: DE, SI: Students in advanced research programmes (ISCED level 6) in these countries are excluded.

Countries diverge greatly in terms of the proportion of their students enrolled abroad. In general, the larger countries have a lower proportion of students studying abroad than the smaller countries.

Table 4.20: Flow of students into and out of the EU, 2005

	Outgoing	Incoming	*Balance*
EU-27	**392**	392	*0*
EEA/candidate countries	**7.9**	62.8	*54.9*
USA	**59.6**	24.9	*-34.7*
Other	**54**	712	*658*

Source: Eurostat (UOE collection), for 'other' 2003 result

This may be attributable to the greater number and range of universities in the larger countries. Another possible explanation is that students from smaller countries may be more likely to go abroad because they have already acquired the language of one of the larger countries. However, one major factor in the high mobility levels of students from countries such as Cyprus and Luxembourg is simply the absence or lack of capacity of third-level institutions in the students' own country. By way of illustration: 75% of Luxembourg's students are enrolled abroad. Cyprus follows with 56.5% of its students at foreign institutions; Ireland is third with 8.8% and Slovakia comes fourth with 8.6%. At the other end of the scale come Spain, the UK and Poland, with less than 1.5% of their students enrolled abroad.

Flow of students

The EU-27 is a net receiver of students (table 4.20): over 650 000 more students with non-EU citizenship study in the EU than the number of EU citizens studying outside the EU. In 2005, 67% of students with foreign citizenship in the EU were from countries outside the EU. This figure included 5% from EEA and candidate countries, 2 % from the USA and 60% from other parts of the world. Two thirds of foreign students study in Germany, France and the UK.

Some countries have more students with foreign citizenship than the number of citizens which they themselves send abroad. Within the EU this is the case for Belgium, France, Germany, Austria, Spain, Sweden and the UK. The UK is the Member State with the lowest proportion of its outgoing students heading for other countries in EU-27, with 45% of its students studying in EU-27. The USA is a net receiver of students from EU-27. More than twice as many students go to the USA from the EU as from the USA to the EU. More than 20% of the outgoing students from the Czech Republic, Sweden and the UK study in the USA.

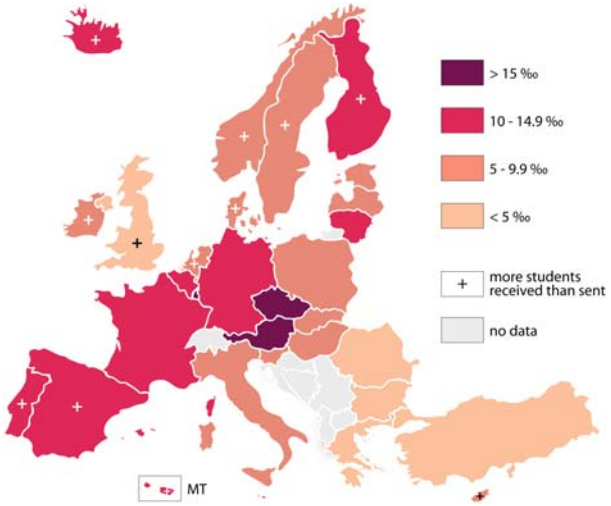
4.4.2 Erasmus mobility

A large proportion of overall mobility is supported through Community programmes such as Erasmus (see table 4.21 and chart 4.3). A number of interesting trends can be observed in participation rates. The total number of Erasmus students increased by 3.2 % in 2006/07 (2.3% in EU) compared with the previous year. This was much lower than the increase in former years. The increase was, however, substantial in many new Member States and notably in the candidate country Turkey. This increase should be seen in the context of the increasing number of European

universities taking part in the Erasmus programme. In fact today almost all European universities are taking part in Erasmus.

In 2006/07 Erasmus led to mobility on the part of 0.8% of the student population in EU and EEA countries. In practice, mobility under Erasmus would have to more than double, i.e. affect more than 2% of students per year, to reach a participation rate of 10% (since then, during a period of four to five years' formal study, 10% of the student population would be affected).

Chart 4.3: Outward mobility of Erasmus students, 2006/07 (students sent per 1000 students)



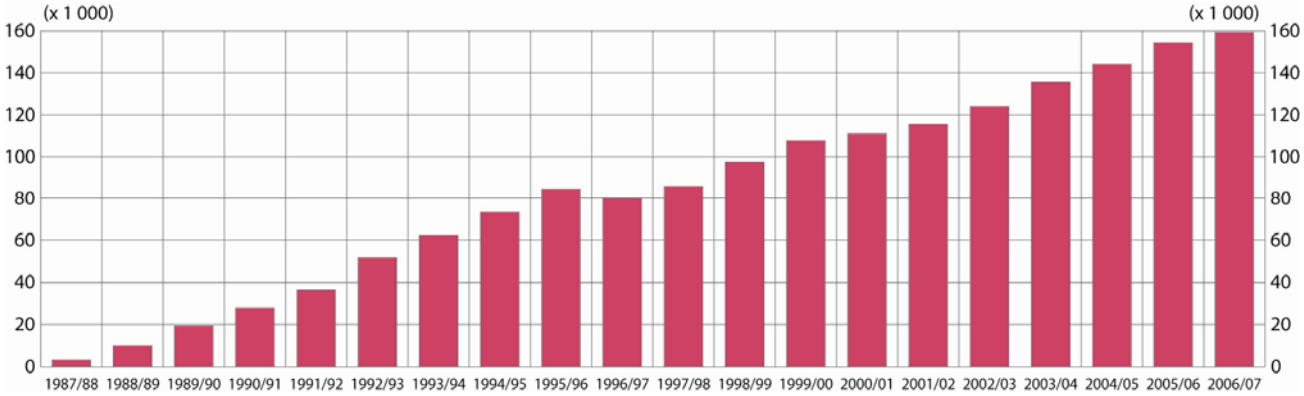
Source: DG Education and Culture (Erasmus programme)

Table 4.21: Mobility of Erasmus students, 2006/07

	Students sent	Students received	Per 1000 students 2005/06	
	2006/07	2006/07	Students sent	Students received
EU-27	153 396	155 070	8.2	8.3
Belgium	5119	5021	13.0	12.7
Bulgaria	938	296	3.9	1.2
Czech Rep.	5079	2812	15.1	8.3
Denmark	1587	4278	6.9	18.7
Germany	23884	16766	10.4	7.3
Estonia	572	460	8.4	6.7
Ireland	1524	3972	8.2	21.4
Greece	2465	1726	3.8	2.6
Spain	22322	27008	12.5	15.1
France	22981	20155	10.4	9.2
Italy	17195	14319	8.5	7.1
Cyprus	129	209	6.3	10.1
Latvia	807	330	6.2	2.5
Lithuania	2082	692	10.5	3.5
Luxembourg	170	24	63.0	8.9
Hungary	3028	1569	6.9	3.6
Malta	125	325	13.3	34.6
Netherlands	4502	6446	7.8	11.1
Austria	4032	3565	15.9	14.1
Poland	11219	3274	5.2	1.5
Portugal	4424	4586	12.0	12.5
Romania	3350	792	4.0	0.9
Slovenia	972	700	8.5	6.1
Slovakia	1346	610	6.8	3.1
Finland	3773	5860	12.2	19.0
Sweden	2532	7194	6.0	17.0
UK	7235	16153	3.2	7.1
Turkey	4438	1321	1.9	0.6
Iceland	189	327	12.0	20.8
Liechtenstein	44	31	73.3	51.7
Norway	1257	2575	5.9	12.0

Source: European Commission, DG Education and Culture

Chart 4.4: Mobility of students in the Erasmus programme



	1987/88	1989/90	1994/95	1999/00	2000/01	2002/03	2003/04	2004/05	2005/06	2006/07	Total
EU-27			72 341	106 418	109 933	122 777	134 190	141 391	149 933	153 396	1 503 951
Turkey	-	-	-	-	-	-	-	1142	2852	4438	8432
Iceland, Liechtenstein and Norway	-	-	1066	1248	1159	1180	1396	1504	1636	1490	18149
Total (EU-27 + EEA + CC)	3 244	19 456	73 407	107 666	111 092	123 957	135 586	144 037	154 421	159 324	1 683 928

Source: European Commission, DG Education and Culture

Appendix:

Table App.4.1 Overview on national University rankings in EU countries

Country	Since	Main information
Austria	**2004. yearly**	http://www.university-ranking.de/ see below
Germany	**1998, yearly**	The DAAD, together with the Centre for Higher Education Development (CHE) and the German weekly news magazine "DIE ZEIT", makes the most comprehensive and detailed university ranking in Germany. More than 280 higher education institutions in Germany, Austria and Switzerland were examined by CHE – Centre for Higher Education Development. **Austrian universities are included in the ranking in 2004 and Swiss universities are included in 2005 (German-speaking universities).** The CHE ranking is going to be extended to Netherlands and Flanders. What's special about the CHE University Ranking? • Not an overall ranking, but a detailed analysis: the ranking deliberately chooses not to add the results of the survey together to produce an overall points score. • League Groups instead of League Positions: the CHE University Ranking has no "league positions" for the individual universities but instead places the universities into one of three groups: Top Group, Middle Group or Bottom Group. CHE's League Group approach ensures that the top and the bottom groups are statistically significantly different from the arithmetic mean. • The ranking is subject specific **Ranking criteria**: Academic studies and teaching, equipment, research, overall opinion students and professors, study location and higher education institution, job market and career orientation http://www.university-ranking.de/
Hungary	**2008**	**Diploma 2008,** joint publication of a national journal, the HVG and the National Higher Education Information Centre (OFIK). **Ranking criteria:** staff quality, student quality, popularity, satisfaction, prestige. **http://www.felvi.hu/index.ofi?mfa_id=459&hir_id=8655&oldal=2**
Italy	**2000, yearly**	**La guida della Repubblica:** published by La Repubblica newspaper in collaboration with CENSIS. **Ranking criteria:** didactic, student's progression, research outcomes, staff characteristics, internationalisation of the faculty. http://www.repubblica.it/speciale/2007/guida_universita/
Poland	**1992, yearly**	**Perspektywy** is the Polish organisation providing rankings in cooperation with 'Rzeczpospolita', a Polish newspaper. **Ranking criteria:** prestige, intellectual power, studying conditions, internationalisation of the university. http://www.perspektywy.pl/index.php?mid=rankingi
Romania	**2005, yearly**	**Romanian universities ranking:** produced by Ad-Astra, one ONG **Ranking criteria:** publications by teaching staff indexed in a particular year in the ISI Science Citation Index Expanded, ISI Social Sciences Citation Index and the ISI Arts & Humanities Citation index. http://www.ad-astra.ro/universitati/universities.php
Slovakia	**2005, yearly**	**Slovakian universities ranking :** published by the Academic Ranking and Rating Agency (ARRA) **Ranking criteria:** publications, proportion of PhD students, staff/student ratios, admission criteria, labour market outcomes for graduates, spending, grant funding. **http://www.arra.sk/index.php?module=pagemaster&PAGE_user_op=view_page&PAGE_id=9&MMN_position=5:5**

Spain	**In 2000 and 2005**	**Ranking found in 2000 and 2005:** conducted by a team of Spanish researchers based in the United States and Spain **Ranking criteria:** context (GDP of the region, age of the institution in years, public or private, number of schools as an indirect measure of the range of studies Resources (Faculty/student ratios, number of books per student), organization (Ratio of students enrolled in long versus short undergraduate programs, percentage of women on faculty, performance. De Miguel, J.M, Vaquera, E. and Sanchez, D. "Spanish Universities and the Ranking 2005 Initiative," Higher Education in Europe 30 2 (2005): 199-215.
The Netherlands	**X, yearly**	**Ranking criteria:** around 90 criteria: student's opinion, student's progression, cost per student, information on the city where the institution is located, etc. Each selected study programme is placed in one of three categories: highest score (green), average score (yellow), and lowest score (red). **http://www.studychoice123.nl/web/site/default.aspx?m=about**
UK	**Good University Guide :** 15 year, yearly **Guardian University Guide:** yearly	Several league tables, **2 examples** **TOP universities league table 2008,Good University Guide 2008 ed. John O'Leary** **Ranking criteria:** Student satisfaction, research assessment, entry standards, student-staff ratio, library/computing spend, facilities spend, good honours, graduate prospects, completion. http://www.thegooduniversityguide.org.uk/single.htm?ipg=6605 **UK, Guardian University Guide** **Ranking criteria:** Teaching quality - as rated by graduates of the course, feedback as rated by graduates of the course, spending per student, staff/student ratio, job prospects, value added - comparing students' degree results with their entry qualifications, entry score. http://education.guardian.co.uk/universityguide2008/story/0,,2067150,00.html

Table App.4.2 Weights used in the ARWU and WUR rankings

Shanghai Jiao Tong University Rankings (ARWU), 2007

Criterion	Indicator	Weight
Research output	Articles published in Nature & Science over the four previous years	20%
Research output	Articles in the expanded Science Citation Index and the Social Science Citation Index during the previous year	20%
Quality of education	Alumni winning Nobel prizes and field medals	10%
Quality of staff	Staff winning Nobel prizes and field medals	20%
Quality of staff	Highly cited researchers	20%
Size of institution	Performance relative to size	10%

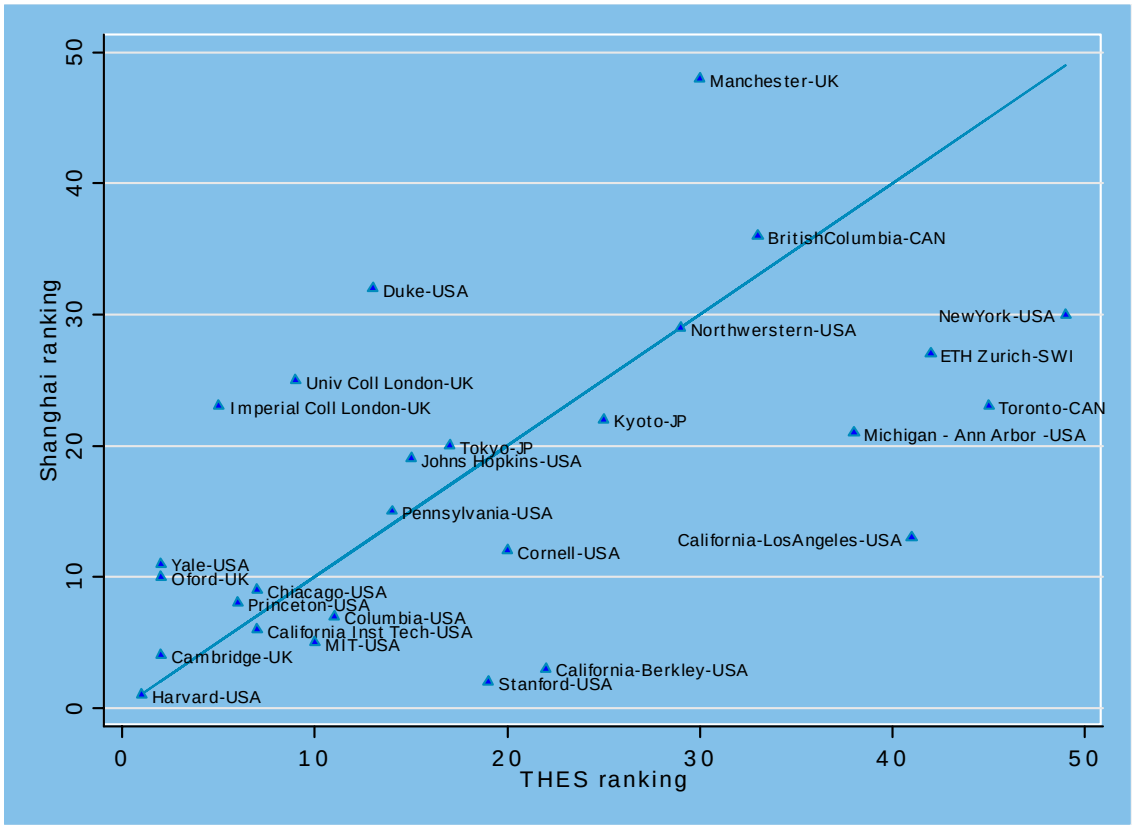
Source: http://www.arwu.org/rank/2007/ranking2007.htm. The indicators and weights used in 2003 are slightly different from those used in 2007 and 2006.

Table App.4.3 Times Higher Education Supplement Rankings (WUR), 2007

Criterion	Indicator	Weight
Quality of faculty	Peer review, 5,101 academics	40%
Quality of research output	Total citation/ Full Time Equivalent faculty	20%
Quality of graduates	Employers' opinion, 1,471 recruiters	10%
Quality of teaching environment	Full Time Equivalent faculty/student ratio	20%
International faculty	Percentage of international staff	5%
International students	Percentage of international students	5%

Source: http://www.thes.co.uk/

Chart App.4.1: Comparing the position of the top 50 universities in the ARWU and WUR rankings



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[29] http://ec.europa.eu/education/policies/educ/bologna/bologna.pdf

[30] http://register.consilium.europa.eu/pdf/en/07st16/st16096re01.en07.pdf

[31] See the annex for a more detailed presentation of the weights and indicators.

[32] Defined here as full members of the European University Association (EUA), i.e; institutions that awarded at least one doctorate in the three years prior to becoming a member of the EUA.

[33] It must be remembered, however, that the definition of university differs between countries. The comparability of statistics on the number of institutions is therefore limited.

[34] The faculty/student ratio in the *WUR* ranking is a proxy for teaching quality.

[35] In addition, in the context of a pilot funded by the European Commission, to design an international system for the comparison of the quality of institutions and programmes in higher education, the CHE approach is currently examining the Dutch and Flemish university system.

[36] Every year, one third of the entire subject range is analysed. See http://www.daad.de/deutschland/hochschulen/hochschulranking/06543.en.html for further details. Recently, the CHE has created a « Ranking of Excellent European Graduates Programmes » in the field of mathematics, biology, chemistry and physics which looks at excellence throughout the whole of Europe. See http://www.che-ranking.de/cms/?getObject=487&getName=CHE-ExcellenceRanking+english&getLang=de for additional details.

[37] Indicator: *Total number of tertiary (ISCED level 5A, 5B and 6) graduates in mathematics, science and technology. MST includes life sciences, physical sciences, mathematics and statistics, computing, engineering and engineering trades, manufacturing and processing, architecture and building*.

[38] For example, the Socrates Action 6 project "GRID - Growing Interest in the Development of Teaching Science (2006)", coordinated by the Pôle universitaire européen de Lorraine.

[40] Eurostat estimates.

[41] "The transnational mobility of people contributes to enriching different national cultures and enables those concerned to enhance their own cultural and professional knowledge and European society as a whole to benefit from those effects." Recommendation, 10 July 2001.

[42] The UNESCO-UIS/OECD/EUROSTAT data collection on education statistics.

[43] For a comprehensive overview of the present state of mobility statistics see "European Parliament Statistics on Student Mobility within the European Union." Final report to the European Parliament prepared by Kassel University, October 2002.

[44] The above-mentioned study estimated that non-mobile students with foreign citizenship make up between 18.3% and over 50% of all students with foreign citizenship.

[45] The proportion of students with home citizenship among mobile students ranges from over 5% to almost 17%.

[46] The term "degree" is used in a wide sense and may refer to a degree, certificate, diploma or other qualification.