BiGGAR Economics

Economic Contribution of the LERU Universities

A report to

LERU

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COPIES OF THIS REPORT AND A TECHNICAL APPENDIX ARE AVAILABLE FROM THE LERU WEBSITE www.leru.org

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1 EXECUTIVE SUMMARY

BiGGAR Economics was asked by the League of European Research Universities (LERU) to assess the economic contribution of its 21 member universities across Europe and this report presents our findings for the combined group of universities.

The economic contribution was measured in terms of Gross Value Added (GVA)[1] to the economy and by the number of jobs supported by the organisation.

The study estimates that in 2014 the LERU Universities generated **a total economic value of €71.2 billion in GVA and 900,065 jobs across Europe**.

For each €1 in GVA directly generated by the LERU Universities, there was a total contribution of almost €6 to the European economy and every job directly created by the LERU Universities supported almost 6 jobs in the European economy.

This economic contribution came from a wide range of sources.

In 2014, the LERU Universities generated a core economic contribution of €23.9 billion in GVA and 375,683 jobs in Europe. This was generated through people employed directly at the LERU Universities, through expenditure on supplies, through the money spent by staff in the local economies and by capital projects.

Student expenditure, student employment (outside the LERU Universities), student volunteering and student placements were worth a further €9.7 billion in GVA and supported a further 220,184 jobs in Europe.

The study included seven aspects of knowledge transfer, enterprise and innovation activity supported by the LERU Universities that can be quantified. We recognise that there are further, highly significant, non-quantifiable aspects to this contribution that can only be considered in terms of developments in knowledge. The aspects of knowledge transfer activities that we could quantify were technology licensing, consultancy, contract and collaborative research, spin-outs and start-ups, research and science parks, workforce training and staff volunteering, which made a combined contribution of €21.9 billion in GVA and 298,489 jobs across Europe.

The tourism contribution created by visits to staff and students and attendance at conferences at the LERU Universities created a contribution of €0.3 billion in GVA and 5,708 jobs across Europe.

One final contribution has been measured which is conceptually different from the others in that it occurs over the lifetime of a graduate. The graduate premium recognises the increased earnings that stem from educating people to degree level. This contribution was estimated to be worth €15.4 billion in GVA across Europe, based on the 2014 graduates from LERU Universities.

Extrapolating this impact across the whole Research Universities sector across Europe suggests that the sector contributes over **€300 billion GVA** per annum and supports **3.8 million jobs** across Europe. This is equivalent to 2.2% of the total GVA of the European economy and 1.8% of all European jobs.

[1] GVA is a measure of the economic value of goods and services produced in a given area. It is the total value of output less the value of intermediate inputs.

2 INTRODUCTION

This report summarises the findings of a study undertaken by BiGGAR Economics Limited into the economic contribution of the network of 21 LERU Universities located in 10 countries throughout Europe (Belgium, Finland, France, Germany, Italy, Netherlands, Spain, Sweden, Switzerland and the UK).

2.1 Objectives

The objectives of the study were to quantify the economic value of the combined group of universities in terms of:

- their core contribution to income and employment;
- the student-related contribution from students spending, working, volunteering and undertaking placements;
- the knowledge transfer, enterprise and innovation activity created by and arising from the LERU Universities;
- the tourism contribution created by visitors to staff and students and attendance at conferences and events held at the Universities; and
- the life-time productivity gains from teaching and learning delivered by each institution (graduate premium).

The base year for all data is 2014. The study presents a snapshot of the contributions of the LERU Universities to the European economy.

The findings based on the LERU Universities were then used to estimate the economic contribution of the whole Research Universities sectors in Europe.

2.2 Background

LERU is an association of research-intensive universities. It was founded in 2002 as a partnership among twelve multi-faculty research universities and expanded its membership to 21 in 2010. Its purpose is to influence research policy in Europe and to develop best practice through mutual exchange of experience. LERU regularly publishes a variety of papers and reports which make high-level policy statements, provide analyses and make recommendations for policymakers, universities, researchers and other stakeholders

The 21 members of LERU are: University of Amsterdam, Universitat de Barcelona, University of Cambridge, University of Edinburgh, University of Freiburg, Université de Genève, Universität Heidelberg, University of Helsinki, Universiteit Leiden, KU Leuven, Imperial College London, University College London, Lund University, University of Milan, Ludwig-Maximilians-Universität München[2], University of Oxford, Pierre and Marie Curie University (Paris), Université Paris-Sud, University of Strasbourg, Utrecht University, University of Zurich. A summary description for each member university is contained in Appendix B.

[2] Ludwig-Maximilians-Universität München did not take part in the study directly, however in order to present as complete a picture as possible of the combined impact of the LERU Universities, we have drawn together a set of assumptions and estimates for Munich based on publically available data.

2.3 Report Structure

This report is structured as follows:

- section three summarises the methodological approach taken to the study;
- section four discusses the role of universities as drivers of productivity and economic growth, as well as the various ways in which universities impact the economy;
- section five describes the economic contribution arising from the core activities of all LERU Universities combined including those associated with direct income and employment, the purchase of bought in goods and services, staff spending and capital spending;
- section six describes the contributions associated with students whilst studying through spending in the local economies, working part-time in local businesses, volunteering and working on placements;
- section seven describes the contribution of knowledge transfer, enterprise and innovation associated with the LERU Universities and their employees using their knowledge to benefit other organisations, including the contributions from technology licensing, consultancy, contract and collaborative research, spin-outs and start-up companies, research and science parks, workforce training (or continuing professional development, CPD) and staff volunteering;
- section eight assesses the LERU Universities combined contribution to tourism from visits to students and staff and from expenditure at conferences and events hosted at each university;
- section nine discusses the economic contribution arising from the increased earnings generated during the working life of graduates as a result of having a university level education;
- section ten summarises the estimated total economic contribution of the LERU Universities across Europe as a whole;
- section eleven sets the findings on the economic contribution of the LERU Universities in the context of Research Universities in Europe and compares the contribution with other sectors of the European economy; and
- section twelve contains our conclusions.

Appendix A provides a guide to abbreviations and terms commonly used throughout the report and Appendix B contains brief summary descriptions for each LERU member.

The methodology used to calculate these contributions is described in detail in a separate Supplementary Methodological Appendix.

3 APPROACH AND METHODOLOGY

This chapter describes the overall approach taken in this report and the broad principles used to assess economic value. It also summarises the methodology used to quantify the economic benefits considered and discusses the main limitations of this approach.

3.1 Previous Uses of Method

BiGGAR Economics is an independent economic development consultancy based near Edinburgh in Scotland. Over the past decade the company has become recognised for its market and thought-leadership on the contribution of higher education institutions to regional and national economies. In that time, BiGGAR Economics has worked with more than 50 leading institutions in the UK, Ireland and the Netherlands, assessing historic, current and potential future economic contributions. The approach used in this report has been developed and informed by this experience.

The methodology used is one that has been in wide usage for at least 20 years. A large number of individual universities, particularly in the UK and the US, have undertaken economic impact studies over the last 20 years, and particularly over the last 5 years. Some other examples of similar studies undertaken by BiGGAR Economics and others include the University of Edinburgh (BiGGAR Economics, 2008, updated in 2012 and 2015), the University of St Andrews (BiGGAR Economics, 2010, updated 2012), the University of Birmingham (Oxford Economics, April 2013), the University of British Columbia (2009, Planning and Institutional Research), the University of Iowa (September 2010, Tripp Umbach) and the University of Notre Dame, Indiana (September 2013, Appleseed).

A similar approach has also been taken by sector organisations to examine the economic contributions of groups of institutions, or the sector as a whole. Examples include the Nederlandse Federatie Van Universitair Medische Centra (NFU, the organisation representing the Medical Research Centres in the Netherlands) study[3], the Russell Group 2010 report on the impact of research[4] and the 2014 report on the economic impact of capital projects[5], Universities Scotland[6] reports on the contribution of the sector to economic growth and a UniversitiesUK report that demonstrates the impact of the higher education sector's contribution to the UK economy[7].

The approach used for the economic impact of universities and research institutes is also consistent with Guidance issued by several governments and public sector organisations. For example, the methodology is consistent with the principles set

[3] Nederlandse Federatie Van Universitair Medische Centra (2014), *Economic Impact of University Medical Centres in the Netherlands* (available at http://www.nfu.nl/actueel/innovatieve-kracht-umcs-stimuleert-maatschappelijke-ontwikkeling)

[4] Russell Group (2010), *The economic impact of research conducted in Russell Group universities* (available at http://www.russellgroup.ac.uk)

[5] Financial Times (20 May 2014), *Russell Group universities invest £9bn to attract best students* (the report is being published at http://www.russellgroup.ac.uk)

[6] Universities Scotland (2013*), Grow Export Attract Support: Universities' contribution to Scotland's economic growth* (available at http://www.universities-scotland.ac.uk)

[7] Viewforth Consulting Ltd (April 2014), *The Impact of Universities on the UK Economy* (available at http://www.universitiesuk.ac.uk/highereducation)

out in European Commission Guidance[8] on major projects, which highlights the importance of assessing the fullest range of potential economic effects possible.

3.2 General Approach

The overarching objective of this research is to illustrate the scale and breadth of the economic contribution made by LERU members. The starting point for doing this was to consider the various activities undertaken by the different universities and identify those that are likely to generate economic value.

Logic chains were then developed to describe how each type of activity generates economic value. These logic chains were then used to develop an economic model that was used to estimate the economic contribution of each institution.

The next step was to consider how the value generated by each type of activity might be measured and what data would be required to do this. For most types of activity two types of information were required: source information about the scale of activity and data that could be used as the basis for assumptions to measure the economic value generated by this activity.

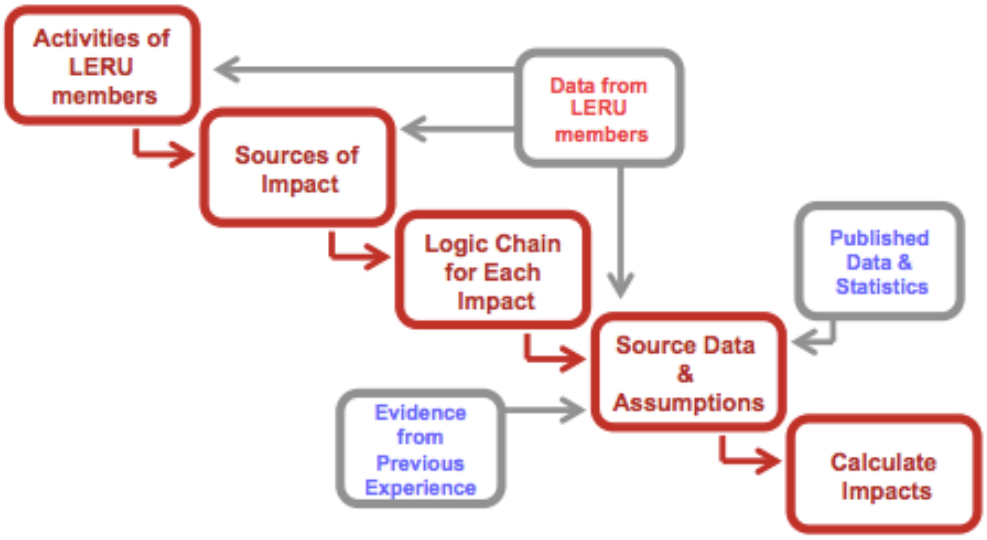
Where possible source data was obtained directly from LERU members. Where this was not possible an appropriate assumption was made based on the data provided by other LERU members and BiGGAR Economics previous relevant experience of other comparable institutions elsewhere in the world. Where it was necessary to make such an assumption and a range of potential values were available the approach taken was to make a conservative assumption. For this reason it is likely that the values reported in this study tend to under rather than over estimate the total contribution of LERU members.

The data required for the general assumptions used in the model was obtained either from published reports, official statistical sources or based on BiGGAR Economics previous experience within the higher education sector. The various sources used are specified in the relevant sections of the report.

This data was then used to populate the economic model and estimate the value of each source of impact for each institution. Each type of impact was then aggregated in order to produce an estimate of the total contribution of all LERU members. This process is illustrated in Figure 3.1.

[8] European Commission (July 2008), *Guide to Cost Benefit Analysis of Investment Projects* [in particular section 2.5 on Economic Analysis] (available at http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide2008_en.pdf)

Figure 3.1 - Approach



Source: BiGGAR Economics

Not all Research Universities in Europe are members of LERU and therefore their impact only represents a fraction of the impact of the sector in Europe. The proportion of the sector represented by LERU was estimated using their proportion of highly competitive research funding and highly influential research publications. The impact of LERU was divided by this percentage to estimate the impact of the Research Universities sector as a whole in Europe.

3.3 Quantifiable Vs Non-Quantifiable Benefits

As far as possible this report has attempted to quantify the economic value generated by LERU members. This value has been quantified using two widely accepted measures of economic impact: jobs and gross value added (GVA).

One of the reasons that these measures are so widely used is because they provide a convenient way of capturing the entire economic contribution of an organisation in a single number. While the appeal of such measures is easy to understand they do suffer from some important limitations.

One of the main limitations of these measures is that they give equal weight to all types of economic activity regardless of their wider value to society. This means that they cannot reflect the fact that some types of activity are intrinsically more valuable to society than others.

3.3.1 Wider Benefits

Through their work LERU employees generate a wide variety of benefits for the European economy and wider society. They help to improve the productivity of the workforce by providing high-quality education and training, stimulate innovation within the business base through their research and enable the development of new economic sectors that will provide the basis for future national competitive advantage.

For example all LERU members are involved in medical research and most work in close collaboration with local hospitals. This research often results in spin-out companies and/or licence deals, the impact of which can be quantified but this is

not always the case. Even when the outputs of medical research are commercialised, it is impossible to quantify the wider benefits that this has for society. Often research undertaken within LERU members is translated directly into clinical practice. Although this has a direct and frequently life-changing effect on patients, these benefits simply cannot be captured in monetary terms.

LERU members also make important contributions to other socially valuable outcomes, such as improving social cohesion, facilitating social mobility and encouraging greater civic engagement. The value of these outcomes to the individuals affected and society as a whole simply cannot be quantified. It is therefore essential that the economic contribution of LERU members is understood as part of this wider context.

3.3.2 Long-term Benefits

Another important limitation of the traditional approaches to assessing economic value is that it fails to take account of dynamic effects in the economy. Much of the activity undertaken by LERU members is focused on long-term outputs that often a long-time to realise – for example it may take many years for the outputs of medial research to be translated into clinical practice. Traditional approaches to economic analysis tend to ignore these time-lags.

For example LERU members are collectively engaged in a wide range of world-leading research that will ultimately provide the foundations for the technologies upon which entirely new economic sectors be based – from new renewable energy technologies to innovative medical devices. Although developing such technologies is fundamental to long-term European competitiveness, it also involves considerable time-lags of the sort that are difficult to account for using traditional approaches to economic impact analysis.

LERU members also generate significant benefits through open innovation – by providing an environment and actively encouraging knowledge transfer between academia and industry. In some cases has led to the development of large-scale innovation hubs (usually focused around university led science parks) that have become important drivers for regional economic growth. This process generally occurs over many years therefore in order to capture the full value generated by LERU members it is necessary to use a dynamic approach to economic analysis.

3.4 Methodology for Estimating Quantifiable Benefits

The methodology used to estimate the economic contribution of the LERU Universities is described in full detail in the Supplementary Methodological Appendix which accompanies this report. The Supplementary Methodological Appendix also contains the main data tables and exchange rates used.

3.4.1 Baseline Year, Measures and Geography

The economic contributions described in this report are for 2014, which is the latest year for which published data on income, staff and students was available from each institution at the time of writing in Spring 2015.

Economic contribution has been reported using two measures:

- Gross Value Added (GVA) is a measure of the value that an organisation, company or industry adds to the economy through its operations. The report used the production approach to measuring this contribution, where the GVA

is equal to the value of production less the value of the inputs used. Typically this is calculated by subtracting the non-labour costs of the organisation from the organisation's total revenue; and

- employment (jobs) is measured in terms of headcount jobs supported unless stated otherwise.

Each area of impact requires the use of three types of economic assumptions:

- GVA to turnover ratio – this is used to estimate the GVA impact of the spend in an area. The ratio for each sector, by country, is obtained from Eurostat;
- turnover per employee – this is used to estimate the employment impact of the spend in area. This is also obtained from Eurostat and is available by sector and for each country; and
- GVA and employment multipliers – these are used to estimate the impact of the initial direct economic contribution elsewhere in the supply chain and through the spending of the salaries associated with the direct economic contribution. These multipliers were calculated by BiGGAR Economics using Eurostat input-output tables for Europe and each of the countries containing the LERU Universities.

Eurostat data was used in order to maintain consistency across countries. The data for the year 2011 was used as this was the most up to date data available from Eurostat.

The economic contributions quantified in this report are those at the level of the European economy. The analysis therefore does not include any economic contributions of the LERU institutions outside Europe (for example, supplies sourced from outside Europe or economic benefits associated with the commercialisation of research findings that take place on other continents).

3.4.2 Number Formats

This report has been produced using UK number formatting, i.e. €1 billion is presented as €1,000,000,000.00 where the symbol for the decimal marker is a point on a line[9]. We appreciate that several of the countries covered by the LERU members use a different format for number presentation. However, we have adopted the convention used in LERU publications as our guide.

3.4.3 Exchange Rates

As the LERU Universities are situated in different countries with differing currencies the relevant exchange rates were applied. The average exchange rate with the Euro for the year 2014 was used and are outlined in Table 3.1.

[9] 22nd General Conference on Weights and Measures, 2003.

Table 3.1 – Average Exchange Rate with Euro in 2014

	Value of 1 Euro
Euro (EUR)	1.00
Sterling (GBP)	0.81
Swedish Krona (SEK)	9.10
Swiss Franc (CHF)	1.21

Source: http://www.oanda.com/currency/average

3.4.4 Avoiding Double Counting

Given the approach summarised in Figure 3.1 above, it has been necessary to make adjustments to some of the calculations, to avoid double counting. So, for example, where a spin-out company from the university also has a license agreement with the university and is based on the science park, the associated impact has been counted only once.

3.4.5 Consistency of Approach and Activities Included

The LERU members are based in several European countries and so there are differences in the national policy environments and in the higher education and research systems in which the universities operate. One of the important principles of the method adopted was to ensure that there was a consistency in the approach to estimating economic impacts, across the systems in which the LERU members operate.

So, for example, in some systems some research activity that would be undertaken by university employees in other systems is undertaken by staff employed directly by national research institutes; so to ensure comparability this activity have been included as part of the economic contribution of the universities.

There are also differences in the scope of activities undertaken by the LERU members. The study focused on those activities that would be most commonly associated with research universities, higher education, research, knowledge exchange and services that support these activities.

Most of the LERU members had some association with a hospital, although there are a wide range of models and legal structures in place. In many cases, the university medical faculties were based wholly or partially at the hospital locations. The economic contributions in this report include medical teaching and research; however, healthcare delivery has been excluded.

3.5 Economic Contribution and the Counterfactual

The question that arises from any study of economic contribution or impact that considers the outputs and impacts delivered by a given set of resources and inputs is what the counterfactual position could have been, that is, what outputs and impacts could have been achieved by using the same resources and inputs in a different way.

This study does not seek to directly compare the economic contribution of research universities with that made by other organisations or sectors. Rather, the counterfactual position is to imagine an alternative situation where the LERU

Universities did not exist and where the activities that they undertake did not take place.

In practical terms, only those economic contributions that can be considered additional and attributable to the Universities have been included. So, for example, the benefits of student part-time work has been included, but adjustments have been made to exclude employment that could have been taken by non-student employees. Where the role of a University has been important in delivering economic benefits, but where other organisations or activities may also have been important drivers (for example, the development of science parks), only a part of the economic contribution has been attributed to the University.

3.6 Sources of Quantifiable Impacts

The economic contributions quantified in this report were based on 18 sources of impact identified and these have been grouped into five themes:

- core contributions, including direct effects, supplier effects, staff spending and capital spending;
- student-related contributions from students spending, working, volunteering and undertaking placements;
- the knowledge transfer, enterprise and innovation activity created by and arising from the LERU Universities;
- the tourism contribution created by visitors to staff and students and attendance at conferences and events held at the Universities; and
- the life-time productivity gains from teaching and learning delivered by each institution (graduate premium).

Methodological notes of each of these sources are provided below, with further details in later chapters as the findings of each contribution are presented.

3.6.1 Direct Effect

The direct effect of any organisation is the value it adds to the economy and the number of jobs it supports in a given time frame. The direct operational GVA of each University was calculated by subtracting all of the non-staff expenditure from the total operational income of the University.

3.6.2 Supplier Effect

Universities have an impact on the wider economy through the purchase of goods and services as this increases turnover and supports employment in the companies that supply them.

The first step in estimating this impact is to estimate how much of the supplier spending occurs in each study area. Across the LERU Universities that provided data for this, on average 98% of supplies were purchased from with Europe. The next step was to categorise the supplier spend data provided by the Universities into the industries used for economic ratios and multipliers.

The spend in each sector supports different GVA depending on the GVA to turnover ratio for that sector. The direct GVA impacts were estimated by multiplying the expenditure in each sector by the appropriate GVA to turnover

ratio. The impact throughout the economy is estimated by applying GVA multipliers appropriate to the sector.

Direct employment was estimated by dividing the direct GVA by the turnover/employment ratio in the industries relevant to the spend. The impact throughout the economy is estimated by applying employment multipliers appropriate to the sector.

3.6.3 Staff Spending

The staff employed by the Universities have an impact on the economy by spending their salaries.

The level of salary paid in each study area was assumed to be proportional to the number of staff that live in each area. Data given by the Universities provided a breakdown of the proportion of staff living in each study area. This was applied to the staff salaries paid by the University in order to estimate how much of the staff spending occurs in each study area.

The second step is an assumption of how much of a person's wage is spent in each study area. This is an assumption about the location of people's expenditure and not an assumption about where the products that are purchased are originally from, as this already accounted for in the economic multipliers. It was assumed that 95% of staff expenditure takes place in the national economy and 99% in Europe.

This allows for an estimate of total staff expenditure in each of the study areas.

The economic contribution of staff spending as measured by GVA and employment supported, is estimated by applying economic assumptions as described in the previous section. It was assumed that staff would spend their salaries across the whole economy, rather than in any particular industry.

3.6.4 Capital Spending

The first step in estimating this impact is to estimate how much of the capital spending occurs in each study area. Where Universities did not provide data it was assumed that all spending was within Europe.

This was applied to the average capital spend of each University over ten years. The economic contribution of this capital spending was estimated by applying economic assumptions for the construction sector to the average capital spend in each study area.

3.6.5 Student Spending

Students create an economic contribution through spending their income in local businesses. The basis for calculating the student spending impact is a study undertaken by the UK Government that considered the level of expenditure of students in the UK. The study gave annual spending figures for students on accommodation, food, travel etc. These figures were adjusted to reflect the cost of living in each of the cities with the member universities and the type of accommodation each student was living in. This expenditure was then converted into economic activity through the relevant industrial ratios.

3.6.6 Student Working

Students also have an impact on the economy through their part time work in local businesses. Universities provided estimates as to the proportion of their student population who also held part time paid employment and approximately the number of hours worked per week. This data was used to calculate the equivalent number of employees in these sectors. The value of the economic activity (GVA) supported by student employment is estimated by applying national ratios of GVA/ employee for the sectors in which students typically work. Not all of the students labour would be additional to the local economy and adjustments were made to reflect the realities of the local youth labour markets.

3.6.7 Student Volunteering

As with student working, students also have an impact on the economy through the voluntary work they undertake with charities and other third sector organisations. Universities provided estimates of the proportion of their student population that volunteered during term time and the approximate number of hours volunteered per week. The value of this non-market activity was represented as a cost saving to the volunteering organisation equivalent to the costs needed to hire employees to undertake the work of volunteers.

3.6.8 Student Placements

Students have an impact on the economy through work they undertake during placements in local businesses as part of their degree programme. Universities provided estimates as to the number of students who undertook work placements during the academic year. The Universities also provided details on the sectors the placements were in and the number of weeks students were on placement. This data was used to calculate the equivalent number of employees in these sectors. The value of the economic activity (GVA) supported by student placements was estimated by applying national ratios of GVA/ employee for the sectors in which students were placed. The productivity of students on placement is likely to be lower than average workers in these sectors and therefore adjustments were made to reflect this.

3.6.9 Licensing

The starting point for calculating the impact generated by licensing activity is to consider the royalties or licence fees that the University receives from licence holders; this reflects the value of the licence to the licence holder. However, as licence holders retain a proportion of the income generated by the licence this income only reflects a proportion of the total value of the technology. In order to estimate the full impact of the technology, it is necessary to estimate how much turnover the licences generate within the license holding company.

The relationship between the royalty paid for a technology and the turnover it generates depends on the details of the licensing agreement and can vary considerably from company to company. In order to agree a licence, negotiators must first form a view of how much the intellectual property (IP) is worth to the prospective licensee.

In 2002 Goldscheider et al[10] undertook further empirical analysis to test the continued validity of the 25% rule. The analysis was based on more than 1,500

[10] Goldscheider, Jarosz and Mulhern (2002), Use of the 25% rule in valuing IP, les Nouvelles.

licensing agreements from 15 different sectors between the late 1980s and the year 2000. The study found that royalty rates ranged between 2.8% in the food sector to 8% in the media and entertainment sector.

The economic contribution of licencing activity undertaken by each University was estimated by applying these royalty rates to the total amount of licensing income received by each academic faculty or department.

The employment supported by this turnover can be estimated by dividing the additional turnover generated by an estimate of turnover per employment for the relevant sector. The GVA of the licensing activity can be estimated by multiplying the additional turnover by an estimate of the GVA/turnover ratio for the relevant sector.

3.6.10 Consultancy and Contract and Collaborative Research

These services support businesses by enabling them to undertake activity that they may not have the skills or facilities to undertake in-house. It is reasonable to assume that the businesses that commissioned consultancy or contract research projects would only have done so if they expected these projects to generate positive returns.

There have been several ex-post evaluations of programmes that support and encourage consultancy and contract and collaborative research, with findings suggesting that the benefit to the organisations engaging with universities in this way have been several multiples of the investment cost.

The GVA impact of consultancy/contract and collaborative research was estimated by multiplying the amount Universities receive from these services by 3.60, based on the evidence from such evaluations. The employment impact was then estimated by dividing the direct GVA impact by GVA/employee in relevant sectors and the indirect effects were captured by applying appropriate multipliers.

3.6.11 Workforce Training

The economic contribution of workforce training is calculated in the exact same way as consultancy, contract and collaborative research. However, as this would be considered business investment in personal productivity, rather than products or processes, there is no employment impact.

3.6.12 Spin-outs and Start-ups

By creating new businesses the universities support economic activities. Data was requested from the Universities regarding the name, employment and turnover figures for their start-up and spin-out companies. However, for many of the Universities the employment and turnover figures were not available and therefore assumptions had to be made.

The first key assumption to make was regarding the average employment levels in the companies that had neither employment or turnover data given. This average was estimated by considering the companies that this information was available for. However, there is likely to be a bias in the selection of companies that have reported their employment, as larger and more successful companies are more likely to report this data. The reported figure was reduced by 33% to take account of this bias. The average employment of these companies was therefore 9.2 jobs per spin-out/start-up.

The direct economic contribution of each of the spin-out and start-up companies was calculated based either on the turnover data supplied, or on the direct employment data supplied. The companies that provided revenue data and not employment data had their employment estimated based on the appropriate ratios for their sector. Companies that supplied no information were assumed to have the average employment per spin out (9.2).

This employment was then applied to the GVA/Employment figure for the appropriate industry in the country they were based. If no appropriate sector was given it was assumed that the company operated in the professional, scientific and technical activities sector. Sector-specific multipliers were then applied to estimate the total contribution.

3.6.13 Research and Science Parks

By creating business space and promoting cluster development the Universities support economic activities. Data was requested from the Universities regarding the name, employment and turnover figures for the tenants of their research and science parks.

Each University's science park tenants was then cross referenced with their start-ups and spin-outs and any start-ups and spin-outs were excluded to avoid double counting.

The main assumption to be made was how much of the economic activity that was created at these research and science parks could be attributable to the Universities. Many of the companies would have found properties elsewhere in the country if the research and science parks were not available. Larger companies that did chose to move into the country as a result of the park would have been likely to find somewhere else in Europe to operate if that particular science park was not available.

Previous studies by BiGGAR Economics, particularly one carried out for the University of Surrey in 2013, found that approximately 1/3 of the economic activity in the Science Park was attributable to the University. As the additionality for Europe would be less than that for the individual countries, this was assumed to be 20%. These additionality assumptions were applied to each country.

The direct economic contribution of each of the tenants was calculated based either on the turnover data supplied, or on the direct employment given. The companies that provided turnover data and not employment data had their employment estimated based on the appropriate ratios for their sector.

The economic contribution of the research and science parks was estimated by applying economic assumptions for the professional, scientific and technical activities sector.

3.6.14 Staff Volunteering

Staff at the Universities also have an impact on the local economy through volunteering, using their skills and experience to support local charities and third sector organisations. The proportion of time that staff contribute to such activity was not provided by the Universities. However, based on consultations with some of the LERU members that had previously made estimates of such activity and previous work by BiGGAR Economics it was assumed that staff work on social and voluntary activities is equivalent to 7.5% of working hours (approximately 2.5 hours per week). As with the student volunteers, the value of

this non-market activity was represented as a cost saving to these organisations. The costs which would be associated with this, if the public and charitable bodies were to pay equivalently qualified people, is equivalent to 7.5% of the total staff costs of all member Universities.

3.6.15 Tourism: Visiting Friends and Relatives

It is expected that friends and family who are not normally resident in the local area will visit staff and students of each University.

In order to calculate this impact it is necessary to estimate the number of visits from friends and relatives (VFR) that students and staff will receive. Eurostat compile data on the number of VFR trips from visitors.

The number of VFR trips per person is multiplied by the number of students and staff at the University to provide an estimate of the number of visits stimulated by the Universities.

This total number of visits is multiplied by the average spend of tourists on a visiting friends and families trip. Data on average tourist spend for VFR trips is sourced from Eurostat for each country. The impact of this visitor spend is estimated by applying the economic assumptions for the industries of tourism expenditure (accommodation and food service activities & wholesale and retail trade; repair of motor vehicles and motorcycles).

3.6.16 Tourism: Conferences and Events

The Universities provided data on the number of delegates attending conferences and events that they hosted throughout the year. These delegates are additional to the area and would contribute to the tourism economy through their expenditure outwith the University. The delegates who were employees of the Universities were not included in the analysis as their expenditure would not be additional and would have been considered in the section on staff spending.

Not all the Universities collated information on conference and event attendees, therefore estimates needed to be made in order to estimate the economic contribution of their activity. This was done by calculating the average number of conference attendees per fte based on the LERU Universities that reported their conference attendances and applying this to the number of fte staff at the University.

Average trip spend for a business visitor (sourced from Eurostat) was then applied to the number of additional attendees (i.e. excluding staff delegates) in order to estimate additional turnover generated. This is converted to GVA and employment by using appropriate ratios and multipliers.

3.6.17 Graduate Premium

The Universities provided data on the number of students graduating in 2014 by subject area and level of study. The earnings premium varies between subjects and the additional lifetime earnings of students, by subject area, was taken from a study undertaken by the UK Government into the graduate premium. This premium was adjusted between the countries of the member institutions to reflect the differences in the national labour markets. The graduate premium for each country was applied to the graduates in each country by subject area to estimate the overall graduate premium supported by learning at each institution.

4 UNIVERSITY DRIVEN GROWTH

Universities are recognised throughout the world as one of the critical drivers of economic growth. The growth of advanced economies has been associated with a growing role for universities, providing the intellectual and human capital required for a successful modern economy. This chapter examines the role of universities in underpinning growth by discussing how knowledge and innovation contribute to productivity growth and therefore economic growth and the various ways that universities impact the economy.

4.1 Theoretical Foundations

As producers of highly-skilled graduates and postgraduates, generators of world-class research and development and located at the centre of industry clusters universities contribute to economic growth. In recent years a number of influential economists have published works that set out a theoretical and empirical case for the role that high level skills and innovation play in both boosting economic competitiveness and addressing inequality in society.

In the late 1950s Robert Solow published papers that showed that it was not the savings rate or increases in the factors of production (labour and capital) that determined the long-run growth rate, but increases in productivity. In the early 1960s Kenneth Arrow published papers on research and development and on learning by doing, which showed that almost all economic growth could be accounted for by innovation, both new ideas emerging from research and improving productivity through learning by doing during the process of production itself.

Building on this, the Nobel prize winning economist Joseph Stiglitz[11] has argued that productivity is the result of learning and consequently, a focal point of policy should be to increase learning within the economy. The observation is made that even within countries and within industries there can be large gaps between the most productive and the others. This means that the diffusion of knowledge is as important as pushing the boundaries of knowledge. Moreover, since productivity growth is what drives growth in the economy, this indicates that there is considerable scope for higher rates of economic growth. As an illustration of this, of the productivity growth that took place in the UK between 2000 and 2008, nearly one third was attributable to changes in technology resulting from science and innovation.[12]

The scale of knowledge and innovation that takes place is also important because there are dynamic effects that come into play. New knowledge and innovation (the diffusion of knowledge) are both based on the foundations of prior knowledge and high levels of investment in knowledge and innovation give rise to an accelerating pace of innovation. In contrast, cutting levels of investment in knowledge and innovation, will mean that the pace of innovation slows because underinvestment compounds over time.

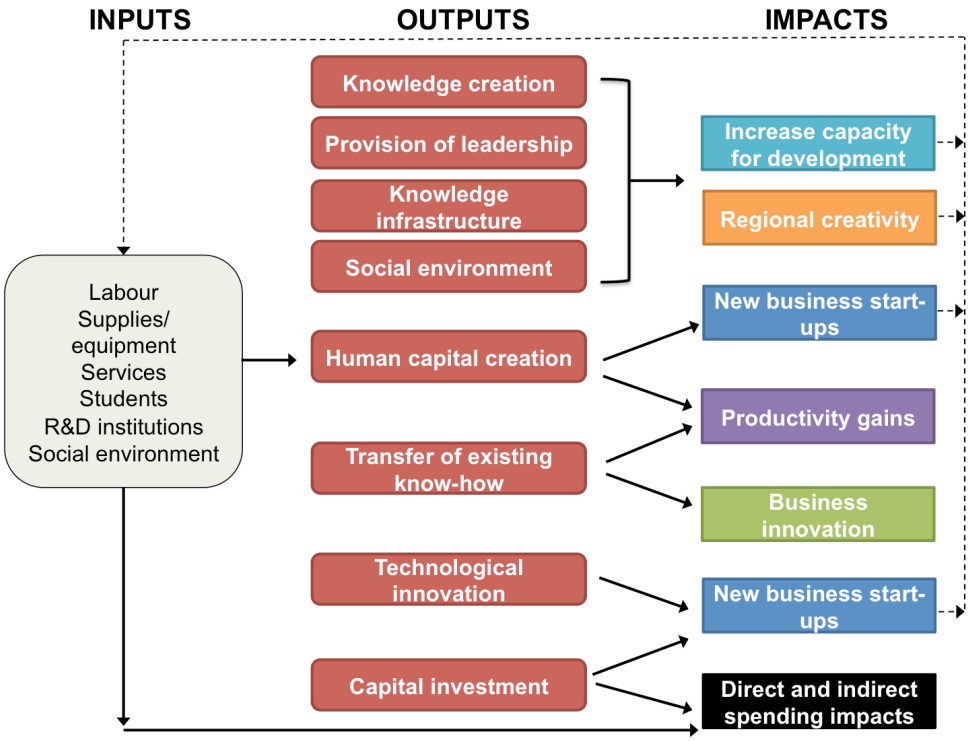
[11] Stiglitz and Greenwald (2014), *Creating a Learning Society: A New Approach to Growth, Development, and Social Progress*.
[12] HM Treasury, Department for Business, Innovation & Skills (2014), *Our Plan for Growth: Science and Innovation*.

In summary, knowledge and innovation are fundamental to economic growth, since it is productivity growth that drives economic growth and productivity growth is in turn driven by knowledge and its diffusion (innovation).

4.2 The Impact of Universities on the Economy

Universities have wide and far-reaching impacts on the economy, which are often interrelated. The outputs and direct and indirect positive economic impacts associated with the main activities that universities undertake are illustrated in Figure 4.1.

Figure 4.1: University Outputs and Expected Economic Impacts



Source: Goldstein and Renault (2004), Contributions of Universities to Regional Economic Development: A Quasi-Experimental Approach.

4.2.1 Knowledge and Human Capital Creation

The two fundamental activities of universities are the creation of intellectual and human capital. Universities contribute to knowledge creation through the basic and applied research that is undertaken. The most influential technologies today and the technologies of the future arise out of this research. Universities also provide high quality graduates for the labour market which in turn increases the innovation potential of the economy, as well as leading to productivity gains for the economy.

4.2.2 Transfer of Existing Knowledge and Technological Innovation

Over and above these fundamental activities universities also work to transfer existing knowledge throughout the economy through their interactions with businesses such as through consultancy and workforce training, which increases productivity and business innovation. Universities are also a vital source of

technological innovation through the commercialisation activities that they undertake such as spin-out companies and intellectual property licensing.

4.2.3 Knowledge Infrastructure

Universities also have a role to play in the production of knowledge infrastructures, which largely arise due to positive agglomeration effects. As an example, many research institutes, and companies choose to locate in close proximity to research intensive universities in order to benefit from informal knowledge sharing as well as frequent face-to face contact with academics involved in research. It is for this reason that cities with universities also have large numbers of associated knowledge infrastructures such as research institutes and science parks, which can ultimately develop into knowledge clusters.

4.2.4 Provision of Leadership

Many universities play an important leadership role regionally and nationally, through their involvement in the advisory boards of private, public and non-profit organisations. This ensures a coordinated economic development approach helping to match skills with regional needs and vice versa.

4.2.5 Social Environment – The University Ecosystem

Finally universities can have a number of impacts on the local environment. The staff and student base provided by the universities undoubtedly contributes to the overall vibrancy of the cities they are located in.

In addition to adding to the quality of the local environment, universities contribute to the attractiveness of a region as a knowledge centre. This wider role of universities in underpinning the economy is something that should not be overlooked. Universities provide a space for discussion and create connections between academia, students and companies that would not otherwise exist and therefore foster an environment for innovation. This creates clusters of people, which lead to the creation of entire university ecosystems, which in turn draw more people.

The further impact of the university ecosystem is that it makes these regions the most attractive places to invest and universities are, as a result, vital to drawing inward investment. This is particularly important as the market for inward investment is globally competitive: a competitiveness that is increasing with the research and development being poured into Asia. The international dimension of the research undertaken at universities and the international character of the institutions themselves therefore contributes to improving Europe's brand as a whole, making Europe more interlinked and providing opportunities for Europe to have partnerships with the wider world by attracting inward investment.

The university ecosystem is entirely built on the world-class research undertaken at universities and it is this world-class research that attracts companies and investment into a region, helping to catalyse innovation in local businesses. The fundamental research undertaken at universities therefore creates the knowledge sectors of the future. A Europe without this world-class research base would consequently be a Europe devoid of these knowledge industries.

5 CORE CONTRIBUTION

The core contribution covered in this chapter includes:

- the direct effect (income and employment);
- the supplier effect (contribution of expenditure on supplies and services and jobs supported by this spend);
- the income effect (contribution of staff spending); and
- the capital spending effect.

5.1 Direct Effect

The direct contribution of any organisation or group of organisations is the value it adds to the economy and the number of jobs it supports in a given time frame. The value an organisation adds to the economy is measured using Gross Value Added (GVA), which can be estimated by subtracting all of the non-staff operating expenditure from the total operational income of the University.

The GVA and employment directly supported by the LERU Universities is shown in Tables 5.1 to 5.3.

Table 5.1: The LERU Universities – Inputs for Income

	Total (€ bn)
Teaching	4.9
Research	7.4
Other	3.9
Total Income	**16.3**

Source: The LERU Universities

Table 5.2: The LERU Universities – Inputs for GVA

	Total (€ bn)
Total Income	16.3
Less Expenditure on Supplies	4.2
Direct GVA	**12.1**

Source: The LERU Universities

Table 5.3: The LERU Universities – Inputs for Employment

	Total
Employment (headcount)	186,580
Employment (FTE)	158,335

Source: The LERU Universities

In 2014, the LERU Universities had a total income of €16.3 billion, just under half of which was research income. Total expenditure on supplies by the LERU Universities amounted to €4.2 billion. The direct GVA of the LERU Universities is therefore estimated to be €12.1 billion across Europe with the LERU Universities

directly supporting 158,335 jobs. The further effects arising from this employment and level of output are estimated in the next section.

5.2 Spending on Supplies

The supplier effect is the contribution occurring from buying in goods and services since these purchases generate GVA and support employment in businesses that supply the LERU Universities.

The inputs used to calculate the supplier effect are shown in Table 5.4. As not all of the LERU Universities were able to provide data about the location of their suppliers, for the Universities that were unable to the average of the provided data was used.

Table 5.4: The LERU Universities – Inputs for Spending on Supplies

	Value	Source
Expenditure on Supplies	€4.2 bn	The LERU Universities
Location of Suppliers		
Europe	98%	The LERU Universities and BiGGAR Economics calculation based on data provided
Outside Europe	2%	

A further round of GVA and employment is supported indirectly by the businesses that supply goods and services to the LERU Universities and this is calculated using multipliers for all industries as a whole. It is assumed that a large proportion of this further round of spending is retained in Europe therefore the indirect effect is relatively large for this area.

The total supplier effect for the LERU Universities is shown in Table 5.5.

Table 5.5: The LERU Universities – Contribution from Spending on Supplies

Europe	GVA (€ bn)	Employment (jobs)
Contribution from Spending on Supplies	4.4	90,408

Source: BiGGAR Economics Analysis

5.3 Staff Spending

The staff employed directly by the LERU Universities spend their wages and salaries in the wider economies and this also increases turnover and supports employment both in businesses near the universities and throughout Europe as a whole.

This effect can be estimated by assessing the amount of wages spent by staff from each institution, based on the number of employees and where they live. The key inputs used in calculating this contribution are shown in Table 5.6.

Table 5.6: The LERU Universities – Inputs for Staff Spending

Staff Numbers	Value	Source
Number of Employees (fte)	158,335	The LERU Universities
Staff Salaries	€8.1 bn	
Salaries as % of staff costs	80%	
Staff Location		
Europe	100%	The LERU Universities
Location of Spending		
Europe	99%	BiGGAR Economics Assumption

These expenditure figures can then be converted into a GVA contribution by applying an appropriate turnover/GVA ratio, which has the effect of excluding taxation paid by employees from the contribution estimates. The income effect estimated here is therefore a conservative estimate since it excludes the contribution of employees to the provision of public services paid for from Government taxation receipts.

The resulting employment contributions are calculated by dividing the GVA contribution by an estimate of the average GVA/employee and finally multipliers are applied to capture the indirect effects of subsequent spending rounds.

This results in a staff spending contribution of €5.6 billion GVA and 99,652 jobs in Europe as a whole. This is summarised in Table 5.7.

Table 5.7: The LERU Universities – Contribution from Staff Spending

Europe	GVA (€ bn)	Employment
Staff Spending Contribution	5.6	99,652

Source: BiGGAR Economics Analysis

5.4 Capital Spending Contribution

Over the ten year period from 2009 to 2019, average annual spending on capital projects by the LERU Universities was anticipated to be €1.5 billion. As the nature of the capital projects will vary from year to year, this average annual expenditure figure reflects the fact that most universities periodically invest in major capital development projects over the longer term.

Capital spending provides an important income stream for the regional construction sector and it is possible to convert this into GVA by applying a turnover to GVA ratio for the construction sector as a whole. The employment contribution of this expenditure is estimated by dividing the GVA contribution by an estimate of average GVA per employee in the construction sector.

The indirect contribution of the construction expenditure can then be calculated by applying GVA and employment multipliers for the construction sector. In this way it can be estimated that the total contribution made by the LERU Universities to the construction sector amounts to €1.8 billion GVA and supports 27,288 jobs across Europe as a whole.

The inputs used in calculating this contribution are summarised in Table 5.8 and the results are summarised in Table 5.9. As not all of the LERU Universities were able to provide data about the location of their capital suppliers, for the Universities that were unable to, the average of the provided data was used or the location breakdown of general suppliers.

Table 5.8: The LERU Universities – Inputs for Capital Spending

Capital Spending	Value	Source
Average Annual Capital Expenditure, 2009-2019	€1.5 bn	The LERU Universities
Location of Capital Suppliers		
Europe	98%	The LERU Universities and BiGGAR Economics calculation based on data provided
Outside Europe	2%	

Table 5.9: The LERU Universities – Contribution from Capital Spending

Europe	GVA (€ bn)	Employment
Capital Spending Contribution	1.8	27,288

Source: BiGGAR Economics Analysis

5.5 Summary of Core Contributions

The contributions associated with the core activity of receiving income, supporting employment, spending on goods and services and spending on capital projects results in an estimated contribution of €23.9 billion in GVA and 375,683 jobs in Europe as a whole. These figures include the multiplier effects of the core activity.

The core contributions are summarised in Table 5.10.

Table 5.10: The LERU Universities – Core Contribution Summary

Europe	GVA (€ bn)	Employment
Direct Contribution	12.1	158,335
Supplier Contribution	4.4	90,408
Staff Spending Contribution	5.6	99,652
Capital Spend Contribution	1.8	27,288
Total Core Contribution	**23.9**	**375,683**

Source: BiGGAR Economics Analysis

6 STUDENT CONTRIBUTION

The contributions covered in this chapter are those associated with students whilst studying, including:

- student spending;
- the contribution arising from students working part-time;
- student volunteering; and
- student placements.

6.1 Student Population

The combined student population of all 21 universities is greater than some European capitals. Two thirds of students at these Universities are studying for undergraduate degrees and the remaining students studying for postgraduate degrees.

This report only considers the economic contribution associated with the full time students of an institution.

Table 6.1: The Student Population

	Total
Undergraduate (full time)	448,124
Postgraduate (full time)	226,368
Total (full time)	**674,492**

Source: The LERU Universities

6.2 Student Spending

Students create an economic contribution through spending their income in local businesses. In turn these businesses are able to employ more people which creates further multiplier effects in the local economies.

The basis for calculating the student spending impact is a study undertaken by the UK Government[13] that considered the level of expenditure of students in the UK. This report considered the expenditure of students on different commodities, including accommodation, entertainment and food costs.

As the costs of living vary from city to city, the expenditure of students is likely to vary considerably between the LERU Universities. In order to reflect this, the expenditure per category for London as given in the UK Government report, was adjusted to reflect the comparative cost of living for each city. This was calculated using the Consumer Price Index (CPI) and Rent Index (RI) for each city. This provided an expenditure profile for each city which was applied to the number of students at each University. The expenditure on accommodation was treated separately to the other aspects of student expenditure and a minimum monthly expenditure on rent was set at €275.

[13] Department for Business, Innovation & Skills (2012), *Student Income & Expenditure Survey 2011/12*.

These estimates imply that, on average, students will require €7,943 per year to cover housing, living and social costs while studying. The key inputs used in making these calculations are shown in Table 6.2.

Table 6.2: The LERU Universities – Inputs for Student Spending

	Value	Source
Total number of students	674,492	The LERU Universities
Annual Student Expenditure Profile		
Accommodation*	21%	BiGGAR Economics calculation based on Department of Business, Innovation and Skills, *Student Income & Expenditure Survey 2011/12* and CPI and Rent Indices
Food/ Household Expenses	19%	
Travel	21%	
Entertainment	10%	
Course Costs (e.g. books, equipment)	6%	
Other	22%	
Total	100%	
Average Student Expenditure per year	€7,943	
Term-time Residence		
Europe	100%	BiGGAR Economics Assumption
Time on Campus		
Undergraduates (per year)	9 months	BiGGAR Economics Assumption
Postgraduates (per year)	12 months	

** Excludes rent paid to universities*

We then calculate how much GVA this level of expenditure provides and how many jobs it supports across the relevant sectors of the economies using national level input-output ratios for each sector. The Supplementary Methodological Appendix provides a more detailed description of the methodology used. These ratios vary for each sector depending on the relative amount of capital and labour involved in generating output from each one.

A further round of GVA and employment is then supported indirectly through this level of spending (the indirect effect) and this is estimated by applying sector-specific multipliers to the direct contribution. Finally, these figures are added together to estimate the total contribution of student spending. The results are shown in Table 6.3.

Table 6.3: The LERU Universities – Contribution from Student Spending

Europe	GVA (€ bn)	Employment
Student Spending Contribution	5.2	93,100

Source: BiGGAR Economics Analysis

This results in a student spending contribution of €5.2 billion GVA and 93,100 jobs in Europe as a whole.

6.3 Part-time Work

Students working part-time can make an important contribution to their local labour markets by helping local businesses and organisations to deliver their goods and services. Data provided by the LERU Universities indicates that on average, 42% of full-time students work to supplement their income and that 2% of these jobs are with the LERU Universities. The economic activity supported by this 2% has been captured in the direct contribution analysis in the previous chapter, therefore these jobs have been excluded from this section of the analysis to avoid double counting.

It is reasonable to assume that some of these jobs may otherwise have been filled by non-students. In order to reflect this we have taken account of local labour market conditions by using the youth unemployment rate in each city as an indicator of the availability of replacement labour. The additionality of student labour is therefore assumed to be inversely proportional to the youth unemployment rate. On average, it is assumed that 69% of student part-time employment is additional. (See Supplementary Methodological Appendix for a full explanation of how this has been calculated.)

The analysis of the contribution of part-time work is based on the number of students living around each University as it is assumed that students take part-time jobs locally to where they live. The key inputs used in calculating the contribution of student part-time work are shown in Table 6.4.

Table 6.4: The LERU Universities – Inputs for Student Part-time Working

	Value	Source
Number of Students	674,492	The LERU Universities
Proportion of students who undertake part-time work	43%	
Proportion of students who undertake part-time work with the LERU Universities	2%	
Average hours worked per week	11.5	
Average additionality of part-time work	69%	BiGGAR Economics calculation based on youth unemployment rates

The value of the additional economic activity (GVA) supported by student employment is estimated by applying national ratios of GVA/ employee for the sectors in which students typically work. A further round of GVA and employment is then supported indirectly through this level of spending (the indirect effect) and this is estimated by applying sector-specific multipliers to the direct contribution.

This results in a total contribution from student employment of €3.9 billion GVA and 117,714 jobs throughout Europe (Table 6.5).

Table 6.5: The LERU Universities – Contribution from Student Part-time Working

Europe	GVA (€ bn)	Employment
Student Working Contribution	3.9	117,714

Source: BiGGAR Economics Analysis

6.4 Student Volunteering

Students have an impact on society through volunteering. Some of the LERU Universities were able to provide data about the number of students who undertake volunteering activities. Based on this, on average approximately 6.9% of students volunteer in the area where they study. Part of the value of this student volunteering can be captured quantitatively by estimating the number of student hours that were contributed towards volunteering. This contribution was only estimated for the LERU Universities that were able to provide information about the number of students who volunteer.

Table 6.6: The LERU Universities – Inputs for Student Volunteering

	Value	Source
Number of Students	674,492	The LERU Universities
Proportion of students who undertake voluntary work (on average)	6.9%	

The value of the hours volunteered to the organisations is estimated by multiplying the total number of hours volunteered by the wage that would be normally paid to a student. These inputs result in an estimate of the value of student volunteering of at least €24.6 million GVA across Europe. The nature of this type of activity is that it will contribute to increasing the productivity of the organisation volunteered for (by contributing to service provision) and will therefore be a GVA impact rather than an employment impact.

Table 6.7: The LERU Universities – Contribution from Student Volunteering

Europe	GVA (€ mn)
Student Volunteering Contribution	24.6

Source: BiGGAR Economics Analysis

However, in practice the value of student volunteering is greater than this figure suggests as the calculations are only a crude method which captures the value of the students' time. It does not reflect the wider community benefits such as:

- the value of the volunteering to the service supported as many organisations could not run without these additional volunteers;
- the value of the services to the people who use them; and
- the value of the impacts on service users, as improvements in health and wellbeing will result in cost savings in health and social services.

6.5 Student Placements

A number of degree programmes require students to undertake work placements and these have an impact on the economy through the students' contribution to the organisations they are placed with. Only placements that are longer than 12 weeks have been considered, as shorter placements would not allow students enough time to learn about the organisation's activity sufficiently well to make an effective contribution.

The contribution of these students to the organisations they are placed in is lower than the average output that would be expected by a worker due to a student having less experience and therefore being less productive. To reflect this it is assumed that the GVA of students on placement is 50% of the average workers' GVA. The impact of these placements has been estimated by applying this percentage to the weekly GVA per employee and then to the number of weeks that the placements last.

Table 6.8: The LERU Universities – Inputs for Student Placements

	Value	Source
Number of students on placement (medical)	22,001	The LERU Universities
Number of students on placement (non-medical)	22,786	
Minimum number of weeks on placement	12	
Productivity as % worker	50%	BiGGAR Economics Assumption

Applying appropriate economic ratios and multipliers as explained in the Supplementary Methodological Appendix, this results in a contribution of €0.5 billion GVA and 9,370 jobs across Europe as a whole (Table 6.9).

Table 6.9: The LERU Universities – Contribution from Student Placements

Europe	GVA (€ bn)	Employment
Student Placements Contribution	0.5	9,370

Source: BiGGAR Economics Analysis

6.6 Summary of Student Contributions

The economic value associated with student spending, student employment, student volunteering and student placements is estimated at €9.7 billion in GVA and 220,184 jobs across Europe (Table 6.10).

Table 6.10: The LERU Universities – Economic Contribution from Student Activities

Europe	GVA (€ bn)	Employment
Student Spending	5.2	93,100
Student Working	3.9	117,714
Student Volunteering	0.02	-
Student Placements	0.5	9,370
Total Student Contribution	**9.7**	**220,184**

Source: BiGGAR Economics Analysis

6.7 International Education and Export Earnings

The above analysis includes the economic contributions of all students at LERU Universities. These include significant numbers of students from outside the EU and Switzerland.

The impacts associated with students that come from outside the EU could be considered exports. A recent study published UniversitiesUK[14] found that each non-EU student that came to study at UK universities contributed £24,028 to the UK economy and supported 0.45 fte jobs. The average expenditure per non-EU student was £23,692 per annum, of which £12,408 was paid to the universities in fees and accommodation.

There are approximately 57,100 non-EU students studying at LERU universities throughout Europe. The tuition fees charged to overseas students vary between countries and between institutions within countries; taking this into account it has been estimated that 57,100 non-EU students pay a total of €692 million in tuition fees to LERU Universities. In addition to this, non-EU students spend an estimated €976 million off campus, including on accommodation.

The total spend of international students at LERU Universities on and off campus is therefore approximately €1.7 billion, significant export earnings for the European economy.

[14] UniversitiesUK (April 2014), *The Impact of Universities on the UK Economy*

7 KNOWLEDGE TRANSFER, ENTERPRISE AND INNOVATION

This section considers the contribution of knowledge transfer, enterprise and innovation occurring in the economy due to the activities of the LERU Universities. This is often referred to as commercialisation or valorisation activity. It relates to the concept of capitalising on the research, technology and skills within the work of the LERU Universities and transferring the benefits more widely through the creation of new businesses and opportunities outside the organisations.[15]

Specifically, we have considered the contribution of seven key aspects of knowledge transfer, enterprise and innovation that can reasonably be quantified:

- licensing;
- consultancy income;
- contract and collaborative research;
- start-up and spin-out companies;
- research and science park activity;
- workforce training (CPD); and
- staff volunteering.

7.1 Licensing

One of the main ways in which research activity is translated into economic activity is through licensing agreements with industry. Licence agreements give companies the legal right to use a particular technology or other type of intellectual property (IP) to generate additional sales, reduce costs or otherwise improve their profitability. In return, companies pay royalties to the LERU Universities.

The amount of royalties paid depends on the details of the licensing agreement and this can vary considerably between agreements. In order to agree a licensing deal, negotiators must first form a view of how much the IP is worth to the prospective licensee. There are a wide variety of variables that may inform this judgement including potential risks to the company, the technology's stage of development and any capital investment that might be required and market conditions.

In 2014, the LERU Universities earned €135.6 million in royalty income from licence agreements for technologies. Some of the LERU Universities were able to provide data about the location of licence holders. For those that could not, the average of this data was used. Analysis of these licence agreements found that 46% of licence income came from licence holders based in Europe and the remaining 54% are licensed to companies located elsewhere in the world.

[15] See Section 3 for further discussion on how universities create economic impact through knowledge transfer.

Table 7.1: The LERU Universities – Inputs for the Value of Licensing

	Value	Source
Licensing Income	€135.6 mn	The LERU Universities
Companies located in Europe	46%	
Companies located outside Europe	54%	

The Supplementary Methodological Appendix describes the methodology used to convert this into turnover and then into economic contribution.

In this way it can be estimated that the licensing activity of the LERU Universities contributes €0.8 billion GVA to the economy of Europe and supports 11,268 jobs. This contribution and the inputs used to calculate it are summarised in Tables 7.1 and 7.2.

Table 7.2: The LERU Universities – Contribution from Licensing

Europe	GVA (€ bn)	Employment
Licensing Contribution	0.8	11,268

Source: BiGGAR Economics Analysis

7.2 Consultancy

Businesses and organisations benefit from academic knowledge through contracting the universities to undertake consultancy projects.

In order to estimate the economic contribution of consultancy work it was necessary to estimate the total income to each University from consultancy contracts. Different universities have different approaches to dealing with consultancy undertaken by academic staff. Some universities collate the data as the contracts are officially taken out through the University, while others have no insight into the consultancy contracts undertaken by staff as these are considered private. As a result of these different approaches not all Universities were able to supply consultancy data.

The total income from those LERU Universities that did report it was €204.3 million. In order to estimate the income from the remaining universities it was assumed that the income from consultancy would be related to the number of staff. The universities that reported consultancy income had a combined staff of 69,791 ftes, therefore the average consultancy income per fte was €2,927. It was assumed that those who were able to report this data had a more established consultancy programme. However, those LERU Universities that did not report consultancy were likely to still have consultancy activity, although not as much. Therefore the average consultancy income per fte was halved to €1,464 and applied to the remaining universities to give a total income of €325.0 million, the majority of which came from contracts with companies based in Europe.

Table 7.3: The LERU Universities – Inputs for the Value of Consultancy

	Value	Source
Given Income from Consultancy	€204.3 mn	The LERU Universities
Adjusted Average Consultancy Income per fte (based on those providing data)	€1,464	BiGGAR Economics calculation based on data provided
Total Estimated Income from Consultancy	€333.8 mn	BiGGAR Economics calculation based on adjusted average consultancy income per fte
Direct GVA contribution from Research	360%	BiGGAR Economics previous research

The method used for estimating the economic contribution made by consultancy contracts is explained in detail in the Supplementary Methodological Appendix.

In this way it can be estimated that consultancy projects at the LERU Universities contribute €3.3 billion GVA and supports 48,005 jobs across Europe.

Table 7.4: The LERU Universities – Economic Contribution from Consultancy Activity

Europe	GVA (€ bn)	Employment
Contribution from Consultancy	3.3	48,005

Source: BiGGAR Economics Analysis

7.3 Contract and Collaborative Research

The benefits of the research activity undertaken by the LERU Universities are not restricted to activity directly undertaken by academic researchers but also include the benefits of contract and collaborative research ventures with partners both nationally and internationally. Although the extent of this effect is difficult to quantify, contract and collaborative research is of such importance to the LERU Universities that it is essential that this contribution be considered.

An important feature of academic research is that it does not typically represent the final stage of the technology development process i.e. in general it tends to be focused at an intermediate stage in the technology development cycle and is unlikely to lead to immediate full scale commercial production or application.

In order for the full results of such research to be realised, it is normally necessary for industrial partners to undertake further development work. The amount of subsequent research investment required will depend on the readiness level of the technology concerned and is likely to vary significantly between projects and could amount to many times the original investment.

It is possible to estimate how much contract and collaborative research is worth to the economy based on the amount of income the LERU Universities secure from industry each year. In 2014 the LERU Universities received €1.3 billion in contract and collaborative research income. This income represents direct investment by private companies in research undertaken by academic

researchers. It is then possible to calculate the value of this activity to the European economy by applying an assumed multiplier for the relevant group of industries.

Previous studies by BiGGAR Economics have found that companies that were involved in research contracts with universities generate an average of 360% direct GVA contribution over time to their investment in research. The increased GVA in these companies is accompanied by increased employment. These inputs and assumptions were used to calculate the direct contribution of private investment in research and development at the universities. The total economic contribution was then calculated based on the appropriate multipliers and ratios for the industries involved.

The inputs used to estimate the economic contribution of contract and collaborative research are presented in Table 7.5.

Table 7.5: The LERU Universities – Inputs for the Value of Contract and Collaborative Research

	Value	Source
Contract Research Income	€1.3 bn	The LERU Universities
Research Income from Europe	76%	
Research Income from outside Europe	24%	
Direct GVA Contribution from Research	360%	BiGGAR Economics previous research

In this way it can be estimated that industrial spillover effects attributable to the LERU Universities contribute €10.9 billion GVA to the European economy each year and support 154,733 jobs. This is summarised in Table 6.6.

Table 7.6: The LERU Universities – Contribution from Contract and Collaborative Research

Europe	GVA (€ bn)	Employment
Contract Research Contribution	10.9	154,733

Source: BiGGAR Economics Analysis

7.4 Start-ups and Spin-outs

The LERU Universities contribute to their national economies through the creation of start-up and spin-out companies. Chapter 3 contains a discussion on the way in which universities can contribute to wider economic development in the regions in which they are located.

Across the LERU members it has been estimated that there are 1,155 start-up and spin-out companies across Europe. The economic contribution to GVA that stems from this group of companies is found by estimating the level of employment in each one and then converting this into turnover by applying industry ratios. The contribution to GVA is found by then applying the relevant GVA/employment ratios. The indirect contribution is calculated by applying sector-specific multipliers to these base figures.

Table 7.7: The LERU Universities – Inputs for the Value of Start-ups and Spin-outs

	Value	Source
Number of Start-ups/ Spin-outs	1,155	The LERU Universities
Average Employment per Company	8.7	BiGGAR Economics calculation based on data provided

The contribution of start-ups and spin-outs is therefore estimated at €2.7 billion GVA and 38,465 jobs across Europe.

Table 7.8: The LERU Universities – Contribution from Start-ups and Spin-outs

Europe	GVA (€ bn)	Employment
Start-ups and Spin-outs Contribution	2.7	38,465

Source: BiGGAR Economics Analysis

7.5 Research and Science Parks

Many LERU members are closely associated with a particular science park. In most cases these science parks have been established directly by the University, often in collaboration with important research (e.g. university hospitals) and economic development partners (e.g. regional government). Some of these parks are extremely large and well established while others have been developed more recently but all of them have been designed with the specific intention of providing a physical focus for knowledge exchange between academia and industry.

The science parks associated with LERU members all provide a physical environment in which researchers working in academia and the private sector can meet and exchange ideas with one another. This helps to stimulate new ideas and facilitate opportunities for collaborative research.

In most cases the science parks also incorporate physical infrastructure (such as incubation centres) designed to support innovative new spin-outs and start-ups emerging from the University. Such facilities provide opportunities for entrepreneurial academics to meet with and learn from businesses in a similar field and develop relationships with potential clients and collaborators.

The science parks also typically act as an entry point for industry to access expertise from within the University. In several cases this has encouraged important industrial partners to establish a presence within the science park, sometimes bringing with them €millions of inward investment.

The more established of these science parks have, over time, evolved into highly successful innovation ecosystems and important drivers of regional (and in some cases national) economic growth. In these parks the University involved generally has close relationships with many of the tenants, often on several different levels. These relationships help to ensure that the activity of tenant companies is well embedded into their host community and therefore less likely to consider relocating.

In these parks the lead University has become a catalyst for growth, helping to attract inward investment and stimulate collaborative opportunities. In some

cases this has even led to second-generation effects whereby successful University spin-outs have spun-out new companies of their own.

Over time some of these parks have become major clusters of activity. These parks are often very successful in attracting investment from new companies (spin-ins), not *necessarily* to collaborate with the University but simply because they are now perceived as the best location for companies operating in a particular sector.

Ultimately the success of these parks is largely due to the University involved, which has enabled them to become more than the sum of their parts. Without the universities science parks would simply be a collection of businesses with little incentive or stimulus to collaborate. For this reason it is appropriate to include the value generated by these Parks within this report.

It is however important to note that in these parks the University involved may not necessarily be directly involved with every tenant company or organisation. This means that, even though this activity is indirectly attributable to the University (because the cluster would not otherwise exist), the University will not necessarily record details of the total amount of activity that occurs. For this reason the impact quantified below is likely to underestimate the full value of the activity supported.

The LERU member universities supported 23 Research and Science Parks throughout Europe. Those companies that were spin-outs and start-ups of the universities were excluded from the analysis to avoid double counting. The details provided by the Universities showed that 2,800 companies were based on these parks, that had not been considered elsewhere in this study.

In assessing the economic contribution made by the science parks, it is necessary to make assumptions about the role that the universities have played in attracting companies and organisation to these locations.

A detailed description of the methodology used is contained in the Supplementary Methodological Appendix. Using this methodology results in a contribution made by the research and science parks of €3.0 billion GVA and 46,019 jobs supported across Europe as a whole (Table 7.9). This takes account of the further round of impacts from companies that supply the science park tenants.

Table 7.9: The LERU Universities – Contribution from Research and Science Parks

Europe	GVA (€ bn)	Employment
Research and Science Parks Contribution	3.0	46,019

Source: BiGGAR Economics Analysis

7.6 Workforce Training (CPD)

Workforce training or continuing professional development (CPD) has a positive impact on the productivity of organisations and business through bringing about an improvement in the skills and knowledge of their employees.

In 2014 the LERU Universities received €128.8 million in income from CPD courses. This contribution was only estimated for the LERU Universities that were able to provide information about income received from professional training.

Attendees based at the LERU Universities were excluded from the analysis to avoid double counting.

Table 7.10: The LERU Universities – Inputs for the Value of Workforce Training

	Value	Source
Income received from professional training	€128.8 mn	The LERU Universities
% of attendees who are normally based at the University	25%	
Private returns to CPD investment	360%	BiGGAR Economics previous research

Applying economic ratios and multipliers as previously explained, results in a contribution made by CPD delivered by the LERU Universities of €344.3 million GVA across Europe.

The nature of CPD is that it will increase the productivity of an existing workforce, rather than increasing GVA by increasing employment. Therefore there would be no material increase in direct employment as a result of investing in CPD.

Table 7.11: The LERU Universities – Economic Contribution from Workforce Training

Europe	GVA (€ mn)
Workforce Training Contribution	344.3

Source: BiGGAR Economics Analysis

7.7 Staff Volunteering

Staff at the LERU Universities often contribute their time to public and charitable bodies which is outwith their contracted hours. However it is their expertise and association with the LERU Universities that enable them to make these contributions. The activities that staff participate in include:

- contributing to policy development;
- contributing to professional organisations; and
- volunteering.

The time that staff contribute to external bodies also benefits the universities themselves as it allows staff to further develop their skills in a non-university environment. For example, an academic member of staff contributing to a committee assessing research funding applications will simultaneously develop their own application writing skills.

The proportion of time that staff contribute to such activity is likely to vary and is not routinely collected and analysed. However, to give some indication of its value, it has been assumed that the time staff work on social and voluntary activities is equivalent to 7.5% of their working hours (approximately 2.5 hours per week). Therefore the costs which would be associated with this, if the public and charitable bodies were to pay equivalently qualified people, is equivalent to 7.5% of the total staff costs of all member universities. This takes into account that

more senior staff are likely to spend a higher proportion of their time on such activities, while junior staff are unlikely to spend as much time.

The total value of staff time which is given voluntarily to external organisations is therefore estimated at €0.7 billion. As with student volunteering, the nature of this type of activity is that it will contribute to increasing the productivity and so will have a GVA impact rather than an employment impact.

Table 7.12: The LERU Universities – Economic Contribution from Staff Volunteering

Europe	GVA (€ bn)
Staff Volunteering Contribution	0.8

Source: BiGGAR Economics Analysis

7.8 Summary of Knowledge Transfer, Enterprise and Innovation Contributions

The combined contribution due to knowledge transfer, enterprise and innovation activity generated and sustained by the LERU Universities is €21.9 billion GVA and 298,489 jobs across Europe as a whole (Table 7.13).

Table 7.13: The LERU Universities – Contribution from Knowledge Transfer Activities

Europe	GVA (€ bn)	Employment
Licencing	0.8	11,268
Consultancy	3.3	48,005
Contract and Collaborative Research	10.9	154,733
Spin-outs and Start-Ups	2.7	38,465
Research & Science Parks	3.0	46,019
Workforce Training (CPD)	0.3	-
Staff Volunteering	0.8	-
Total Knowledge Transfer Contribution	**21.9**	**298,489**

Source: BiGGAR Economics Analysis

However, the true impact of knowledge transfer activity is much wider than these figures suggest as not all technological breakthroughs that have an impact can be commercialised or are quantifiable. For example, the Linux operating system was developed by a student at the University of Helsinki and is one of the most prominent examples of free and open source collaboration that has had a wide reaching impact. As it is freely redistributable, anyone may create a distribution for any intended use, providing an increasing number of applications. Linux is commonly used for everything from supercomputers to tablets and smartphones. The Linux foundation estimates that the Linux industry was worth $49 billion in 2011.[16]

[16] The Linux Foundation, http://www.linuxfoundation.org/what-is-linux (Accessed 20th April 2015)

8 TOURISM CONTRIBUTION

This section considers the contribution that the LERU Universities make to tourism in the area. This arises from:

- visits from friends and family to staff and students; and
- visitors to conferences and events held at the LERU Universities.

8.1 Visits to Staff and Students

The presence of staff and students in the area creates an economic contribution through visits from their friends and family. These visitors spend money in the economy and this spending increases turnover in local businesses which in turn supports local employment.

The contribution of visits to staff and students has been calculated by assessing the number of visits from friends and family per head of the population in each country as estimated by Eurostat data for 2012.

We then applied this ratio to the total number of staff and students employed at the LERU Universities. Next, we applied an estimate of trip expenditure per visit. The economic contribution in the study areas was found by converting trip spend (turnover) to GVA and employment and applying multipliers to estimate the indirect and induced effect of this level of spending. The key inputs used and the resulting contribution are shown in Tables 8.1 and 8.2.

Table 8.1: The LERU Universities – Inputs for Visits to Staff and Students

	Value	Source
Total number staff & students	861,072	The LERU Universities
EU (28 country) average trip spend per visitor	€120.13	Eurostat

This results in an estimated economic contribution from visits to staff and students of €0.1 billion GVA and 2,060 jobs in Europe as a whole.

Table 8.2: The LERU Universities – Contribution from Visits to Staff and Students

Europe	GVA (€ bn)	Employment
Visits to Staff and Students Contribution	0.1	2,060

Source: BiGGAR Economics Analysis

8.2 Conference & Event Contribution

The LERU Universities organise conferences and events that generate an economic contribution by attracting people to the area who would not otherwise have visited.

Not all the Universities collated information on conference and event attendees, therefore estimates needed to be made in order to estimate the economic contribution of their activity. Nine LERU Universities reported their conference attendances, with a combined total of 286,777 attendees. The number of

conference attendees was also assumed to be proportional to the number of staff in each institution. The nine universities that reported on their conference attendees had 64,736 members of staff. Therefore each University would expect to receive 4.70 conference attendees each year per fte. This assumption was applied to the remaining LERU Universities. In this way it was estimated that in 2014, there were 743,905 delegates at conferences and events that were organised at the LERU Universities.

Applying expenditure data on business trips from Eurostat data, we can estimate the additional total turnover generated by people attending conferences organised by the LERU Universities. This is converted to additional GVA and employment by using ratios and multipliers appropriate to the sector.

The inputs used are shown in Table 8.3 and the resulting contribution is presented in Table 8.4.

Table 8.3: The LERU Universities – Inputs for Conferences & Events

	Value	Source
Average number of conference attendees per fte	4.70	BiGGAR Economics calculation based on data provided
No. of delegates to organised conferences and events at the LERU Universities	743,905	
EU (28 country) average trip spend per visitor on business	€302.70	Eurostat

This results in an economic contribution from conferences of an estimated €0.2 billion GVA and 3,648 jobs in Europe as a whole.

Table 8.4: The LERU Universities – Contribution from Conferences & Events

Europe	GVA (€ bn)	Employment
Conferences & Events Contribution	0.2	3,648

Source: BiGGAR Economics Analysis

8.3 Summary of Tourism Contributions

The contribution the LERU Universities make to the economy through attracting "tourist" visitors results in an estimated €0.3 billion additional GVA and 5,708 jobs per year in Europe as a whole.

Table 8.5: The LERU Universities – Economic Contribution from Tourism

Europe	GVA (€ bn)	Employment (jobs)
Visits to Staff and Students	0.1	2,060
Visits to Conferences	0.2	3,648
Total Tourism Contribution	**0.3**	**5,708**

Source: BiGGAR Economics Analysis

Many of the LERU Universities have their own tourist attractions, such as museums and botanical gardens, and therefore support further economic activity by attracting visitors to these attractions.

Some examples of this include:

- Utrecht University has its own museum and a botanical garden, which between them attract 140,000 visitors each year;
- KU Leuven's Library is featured on tourist maps of the city and offers visitors guided tours;
- The University of Oxford's museums and collections, including the Bodleian Library, are open to visitors and run public engagement programmes which include exhibitions, events, lectures and tours (including school visits); and
- Thousands of Lund University students organise a large Carnival every four years that in 2014 attracted approximately 80,000-100,000 people.

These examples provide a snapshot of the additional tourism activity supported by the LERU Universities and are by no means a comprehensive list. The economic contribution quantified in this chapter is therefore likely to be an underestimate of tourism activity attributable to the LERU Universities.

9 GRADUATE PREMIUM

9.1 Graduate Premium

One of the most important ways in which universities generate economic impact is through their graduates. The skills students learn and the experiences they have while at university directly enhances their future productivity. This enables them to contribute more to their employer and generate a greater benefit for the national economy than they would otherwise be able to.

The GVA of this productivity gain includes the additional profits that employers of graduates are able to generate and the additional employment costs they are willing to pay in order to attract graduates of the required calibre.

As the subject of graduate earnings premiums has been well researched information about the earnings premium of graduates is readily available and can be used to provide a measure of the additional contribution graduates make to the economy each year. Unfortunately information about the additional profits of graduate employers or the additional taxation revenue they help to generate is not readily available so the impact presented in this section is likely to underestimate the true productivity impact of learning.

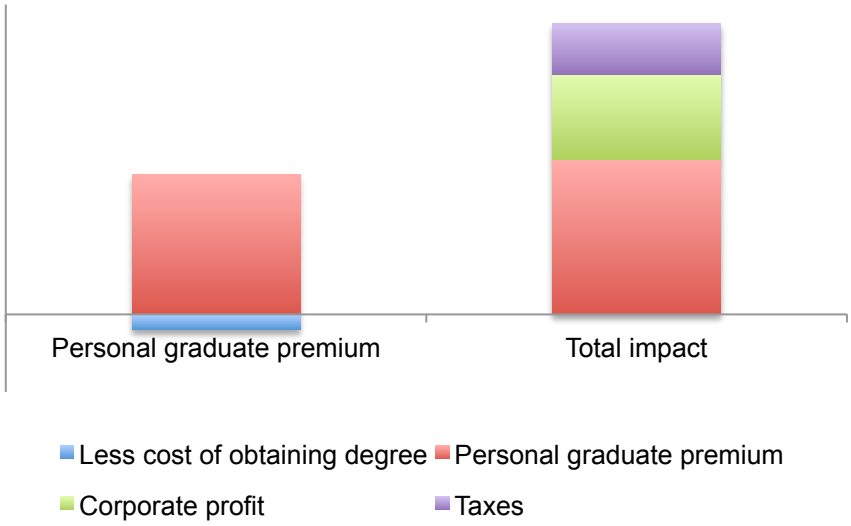
Information about the graduate premium for different subject areas is provided in a research paper produced by the Department for Business Innovation & Skills[17], which considered data from the Labour Force Survey between 1996 and 2009. Although the data used in the report is now somewhat dated, evidence from the OECD[18] suggests that returns to higher education are fairly consistent over time. For this reason, the report remains the most robust and comprehensive source available for estimating this impact.

The analysis considered the after tax earnings of a graduate compared to the after tax earnings of a non-graduate. Direct costs, such as tuition fees less student support, and indirect costs, such as foregone earnings, were then subtracted from the gross graduate premium for each degree subject to give the net graduate premium.

In this way the total graduate premium gives the combined personal economic benefit that the years graduates will obtain rather than the increase in national productivity associated with the degree, which will be higher. It therefore does not include the corporate profit associated with each graduate or the taxes paid to the Treasury. As illustrated in Figure 9.1 the impact presented in this section is therefore likely to underestimate the full impact that graduates generate for their national economies.

[17] Department for Business Innovation & Skills (2011), *The Returns to Higher Education Qualifications*.
[18] OECD, *Education at a Glance*: OECD Indicators series

Figure 9-1: Personal Graduate Premium Benefit Vs. Economic Benefit



9.2 Estimating the Graduate Premium

Looking specifically at the educational aspect of the work of the LERU Universities, there is a lifetime earnings premium generated by training graduates across a spectrum of subjects that occurs as a direct result of an individual possessing a university qualification.

The economic value of teaching and learning are a different kind of contribution, compared to the others described in previous chapters, because this contribution occurs over the *working lifetime of graduates* rather than in the year of their graduation. These contributions would not have been realised in 2014, which is the year our analysis covers. However, in 2014 graduates from previous years will be creating these contributions and this has not been captured elsewhere in this study. Therefore the future contribution of the 2014 cohort of graduates have been quantified and added in to ensure that the full contribution of teaching and learning is reflected in the analysis.

The key inputs used to estimate the value of the graduate premium are shown in Table 9.1 and a full description of how these inputs were derived and applied can be found in the Supplementary Methodological Appendix.

Table 9.1: The LERU Universities – Inputs for Graduate Premium

	Value	Source
Baseline UK earnings premium for a first degree holder	€155,458	BiGGAR Economics calculation based on OECD, *Education at a Glance* and BIS, *The Returns to Higher Education Qualifications*
Baseline UK earnings premium for a postgraduate degree holder	€86,823	
Total number of first degree graduates	87,634	The LERU Universities
Total number of masters/ PhD graduates	84,646	

The overall contribution of teaching and learning at the LERU Universities is summarised in Table 9.2. This results in an estimated earnings premium contribution of €15.4 billion GVA in Europe as a whole as a result of people graduating in any subject from the LERU Universities. As this contribution is a productivity gain it is measured in terms of GVA and consequently does not have associated employment gains.

Table 9.2: The LERU Universities – Graduate Premium

Europe	GVA (€ bn)
Graduate Premium Contribution	15.4

Source: BiGGAR Economics Analysis

10 SUMMARY ECONOMIC CONTRIBUTION

10.1 Total Contribution

By bringing together the various sources of economic value discussed in this report it can be estimated that the LERU Universities contribute:

- €71.2 billion GVA; and
- 900,065 jobs are supported in Europe as a whole.

The economic value of employment includes a direct contribution of 158,335 jobs, which means that the employment multiplier in the wider European economy is **5.68**. In terms of GVA contribution, the direct GVA of the LERU Universities is €12.1 billion and therefore the GVA multiplier in the wider European economy is **5.88**.

This implies that each €1 GVA directly generated by the LERU Universities contributes almost €6 to the European economy and every job directly created by the LERU Universities supported almost 6 jobs in the European economy.

In 2014 the LERU Universities received €16.3 billion in income and generated a total economic impact of €71.2 billion. This implies that the LERU Universities generated €4.37 GVA for every €1 income earned.

A breakdown of all economic contributions that can be quantified is provided in Table 10.1.

The LERU members attract over 50,000 students from outside the EU, which contributes to European export earnings. These students spend €1.7 billion in the European economy, through the fees and their spending in the wider economy.

Table 10.1: The LERU Universities – Summary of Economic Contributions Across Europe

	GVA (€ bn)	Jobs
Core Contribution	**23.9**	**375,683**
Direct Effect	12.1	158,335
Supplier Effect	4.4	90,408
Staff Spending Effect	5.6	99,642
Capital Spending	1.8	27,288
Student Contribution	**9.7**	**220,184**
Student Spending	5.2	93,100
Part-time Work	3.9	117,714
Student Volunteering	0.02	-
Student Placements	0.5	9,370
Knowledge Transfer Contribution	**21.9**	**298,489**
Technology Licensing	0.8	11,268
Consultancy	3.3	48,005
Contract and Collaborative Research	10.9	154,733
Start-ups and Spin-outs	2.7	38,465
Research and Science Parks	3.0	46,019
Workforce Training (CPD)	0.3	-
Staff Volunteering	0.8	-
Tourism Contribution	**0.3**	**5,708**
Visits to Staff & Students	0.1	2,060
Conferences & Events	0.2	3,648
Sub-Total	**55.7**	**900,065**
Graduate Premium	15.4	-
Total	**71.2**	**900,065**

Source: BiGGAR Economics Analysis, figures may not total due to rounding

10.2 Wider Benefits of Higher Education

This report has assessed the quantifiable economic impacts of the LERU Universities. There are however significant wider, unquantifiable benefits to the individual and to society of higher education. These benefits have been well documented and include greater social cohesion, improved social mobility, better health and wellbeing and greater civic engagement.

As universities attract students from a wide range of social and ethnic backgrounds, interaction with fellow students can lead to increased sensitivity towards other cultural perspectives, cultivate freedom of expression, and a higher

acceptance of differences.[19] Universities therefore help to shape individuals and consequently societies that are open to new ideas and diversity.

Higher education can also help to break cycles of educational deprivation. This suggests that increasing higher education in one generation can enhance the prospects, and therefore skills, of future generations, thereby improving social mobility.

Better health and wellbeing, reduced risk of depression and better health behaviours in general are also impacts of higher education.[20] Impacts like this can have wider economic benefits that are impossible to quantify; better physical and psychological health would lead to reduced health costs for the economy.

Higher education participation can also have positive knock on effects in terms of civic participation. Across OECD countries, educational attainment is generally positively associated with electoral participation.[21] Greater civic engagement would in turn have consequences for democratisation and wider political stability.

A further wider benefit of higher education is personal growth and social development beyond academic learning through off-campus activities such as part-time work and volunteering. This benefit has further spill-over effects after graduation with those individuals being more likely to interact in social networks, such as participation in voluntary and charitable organisations.

Universities therefore have significant wider impacts which although unquantifiable are equally important on an individual and societal level. The impacts described in this report therefore present only a partial picture of the contribution of the LERU Universities.

[19] Department for Business Innovation & Skills (September 2013), *The Wider Benefits of International Higher Education in the UK*.
[20] Department for Business Innovation & Skills (October 2013), *The Benefits of Higher Education Participation for Individuals and Society: key findings and reports "The Quadrants*".
[21] OECD (2011), *Education at a Glance 2011*: OECD Indicators.

11 IMPACT OF RESEARCH UNIVERSITIES IN CONTEXT

The scale of the economic impact of Research Universities in Europe is easier to comprehend when it is contextualised. This section uses the impact of the LERU members to extrapolate the total impact of the sector in Europe and compare this impact to some of the major sectors in the European economy.

11.1 Extrapolation

In order to indicate the magnitude of the overall contribution this sector makes to the European economy two estimates are used, these use data from:

- the Centre for Science and Technology Studies (CWTS) Leiden rankings; and
- the European Research Council.

By comparing figures for LERU members to the overall figures for European Research Universities, it is possible to gross-up the impact findings from the LERU members to gain an estimate for the impact of the Research Universities sector as a whole.

11.1.1 CWTS Leiden Rankings

The CWTS Leiden rankings compare 750 global universities on the scientific impact of their research. The methodology used does not use reputational surveys nor data provided by Universities themselves and therefore allows a more objective analysis than other rankings. The 750 global institutions include 285 universities based in Europe and all off the LERU institutions. All publications and those that belong in the top 1%, top 10% and top 50% of their field in terms of impact are taken into account.

The rankings considered 907,000 publications from the European institutions, of which 154,000 were from LERU members. This is equivalent to 17% of the total. However, LERU members accounted for a larger proportion of publications that had the top 1% of impact in their field, LERU members accounted for **23.5%** of publications. Since these publications are likely to be indicators of high impact, this is the figure used to extrapolate the findings from this study on the economic contribution of the LERU Universities to the Research Universities sector.

11.1.2 European Research Council

The European Research Council (ERC) forms part of the Horizon 2020 project, which is the European Union's mechanism for funding research and innovation. The ERC's mission is to encourage the highest quality research in Europe through competitive funding and to support investigator driven frontier research. In June 2015 the organisation made its 5,000th research award with a combined value of around €9 billion.

Analysis of funding activities between 2007 and 2013 found that 4,556 projects were funded[22]. Of these, approximately 3,600 were awarded to researchers

[22] European Research Council (June 2015), *ERC funding activities 2007 – 2013:* Key facts, patterns and trends, European Commission

based in universities in the EU and Switzerland. Data is provided for the most successful 100 institutions, which accounted for 61% of the contracts awarded. The 100 most successful institutions included 18 LERU members, who between them have had 798 projects funded by the ERC. On this basis, the LERU members would account for **23.3%** of the Research Universities sector in Europe.

The ERC funds projects across the academic spectrum and categorises projects as either Life Sciences, Physical Sciences and Engineering and Social Sciences and Humanities. LERU members have accounted for 22.5% of the Life Sciences projects, 22.1% of the Physical Sciences and Engineering projects and 27.2% of the Social Sciences and Humanities projects that were funded between 2007 and 2013.

Table 11.1: ERC Grants to EU and Swiss Universities

	Proportion awarded to LERU
Life Sciences	22.5%
Physical Sciences and Engineering	22.1%
Social Sciences and Humanities	27.2%
Total	**23.3%**

Source: BiGGAR Economics Analysis

The two methods described above were used to extrapolate the impact of LERU members across the entire European Research Universities sector. Both methods give similar values for the overall impact of the European Research Universities sector of €300 billion GVA and 3.8 million jobs.

Table 11.2: Contribution of Research Universities Sector

	LERU as % sector	Sector Contribution	
		GVA (€ bn)	Jobs (mn)
LERU Members only	n/a	71.2	0.9
CWFT Leiden Rankings	23.5%	303.0	3.8
European Research Council	23.3%	305.4	3.8
Average	**23.4%**	**304.2**	**3.8**

This approach is likely to underestimate the full economic contribution of Research Universities in Europe. This is because it will not take into account the catalytic impacts that having multiple Research Universities in a country or region will have on that area and its ability to support development. Similarly, impacts that have only been considered partly attributable to the individual universities, (for example, Science Parks will have a higher additionality when the whole sector is considered).

11.1.3 Additional Measures

The estimates given in Table 11.1 consider only LERUs share of the most competitive and influential research undertaken in European universities and as a result may be an underestimate of the impact of the European Research Universities sector.

Another proxy that could be used to estimate the magnitude of the sector in Europe is to consider the total expenditure on research and development in the European Higher Education sector. Data provided by Eurostat shows that the value of intramural Research and Development Expenditure in the Higher Education sector in 2013 was €63.5 billion[23]. The combined research income of the LERU members was €7.4 billion in 2014. On this basis the LERU members would account for **11.7%** of the Research Universities sector in Europe.

The final method for estimating the size of the European sector is to consider the overall number of doctoral students. Doctoral students are engaged in research in their field of study and therefore they can be used as a proxy for the level of research in these institutions. Data provided by Eurostat shows that there are 745,267 doctoral students in Europe[24]. The combined doctoral student population of the LERU members is approximately 50,000. On this basis the LERU members would account for **6.7%** of the Research Universities sector in Europe

11.2 Impact in Context

11.2.1 Impact in Context

In order to better understand the scale of the economic contribution generated by the Research Universities sector it is useful to place the contribution within the context of the wider European economy.

The total GDP of the European Union in 2014 was €13,921 billion in 2014[25] and 216.7 million people were employed. The Research Universities sector was estimated to support at least €300 billion GVA and 3.8 million jobs throughout Europe. This is equivalent to 1.8% of all employment in the EU and 2.2% of all GVA.

Table 11.1: Research Universities contribution to European economy

	Jobs (mn)	GVA (€ bn)
European Union Whole Economy	216.7	13,921.0
Research Universities	3.8	304.2
Equivalent (%)	1.8%	2.2%

Source: BiGGAR Economics Analysis

11.2.2 Impact in Context by Sector

In order to place the economic contribution of Europe's Research Universities in context it is also helpful to consider the economic contribution of other recognised sectors of the European economy.

The contribution of the Research Universities is greater than that of the direct GVA and employment of the automotive industry in Europe. In 2011 the automotive industry employed 2.2 million people throughout the EU and

[23] Eurostat (March 2015), *Total intramural R&D expenditure (GERD) by sectors of performance,* Eurostat
[24] Eurostat (June 2014), *Tertiary students (ISCED 6) by field of education and sex,* Eurostat
[25] European Union, *The Economy, http://europa.eu/about-eu/facts-figures/economy/index_en.htm* Accessed 03/07/15

contributed €123.1 billion GVA to the European economy[26]. This is smaller than the estimate for the size of the Research Universities sector, in which it contributes more than €300 billion and supports 3.8 million jobs.

The impact of the Research Universities sector is also greater than the European Pharmaceutical and Real Estate sectors. The Real Estate sector employs 2.7 million people in Europe and contributes over €250 billion to Europe's GDP, 15% less than the Research Universities sector. The Pharmaceutical sector is also characterised with high levels of Research and Development investment, and the sector contributes €160 billion GVA to the European economy, equivalent to 54% of the contribution of the Research Universities sector.

Figure 11.1: Contribution in Context - Other sectors (Jobs)

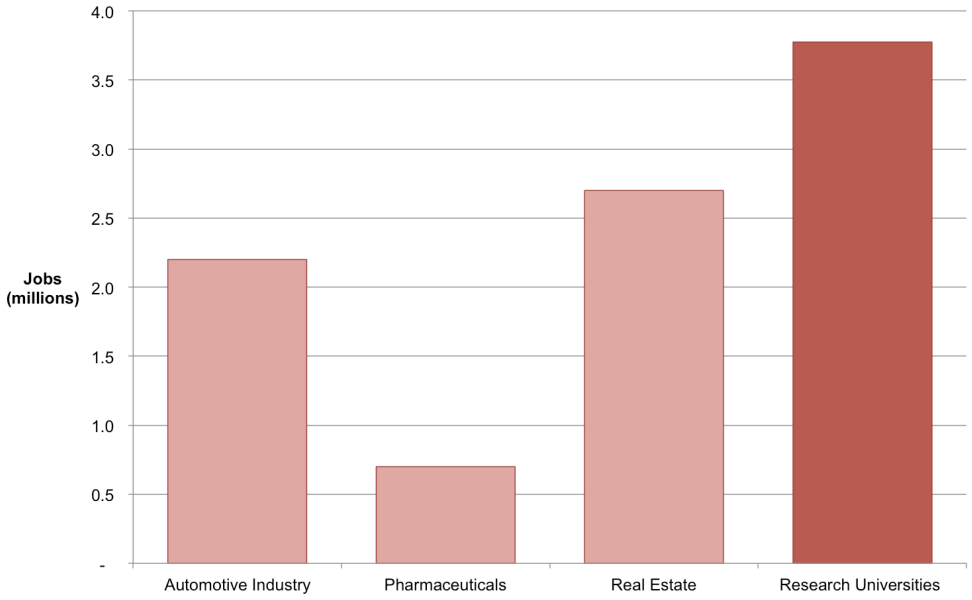
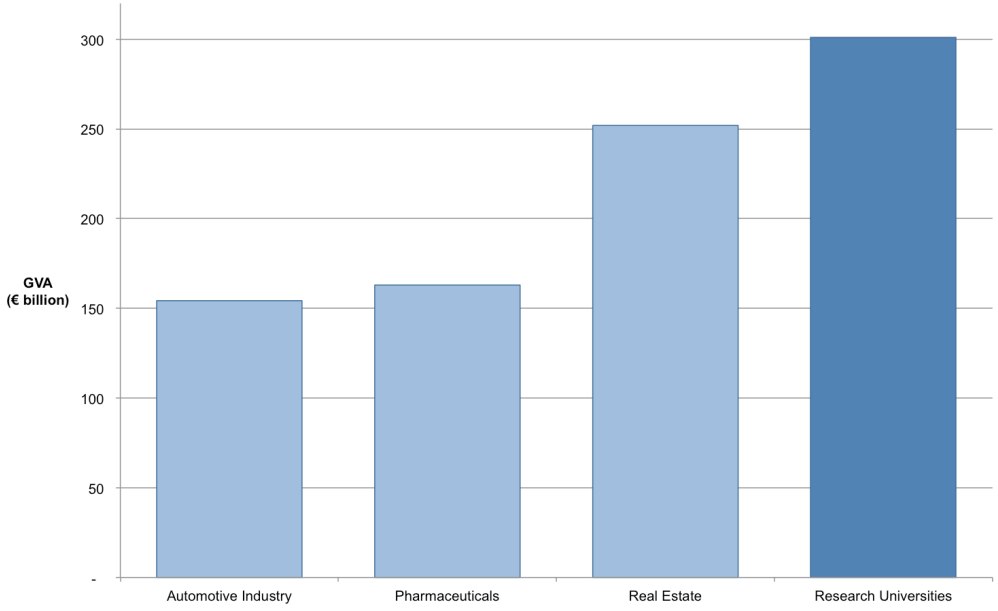


Figure 11.2: Contribution in Context - Other sectors (GVA)



[26] European Automobile Manufacturers Association, *Key Figures*, http://www.acea.be/statistics/tag/category/key-figures

12 CONCLUSIONS

This study set out to consider the contribution that the 21 LERU Universities and the Research Universities sector as a whole make to the European economy. In order to do this the quantifiable economic value generated by the wide-ranging activities of the LERU Universities has been considered. This included the contribution from their core activities, students while they are studying and after graduating, knowledge transfer and commercialisation activities and attracting visitors.

In 2014 the LERU Universities are estimated to have generated more than €55 billion GVA for the European economy and supported around 900,000 jobs. Including the earnings premium associated with one year's cohort of graduates increases this to €71.2 billion GVA.

The scale of this impact is substantial, and implies that each €1 GVA directly generated by the LERU Universities contributes almost €6 to the European economy and every job directly created by the LERU Universities supports almost 6 jobs throughout the European economy.

The LERU members attract over 50,000 students from outside the EU, which contributes to European export earnings, estimated at €1.7 billion per year for the European economy, through the fees that they pay and their spending in the wider economy.

The economic contribution of the LERU Universities has been used as a basis for estimating the contribution of the Research Universities sector as a whole. By extrapolating the findings it can be estimated that the entire European Research Universities sector contributes over €300 billion GVA, and supports 3.8 million jobs across Europe.

Although the magnitude of this contribution is considerable, the true contribution of Research Universities is much larger than these figures indicate, as there are limitations to assessing economic contribution. For example, the LERU Universities are collectively engaged in a wide range of world-leading research that will ultimately provide the foundations for the technologies of the future to be developed. However these significant time lags make it difficult to account for these contributions. In addition, many technological and medical breakthroughs are collaborative efforts building on the research undertaken by other universities and industry partners. They are also often the result of an open innovation approach whereby universities co-locate with companies and knowledge spill-over effects come into play. Therefore even if all the contributions could be quantified the significant interplay would make it impossible to separate these effects.

Additionally, Research Universities have many wider impacts, which although unquantifiable, are equally important. For example, all of the LERU Universities are involved in medical research and even when the outputs of research are commercialised or translated directly into clinical practice it is impossible to quantify the wider benefits that this has for society. Research Universities also impact wider society by improving social cohesion, facilitating social mobility, encouraging better health and wellbeing and greater civic engagement. Furthermore, each of the LERU Universities contributes to the overall character and vibrancy of the cities and regions in which they are located by attracting students, staff and tourists to the area. The value of these outcomes to

individuals and the collective impact on society as a whole simply cannot be quantified but should not be overlooked.

Research Universities also have a crucial overarching role as drivers of long term sustainable economic growth in Europe. Economic growth in advanced economies is driven by productivity growth, which is in turn driven by knowledge and its diffusion (innovation). Research Universities have a unique role to play in this by pushing the boundaries of academic discovery and increasing the pool of knowledge available to society and, at least as importantly, their ability to diffuse this knowledge throughout the economy to provide the basis for future productivity improvements and therefore economic growth. Research Universities support the diffusion of knowledge by providing high quality graduates for the labour market as well as through their commercialisation activities, such as spin-out companies and intellectual property licensing. In doing so they contribute to the strategic aim of Horizon 2020, to achieve economic growth and create jobs by investing in research and innovation. Particularly in the current economic climate the role of Research Universities in driving economic growth should not be underestimated.

Moreover, Research Universities create highly successful innovation ecosystems that are major clusters of activity. They provide a space for discussion and create connections between academics, students and companies. They therefore make the regions they are located in attractive places to invest in and so are vital to drawing inward investment. This university ecosystem is entirely built on the world-class research undertaken at Research Universities, as it is this that attracts students, researchers, businesses and investment, helping to catalyse innovation and create the knowledge sectors of the future.

APPENDIX A – ABBREVIATIONS AND TERMS

This section contains a list of common abbreviations and terms used in this report.

Assumptions are the data upon which calculations are based.

FTE (or fte) – Full Time Equivalent a unit to measure employed persons or students in a way that makes them comparable although they may work or study a different number of hours per week. The unit is obtained by comparing an employee's or student's average number of hours worked to the average number of hours of a full-time worker or student. A full-time person is therefore counted as one FTE, while a part-time worker / student gets a score in proportion to the hours he or she works or studies. For example, a part-time worker employed for 20 hours a week where full-time work consists of 40 hours, is counted as 0.5 FTE.

GDP – Gross Domestic Product refers to the market value of all final goods and services produced within a Country in a given period.

GVA – Gross Value Added is also a measure of the value of goods and services produced in an area, industry or sector. GVA is linked to Gross Domestic Product (GDP) because both are measures of output. The relationship is defined as:

GVA + taxes on products - subsidies on products = GDP

As the total aggregates of taxes on products and subsidies on products are only available at whole economy level, GVA is used for measuring entities smaller than a whole economy (such as universities). In simple terms at the level of an organisation, it is represented by turnover less the non-labour costs of production.

GVA/turnover ratio is a measure of the relationship between the total turnover of a particular sector and the GVA it generates. It is calculated by dividing total GVA by total turnover and can be used to estimate how much GVA will be created as a result of an increase in output (turnover or expenditure).

Spin-outs are companies that are created to commercialise a university's intellectual property; usually involving a licensing agreement and/or staff transfer.

Start-ups are businesses that are set up by university staff and/or former students. Although such companies will draw on the experience acquired by the founders during their time at the university, they have no formal intellectual property relationship with the university.

APPENDIX B – LERU MEMBER DESCRIPTIONS

This section provides a brief summary description of each LERU member.

B.1 University of Amsterdam (UvA)

UvA's origins can be traced back to 1632 when its forerunner the Athenaeum Illustre was established to educate students in trade and philosophy. With some 32,000 full time students, 5,700 staff and a budget of more than €600 million, it is one of the largest comprehensive universities in Europe.

The University has seven faculties spanning the Humanities, Social and Behavioural Sciences, Economics and Business, Law, Natural Sciences, Medicine and Dentistry.

In terms of world rankings UvA is one of the world's leading universities. It is ranked:

- in the top 1% of universities in the world according to the QS World University Rankings 2014-15 (50th) and the Times Higher Education World University Rankings (77th); and
- in the top 50 universities in the world for Arts and Humanities (45th), Social Sciences (36th), and Clinical, Pre-Clinical and Health (47th).[27]

The strategic priorities of UvA are described in An Eye for Talent: Strategic Plan 2011-2014[28]. The Plan discusses three objectives that will guide the University's decisions in the years covered. These objectives are research, education and social responsibility and innovation.

Amsterdam Science Park is a joint development by the University of Amsterdam, the City of Amsterdam and the Netherlands Organisation for Scientific Research (NWO). It has the largest concentration of university science education and research in the Netherlands and one of the largest in Europe. Amsterdam Science Park is a major hub for research, innovation and entrepreneurship because of its world-class research institutes, universities, and some 120 companies. The park is home to the world's largest data transport hub, the AMS-IX, and offers opportunities for ICT, life sciences, advanced instrumentation and sustainable businesses.

B.2 Universitat de Barcelona

Founded in 1450, the University of Barcelona today comprises six campuses located within the inner city. The University has 18 faculties, in which 65 bachelor's degree programmes, almost 140 master's degree courses and 71 doctoral programmes are offered. With more than 55.500 full time and part time students and more than 6.100 teaching, research and administrative staff, it is the most renowned public institution of higher education in Catalonia. As well as this, the University of Barcelona has two campuses of International Excellence, the BKc and HUBc.

The University is the highest ranked university in Spain and is placed by the QS rankings:

[27] Times Higher Education *World University Rankings 2014-15*
[28] University of Amsterdam, *An Eye for Talent: Strategic Plan 2011-2014*, 2011

- in the top 100 universities in the world for the faculties of Arts and Humanities (91st), Life Sciences and Medicine (92nd) and Natural Sciences (76th); and
- in the top 100 universities in the world for the subjects of Medicine, Pharmacy and Pharmacology, Chemistry, Earth and Marine Sciences and Environmental Sciences.

The University has 14 research institutes, 106 research departments and a research income of €58M. It has particular strengths in disciplines such as biomedicine and biotechnology, and is also active in other fields such as experimental sciences, social sciences, the humanities, and the fine arts.

The University of Barcelona was instrumental in creating the Barcelona Science Park (PCB), which was established in 1997 and was the first of its kind in Spain. The Science Park promotes innovation and knowledge transfer by leveraging relationships between the University, public research organisations and the private sector. At present it is home to 70 organisations and provides employment for approximately 2.000 people.

The University of Barcelona's Science and Technology Centres (CCiT) are equipped with state of the art research facilities occupying more than 12.000 sqm, offering the broadest range of instrumental technologies and highly qualified technical staff. The Centres further support research and innovation by providing researchers with advice on experimental techniques and organising technology training courses and seminars.

The Bosch i Gimpera Foundation (FBG) is the University of Barcelona's centre for the transfer of technology and innovation. The goal of the FBG is to bring the scientific skills and the research results generated at the University to market by means of contracts for R&D projects, consultancy services, the protection and licensing of Intellectual Property and the creation of knowledge-based companies (spin-outs).

B.3 University of Cambridge

The University of Cambridge was founded in 1209 and is the second oldest university in the English-speaking world and the third oldest surviving university in the world. It comprises 31 autonomous Colleges and over 150 departments, faculties and other institutions. Academic units are grouped into six Schools: Arts and Humanities, Biological Sciences, Clinical Medicine, Humanities and Social Sciences, Physical Sciences and Technology. The University employs more than 9,700 staff, has almost 18,400 full time students and a total income in 2014 of €1.3 billion.

The University of Cambridge is consistently ranked among the foremost universities in the world:

- 2nd best university in the world according to the QS World University Rankings 2014-15 and 5th by the Times Higher Education World University Rankings;
- in the top 10 universities in the world for Arts and Humanities (4th), Clinical, Pre-Clinical and Health (3rd), Engineering and Technology (5th), Life Sciences (3rd), Physical Sciences (6th) and Social Sciences (10th); and [THE]
- in the top 3 universities in the world in the fields of Arts and Humanities, Life Sciences and Medicine and Natural Sciences (3rd) and in the top 5 universities

in the world in the fields of Social Sciences and Management and Engineering and Technology (4th); and [QS]

- the highest ranked UK university according to the Guardian University League Table 2015, the QS World University Rankings 2014-15 and the Complete University Guide 2015.

The University's mission is to contribute to society through the pursuit of education, learning and research at the highest international levels of excellence. To date, 90 affiliates of the University have won the Nobel Prize, more than any other institution.

The Research Excellence Framework (REF) assesses the quality and impact of research submitted by UK universities across all disciplines. Almost nine out of ten (87%) University of Cambridge submissions for the REF have been rated as 'world leading' or 'internationally excellent', demonstrating the institution's strength in research.

The University is located at the heart of the largest technology cluster in Europe, comprising 1,500 hi-tech and bio-tech companies. Fourteen companies which started in the Cambridge cluster are now valued at over €1 billion.

Cambridge University instigated the creation of Cambridge Science Park over 40 years ago and it has been intrinsically linked to the growth, development and attraction of companies to the park during this time. It is the oldest science park in the UK.

B.4 University of Edinburgh

The University of Edinburgh was founded in 1583 and currently offers over 500 first degree programmes, spread across 100 academic disciplines. The University has around 25,400 full time students (more than a third of them from outside the UK) and around 12,900 staff. The University has three Colleges; the College of Humanities and Social Sciences, the College of Science and Engineering and the College of Medicine and Veterinary Medicine.

The University of Edinburgh is consistently ranked one of the world's top universities:

- in the top 20 universities in the world according to the QS World University Rankings;
- the highest ranked Scottish university in the world according to both the QS World Rankings and the Times Higher Education World University Rankings;
- ranked in the top 50 universities in the world for Arts and Humanities (12th), Clinical, Pre-Clinical and Health (27th), Life Sciences (23rd), Physical Sciences (34th) and Social Sciences (41st). [THE]

The University's research was recently assessed by the Research Excellence Framework. A total of 1,852 individuals, 83% of the institution's academic workforce, had their research assessed across 31 disciplines. 83% of the University's research activity was found to be 'world leading' or 'internationally excellent' in 2014. In particular, Edinburgh research in Sociology, Earth Systems and Environmental Sciences and in Computer Science and Informatics was rated the best in the UK.

The University's vision, as stated in its Strategic Plan 2012-16, is 'to recruit and develop the world's most promising students and most outstanding staff and be a truly global university benefiting society as a whole.'

B.5 University of Freiburg

The University of Freiburg was founded in the 15th Century as a comprehensive university focusing on theology, law, medicine and philosophy, with the first classes taught in Latin. The University today has more than 26,000 full time students from over 100 nations, matriculated in 180 degree programs, ranging from applied information technology, the entire spectrum of medical specialities and natural sciences to the fields of humanities and social sciences.

The University's mission, as described in its Mission Statement is, to build on the original disciplines of the University and pass on this classical cultural heritage to new generations while, 'at the same time, the University is dedicated to defining and pioneering new research areas and promoting a strategic interweaving of the natural and social sciences with the humanities.'

The University therefore has an important focus on cross-disciplinary teaching and research. In the area of teaching this is manifested by an above-average proportion of interdisciplinary modules and a cross-disciplinary orientation of the courses at the Master's level. In terms of research, this is manifested in the University's close collaborations with the five Fraunhofer Institutes, the Max Planck Institute of Immunobiology and the Kiepenheuer Solar Physics Institute.

In terms of world rankings, the University of Freiburg is ranked:

- 121st in the world according to the QS World Rankings and 163rd in the world by the Times Higher Education Rankings; and
- in the top 100 universities in the world for Arts and Humanities (94th). (QS)

The University Medical Centre Freiburg is the teaching hospital of the University of Freiburg and was founded in 1457. As well as patient health care, the Medical Centre engages in research and teaching. In addition, training of professions within the health sector is undertaken through the University Medical Centre in the form of apprenticeship training positions.

B.6 Université de Genève

The Academy of Geneva was officially founded in 1559 and was renamed the University of Geneva (UNIGE) in 1873. It is ranked in the top 100 universities globally by the QS rankings for 2014/15 with particular research strengths in molecular biology, astrophysics, social and economic sciences. It also hosts six national research centres, and has on its staff a recipient of the Fields Medal, which is the equivalent of the Nobel Prize in Mathematics.

It has nine faculties and several interfaculty centres and an enrolment of more than 16,000 full time students from over 140 countries.

UNIGE offers more than 280 types of degrees and more than 250 Continuing Education programmes covering an extremely wide variety of fields: exact sciences, medicine and humanities. Its domains of excellence in research include life sciences (molecular biology, bio-informatics), physics of elementary particles, and astrophysics. UNIGE is also host and co-host to six National Centres of

Competence in Research: Frontiers in Genetics, Materials with Novel Electronic Properties (MaNEP), Chemical Biology, Affective Sciences, Synaptic Bases of Mental Diseases and LIVES-Overcoming vulnerabilities in a life course perspective.

UNIGE is part of a network of international and non-governmental organisations and collaborates with scientists and researchers from CERN (European Organisation for Nuclear Research), UNEP (United Nations Environment Programme) and WMO (World Meteorological Organisation). It also has strong ties with the World Health Organization, the International Telecommunications Union and the International Committee of the Red Cross.

B.7 Universität Heidelberg

Heidelberg University, founded in 1386, is Germany's oldest university and one of the strongest research institutions in Europe. Its successes in both rounds of the Excellence Initiative by the German federal and state governments and in international rankings highlight Heidelberg's excellent reputation and leading role in the scientific community.

Both the QS and Shanghai ranking scales place the University in first position overall in Germany and in the top 50 universities globally for 2014/15. The faculties of life sciences and medicine, natural sciences and arts and humanities rank in the top 50 globally in the QS rankings. Notably, Heidelberg has particular strengths in law and medicine.

With over 180 degree programmes, it is a comprehensive university, offering the full spectrum of disciplines in the humanities, law, social sciences, natural and life sciences and medicine. It has has twelve faculties with a total of more than 35,000 full time students and a research and teaching staff of more than 5,000 scientists, including 440 professors.

Heidelberg aims to strengthen the individual disciplines and to further interdisciplinary cooperation as well as to carry research results over into society and industry. At the heart of the university's strategy are four major research fields, the "molecular and cellular basis of life", "structure and pattern formation in the material world", "cultural dynamics in globalised worlds" and "self-regulation and regulation: individuals and organisations".

Heidelberg University also draws its strength from its cooperation with numerous local non-university research institutions and is tied into a worldwide network of research and teaching collaborations. Exchange programmes with more than 450 universities worldwide and 23 university partnerships provide evidence of Heidelberg's marked global interconnectedness.

B.8 University of Helsinki

Founded in 1640, the University of Helsinki is Finland's largest university with almost 35,000 full time students and more than 7,800 members of staff. It operates on four campuses in Helsinki and in 15 other localities in Finland.

It is currently ranked among the top 100 top universities in the world according to the QS, Shanghai and TES research ranking scales for 2014/15. The University is especially strong in the fields of atmospheric physics, metapopulation biology, molecular medicine, mathematics of inverse problems, world politics and Russian studies.

The University of Helsinki's 11 faculties are home to many departments and the University also accommodates several independent research-oriented institutes, multidisciplinary research networks and campus units, as well as units attending to the duties of a national authority.

The University's core duties are research, teaching and their support through community relations and it is a member of more than half of all national and Nordic centres of excellence in research. As a research-intensive university, the University of Helsinki encourages most of its students to complete a second-cycle degree.

It is a responsible social force, an advocate of science and scholarship, and a valued partner. The University boasts an extensive network of partners, including its alumni and friends, donors and funders, foundations and civic organisations, businesses and the media as well as political decision-makers and civil servants in the public sector.

With an international academic community and approximately 80 co-operation agreements with universities on different continents, the University of Helsinki has an international outlook with research and education linkages that span the globe.

B.9 Universiteit Leiden

Leiden University, founded in 1575 is the oldest university in the Netherlands and has a reputation as one of Europe's foremost international research universities. The University has approximately 25,000 full time students and 5,100 staff and offers a range of 46 bachelors programmes and 73 masters programmes.

Leiden University has identified 11 priority themes for its research, these are:

- Asian modernities and traditions;
- Bioscience: the science base of health;
- Brain function and dysfunction over the lifespan;
- Fundamentals of science;
- Global interaction of people, culture and power through the ages;
- Health, prevention and the human life cycle;
- Interaction between legal systems;
- Language diversity in the world;
- Political legitimacy: institutions and identities;
- Translational drug discovery and development; and
- Vascular and regenerative medicine.

In terms of world rankings, Leiden University is placed:

- 75th in the world according to the QS World Rankings and 64th in the world by the Times Higher Education Rankings; and

- is the highest ranked University in the Netherlands according to the Times Higher Education Rankings.

Leiden University was responsible for the foundation of the Leiden Bio Science Park in 1984. Today this is home to the leading life sciences cluster in the Netherlands and ranks among the top five most successful science parks in Europe. It is fully dedicated to biomedical life sciences and offers opportunities for both start-ups and established companies.

B.10 KU Leuven

Founded in 1425, KU Leuven today is one of the oldest and most renowned universities in Europe as well as being the largest and highest-ranked university in Belgium. As a leading European research university and co-founder of the League of European Research Universities (LERU), KU Leuven offers a wide variety of international bachelor and master's programmes, all supported by innovative, interdisciplinary research.

From its base in Leuven, the university also offers degree programmes at campuses in 11 Belgian cities, including Brussels, Ghent and Antwerp.

With a staff total of over 11,000 people, 54,000 full time and part time students across Belgium and research expenditure of over €540 million, KU Leuven offers a comprehensive catalogue of 322 academic degree programmes supported by its research activities, including 85 degree programmes taught in English. The university's doctoral schools provide internationally oriented PhD tracks for more than 5,000 doctoral students.

The University ranks in the top 100 universities globally in the TES (55th), QS (82nd), and Shanghai World Rankings (96th) for 2014/15.

KU Leuven played a central role in the creation and development of the Leuven Bio-incubator and the Arenberg Science Park in the knowledge region of Belgium. The Bio-incubator is the touchstone of biotechnology in Flanders and is fully dedicated to biomedical life sciences, offering opportunities for both start-ups and established companies. It highlights the commitment of KU Leuven and its partners to actively and diligently pursue the innovation opportunities created and generated by its researchers.

KU Leuven cooperates closely with external partners in industry, government and civil society. Its university hospital network provides high-quality healthcare, including advanced tertiary care, at five medical campuses in the region.

B.11 Imperial College London

Consistently rated amongst the world's best universities, Imperial College London was founded in 1907 as a constituent college of the University of London, becoming independent in 2007. Today, it's nine campuses house over 14,700 full time students and 7,400 staff.

The College's Mission, as stated in its 'Strategy 2010-14' is to 'embody and deliver world-class scholarship, education and research in science, engineering, medicine and business, with particular regard to their application in industry, commerce and healthcare.' The College is therefore a science-based university with four faculties – medicine, natural science, engineering and business and is renowned for its application of these skills to industry and enterprise.

In 2007, Imperial College London and Imperial College Healthcare NHS Trust formed the UK's first Academic Health Science Centre. This unique partnership aims to improve the quality of life of patients and populations by taking new discoveries and translating them into new therapies as quickly as possible.

Imperial College London is ranked:

- consistently among the top five universities in the UK – Times/Sunday Times University Guide 2015 (4th);
- in the top 10 universities in the world – QS World Rankings (2nd) and Times Higher Education World Rankings (9th); and
- in the top 20 universities in the world for Clinical, Pre-Clinical and Health (4th), Engineering and Technology 6th), Life Sciences (10th), and Physical Sciences (12th).

The 2014 REF found 91% of Imperial research to be 'world-leading' or 'internationally excellent'– the highest proportion of any major university. Overall, Imperial came fourth out of major UK universities for 'world-leading' research, behind the London School of Economics, Oxford and Cambridge, and just ahead of UCL.

Imperial College London played a leading role in the creation and development of two science park/ incubator facilities (ThinkSpace and Imperial Incubator).

B.12 University College London

Founded in 1826, UCL was the first English university established after Oxford and Cambridge and the first to admit students regardless of race, class, religion or gender. UCL's mission as stated in its 20-year strategy, 'UCL 2034', is to be 'London's Global University: a diverse intellectual community, engaged with the wider world and committed to changing it for the better; recognised for radical and critical thinking and its widespread influence; with an outstanding ability to integrate education, research, innovation and enterprise for the long-term benefit of humanity.'

UCL is one of Europe's largest centres for biomedical science interacting with eleven leading London hospitals, to world-renowned centres for architecture (UCL Bartlett) and fine art (UCL Slade School). UCL also works in cooperation with many worldwide partners such as Intel, NASA and BHP Billiton.

Over 140 nationalities are represented among UCL students with overseas students making up almost half of the 26,600 full time students. UCL has more than 4,000 academic and research staff. UCL academics and alumni have been awarded 28 Nobel Prizes, the most recent of which was in 2013.

UCL is consistently ranked as one of the top UK universities and in the top 10 universities worldwide:

- ranked joint 5th in the world by the QS World University Rankings and 22nd by the Times Higher Education Rankings;
- in the top 20 universities in the world for Social Sciences (13th), Life Sciences (17th), Clinical, Pre-Clinical and Health (8th), Arts and Humanities (8th).

The 2014 REF found 42.6% of UCL's research to be 'world-leading'. In addition, UCL had the highest level of world leading research in the UK in Economics and Econometrics, with 79% of research considered 'world-leading'.

UCL played a leading role in the creation and development of two science park/ incubator facilities (IDEALondon and UCL Advances Hatchery).

B.13 Lund University

Lund University in Sweden was founded in 1666 and is currently ranked among the world's top 100 universities. It has over 42,000 full time students and almost 7,000 employees based at campuses in Lund, Malmö and Helsingborg. The University has a turnover of around €863 million.

Through 8 faculties plus several specialised research centres and institutes, it offers 75 undergraduate degree programmes, over 200 Masters degree programmes and awarded approximately 400 PhDs in 2014.

Lund University's faculty of Life Sciences is rated in the top 100 globally in 2014/15 by QS, Shanghai and TES rankings. It's faculties of natural sciences and social sciences also rank in the top 100 globally in the QS rankings.

The University has over 600 partner universities in approximately 70 countries throughout the world, enabling student exchange at undergraduate level.

Lund University played a key role in the creation and development of four science parks and incubator facilities (Ideon Science Park, VentureLab, Medicon Village and Medeon).

Ideon was founded in 1983 as a joint venture between Lund University and industry. As Sweden's first science park, its purpose was to take advantage of the expertise that existed at Lund University and to create new growth companies with local ties, thus increasing the employment level in the region. During its first 28 years, more than 900 companies have operated at Ideon Science Park. Seventy-six per cent of the companies have, over the years, had some kind of close connection with Lund University.

The University is currently building two new facilities for materials research in Lund, the MAX IV Laboratory and the ESS which will further raise the university's presence in the future.

B.14 University of Milan

The University of Milan was established in 1923 by the merger of two older institutions in the city. It is one of Italy's largest universities, with almost 66,000 full time students and almost 3,900 staff distributed over nine locations around Milan and Lombardy.

It offers 65 bachelor programmes, 63 masters programmes and 94 third cycle research and specialisation programmes across nine faculties and has a total income of almost €540 million.

Very actively participating in the EU framework programmes, the University has particular strengths in the fields of life sciences (especially medicine and pharmacy), food quality and safety, nanotechnologies, environmental sciences and social sciences.

The faculty of Life Sciences at the University of Milan is ranked in the top 100 globally by both the QS and the Shanghai rankings for 2014/15.

In recent years, the range of courses has been expanded and diversified with the establishment of new study programmes, designed to meet the specific requirements of new social-economic contexts. Moreover, some degree courses are partially or entirely taught in English.

The University of Milan plays a major role in promoting sciences at international level. With a proactive role in science, technology and economics networks, it is involved in national and international research programs and also collaborates with other scientific institutions. The University of Milan has also strengthened its efforts to promote technology transfer, a growth area offering exciting new changes and challenges.

The University's international partnerships are numerous and worldwide. Several bilateral and multilateral relationships have been established with partners in both developed and developing countries.

B.15 Ludwig-Maximilians-Universität Munich

Founded in 1472, Ludwig-Maximilians-Universität (LMU) in Munich is ranked in the top 100 universities in the world overall in the 2014/15 QS rankings with particular strengths in sciences (ranked in the top 50 globally) and physics (top 20 globally).

With degree programmes in 200 subjects and numerous thematic combinations, LMU offers a diverse array of courses ranging from the humanities and cultural sciences, law, economics and social studies, to medicine and the sciences.

The University has a population of over 50,000 full time students enrolled on courses across 18 faculties where they are supported by almost 6,000 academic staff.

LMU Munich provides innovative research, both within individual fields and through inter- and transdisciplinary collaborations. It was highly successful in the Excellence Initiative in both 2006 and 2012 which was a national competition designed to strengthen world-class research at German universities.

The University maintains cooperation agreements with more than 500 partner universities worldwide and has a large international student population of around 7,500 students from 130 countries.

B.16 University of Oxford

The University of Oxford is the oldest university in the English-speaking world, with teaching taking place since 1096. The University’s aim is to lead the world in research and education in ways which benefit society on a national and global scale. The University has four academic divisions – medical sciences, mathematical, physical and life sciences, social sciences and the humanities.

As an internationally renowned centre for teaching and research, Oxford attracts students and scholars from across the globe, with almost a quarter of students from overseas. More than 130 nationalities are represented among a full time student population of more than 20,000. Graduate students make up around 41% of the total student body at Oxford and 62% of them come from outside the UK.

The collegiate system is at the heart of the University's success, giving students and academics the benefits of belonging both to a large, internationally renowned institution and to a small, interdisciplinary academic community. It brings together leading academics and students across subjects and year groups and from different cultures and countries, helping to foster the intense interdisciplinary approach that inspires much of the research achievement of the University and makes Oxford a leader in so many fields.

Oxford is consistently ranked highly:

- Oxford was ranked first in the UK and third in the world in the Times Higher Education University Rankings;
- The QS World University Rankings placed the University 5th in the world and third in the UK;
- In the disciplinary tables, Oxford was ranked in the top 10 universities in the world for all of the key disciplines – Arts and Humanities (5th), Clinical, Pre-Clinical and Health (1st), Social Sciences (3rd), Life Sciences (4th), Engineering and Technology (7th), Physical Sciences (7th).

The official UK-wide assessment of all university research, the Research Excellence Framework, found that Oxford has the largest volume of world-leading research in the UK. The University submitted 2409 members of Oxford's academic staff, researching in 31 academic areas. The assessment panels rated 48% of the University's research in the 'world-leading' category while 39% more was rated as 'internationally excellent'.

Oxford University Press is the world's largest university press and has offices in 50 countries and more than 6,000 employees worldwide.

The University has also played a leading role in the creation and development of two science park/ incubator facilities (Oxford Science Park and Begbroke Science Park).

B.17 Pierre & Marie Curie University (UPMC)

Pierre & Marie Curie University (UPMC), is a leading French university of science and medicine. It is a direct descendant of the historic Sorbonne and is ranked the top French university by the Shanghai Rankings, 6th in Europe and 35th in the world. UPMC encompasses all major sciences, including mathematics (4th in the world); chemistry; physics; electronics; computer science; mechanics; Earth, marine and environmental sciences; life sciences; and medicine.

With a complement of 8 600 staff across seven departments and faculties, UPMC provides a diverse curriculum organised into 10 bachelor programs, 10 master's degrees and 16 doctoral schools and France's largest library centre to its 34 000 students.

The University has more than 3 750 professor-researchers and researchers in 100 laboratories in partnership with the four main French national research organizations. It has earned recognition not just for its contribution to fundamental science but also for its extremely targeted research, as demonstrated by the many awards regularly won by UPMC researchers. UPMC actively promotes corporate research and education partnerships (industry-sponsored research, chairs affiliated to a sponsoring company) and technology transfer. Its

partnerships with major French and international research organizations and participation in various international networks are testament to the University's international involvement.

UPMC is a founding member of Sorbonne University, one of the most comprehensive university centres in the country comprising five establishments, all top in their fields: UPMC, Paris-Sorbonne, Muséum National d'Histoire Naturelle (MNHN), Compiègne University of Technology and INSEAD Business School. The comprehensive institution of Sorbonne University offers students an expanded choice of major-minor courses and degrees designed for emerging professions. As part of the Sorbonne University group, UPMC research spans not only the sciences and medicine, but also technology, economics, humanities and the arts.

Sorbonne University was also selected as an "Excellence Initiative" by the French government, and includes four national research organisations as members: the CNRS (the national scientific research centre), Inserm (the national institute of health and medical research), the IRD (national institute for research and development) and Inria (national institute for computing and automation).

B.18 Université Paris-Sud

Founded in 1970 from a merger of five scientific research centres in the Orsay area, Université Paris-Sud is one of the most distinguished research institutions in Europe, now playing a major role in the creation of the consortium university of Paris-Saclay.

With a complement of over 5,700 teaching, support and research staff across five faculties, three University Institutes of Technology and a School of Engineering, Université Paris-Sud hosts a student population of around 24,000 full time students.

As a multidisciplinary university with a strong science and health science component, it offers education and training in a broad spectrum of fields, ranging from exact sciences to clinical medical practice, through computer science, physics, chemistry, nanotechnologies, biology, and pharmacy. Mathematics and physics in particular have historically earned Université Paris-Sud its worldwide standing, which has been recognised though a number of prestigious awards.

Université Paris-Sud is recognised globally for the exceptional quality of its research. In 2011, it was rated first amongst French universities in the Shanghai ranking, and in its forty years of existence it has accumulated numerous prestigious awards and honours.

The University actively participates in several competitiveness clusters such as Medicen, in therapeutic innovation, Moveo, in research and development in the automobile industry and public transport, and Astech, in aeronautics, space, and embedded systems. It is also a partner in other Advanced Research Topic Networks such as the Physics Triangle, Digitéo, Paris-Île-de-France Neuroscience School, and the Jacques Hadamard Mathematics Foundation.

Since 2003, Université Paris-Sud has been working towards the technological transfer of its research output through its Industrial and Commercial Activity Office, whose role is to protect intellectual property by patenting, and to facilitate its transfer into socio-economic circles (by licensing, or creating start-ups).

B.19 University of Strasbourg

A founding member of LERU, the University of Strasbourg was created in 2009 by the successful merger of three long-established universities in the region. It has a staff complement of over 6,000 people (teachers, lecturers, support staff and contractors) and is organised into 37 departments covering five academic fields. It offers Bachelors degrees in 47 subjects, Masters degrees in 192 subjects and Doctorates in 145 subjects and has a student population of almost 45,000 full time students.

The University of Strasbourg is driven by the ambition to rank among the best research universities. Strasbourg is a cluster of activity in many scientific fields such as biology, biotechnology, pharmaceutical drugs, chemistry, material physics or space sciences and is strongly involved in the development of research in humanities and social sciences.

Strasbourg was one of seven universities selected by the French government for the "Initiative of Excellence" programme launched in 2011.

The University is strongly tied to its neighbour universities of the Upper Rhine Region such as Freiburg and Karlsruhe in Germany and Basel in Switzerland. With 20% of its students coming from abroad (up to 50% for PhDs) the university is an attractor of international talent.

It has a strong commitment to technology and knowledge transfer and is a member of the international Biovalley cluster, one of the most important clusters in biotechnologies and health in Europe with more than 2,000 jobs and 45 companies created since 2005.

B.20 Utrecht University

Utrecht University was founded in 1636 and is located in the heart of the Netherlands. With over 31,700 full time students, more than 5,100 staff and an annual budget of €786 million, it is one of the largest and most renowned public institutions of higher education in the Netherlands. It currently has seven faculties in which 45 undergraduate degree programmes, almost 138 master's degree courses and 32 teacher programmes are offered.

The university rankings highlight the strong performance of Utrecht University with the Shanghai Rankings putting it in first place in the Netherlands, 16th place in Europe and 57th place in the world for overall performance.

The QS rankings place Utrecht University:

- in the top 100 universities in the world for the Faculties of Arts and Humanities (86th), Life Sciences and Medicine (53rd) and Natural Sciences (100th);
- in the top 100 universities in the world for the subjects of Medicine, Biological Sciences, Environmental Sciences and Computer Science and Information Systems; and
- in the top 50 universities in the world for Earth and Marine Sciences (33rd).

Utrecht University is an internationally prominent, research-led university that carries out fundamental and applied research across a wide range of academic fields. With its chosen research themes of sustainability, life sciences, institutions

and dynamics of youth, the university contributes to solving issues such as climate change, infectious diseases, the aging population, social cohesion and security.

It was a major contributor to the foundation of Utrecht Science Park which promotes innovation and knowledge transfer by leveraging relationships between the University, public research organisations and the private sector. At present the Science Park is home to over 60 research and development companies, of which more than half focus on the life sciences, including Merus Biopharmaceuticals, Genmab and Danone.

B.21 University of Zurich

Founded in 1833, the University of Zurich (UZH) is Switzerland's largest university, with a current enrolment of almost 25,600 full time students across seven faculties. Its staff complement of over 6,000 people offers a comprehensive academic programme covering more than 100 different subject areas.

It ranks among the world's top 100 universities, ranked 57 in the QS World Rankings and 56 in the Shanghai Ranking. Notably, the University of Zurich has been placed in the top 50 universities globally for the faculties of life sciences and medicine, with the Shanghai Ranking placing it 25th in Life and Agricultural Sciences and 33rd in Clinical Medicine and Pharmacy. The Nobel Prize has been conferred on twelve UZH scholars. Zurich's international reputation is based on ground-breaking research, particularly in molecular biology, brain research and anthropology, and on the work of the University Hospital and Veterinary Hospital.

The University of Zurich has developed several strategies to support and promote its international reputation of excellence in research by forming strategic networks to share findings with groups from other institutions of higher learning in Switzerland and abroad. It has also established interdisciplinary research projects and international networks and is a leading member of three National Centres of Competence in Research and a partner in numerous others.

In order to underpin its excellent position among the world's leading research institutions, the University of Zurich has established its University Research Priority Programs (URPP). The current URPP of the University of Zurich are: Asia and Europe, Dynamics of Aging, Ethics, Evolution in Action, Financial Market Regulation, Global Change and Biodiversity, Integrative Human Physiology, Social Networks, Language and Space, Systems Biology, Translational Cancer Research and Solar Light to Chemical Energy Conversion.