BiGGAR Economics

Economic Contribution of the Finnish Universities

A report to

Suomen yliopistot ry
Finlands universitet rf

Akava

Sivistystyönantajat
opetus · tutkimus · luovuus

SUOMEN YLIOPPILASKUNTIEN LIITTO
NATIONAL UNION OF UNIVERSITY STUDENTS IN FINLAND
FINLANDS STUDENTKÅRERS FÖRBUND

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1 EXECUTIVE SUMMARY

In late 2016 BiGGAR Economics was invited to assess the economic contribution generated by Finland's public Universities on behalf of a group[1] of agencies led by UNIFI, the representative body for Finland's Universities. This report presents the findings of the study.

1.1 Key Findings

The key finding of the report is that in 2016 the Finnish Universities contributed an estimated **€14.2 billion GVA**[2] and **136,000 jobs** in Finland. To put this in context, this equates to over 6% of Finnish economic output and more than 5% of Finnish employment.

This implies that:

- for each €1 Finnish Universities generated through their direct operations in GVA terms, they created almost €8 in total benefits for the Finnish economy; and
- each person directly employed the Universities supported more than four jobs elsewhere in Finland.

As a group, the 14 Finnish Universities had a full-time student population of approximately 148,000 students in 2016, a staff complement of around 32,000 people and a combined annual budget of approximately €2.7 billion.

The Universities are an embedded part of the cities and towns where they are based and bring an added vibrancy to these localities. The Finnish towns and cities that have Universities have experienced a population growth rate of twice the national average. Compared to non-university towns their growth is even more marked: in some cases growing at seven times the national rate.

They are also active contributors to the wider economic, social and commercial life of the country. For many years they have adopted a culture of knowledge exchange, collaboration and innovation. This has been vital for ensuring that the benefits of higher education and research are widely disseminated and has been a key driver of long-term economic growth.

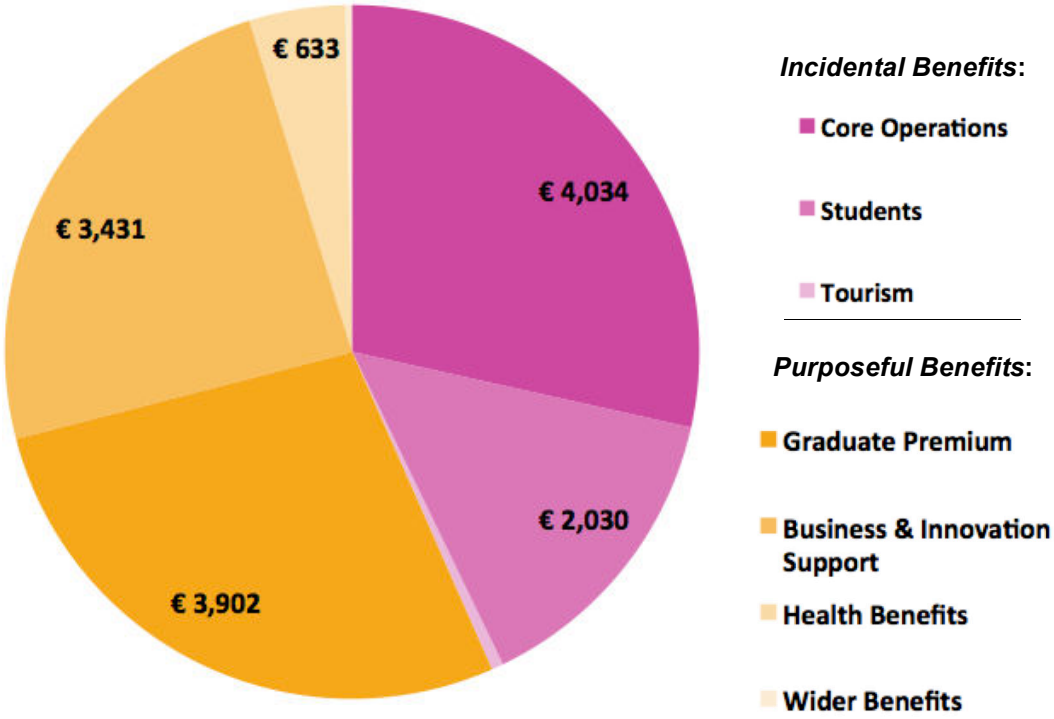
The Universities have purposely been spread across the country in order to extend the reach of higher education to people living beyond the capital region. This has had a very positive impact on the quality of education throughout the country and is a key factor behind the strong academic performance of Finland compared to other countries.

[1] This group also included the Confederation of Finnish Industries, the Association of Finnish Independent Education Employers, The Confederation of Unions for Professional and Managerial Staff in Finland and The National Union of University Students in Finland.
[2] Gross Value Added (GVA) is a measure of the value that an organisation, company or industry adds to the economy through its operations. In the case of Universities this is estimated by subtracting the non-staff operational expenditure (mainly represented by expenditure on goods and services) from the total income of the Universities.

1.2 Sources of Impact

There are two main groups of economic contribution generated by the Finnish Universities, Incidental benefits and Purposeful benefits. These are illustrated in Figure 1.1 and described below.

Figure 1.1: Sources of Economic Contributions in Finland, €million GVA (Incidental & Purposeful Benefits)



Total Contribution in Finland = €14.2 billion

Source: BiGGAR Economics

Incidental benefits (represented by the pink segments in Figure 1.1) are generated by any organisation or group and result from the core business of employing people and running services. In the case of the Finnish Universities, 43% of their total economic contribution in Finland can be classified as institutional benefits. These are:

- **Core Contributions** - The core contribution of the Finnish Universities includes the activity directly supported by the Universities as well as the activity supported by their expenditure on supplies and capital projects and the expenditure of their staff. It was estimated that in 2016, these activities generated €4.0 billion GVA and supported around 60,000 jobs in Finland.
- **Student Contributions** - There were 148,100 full-time students studying at the Finnish Universities in 2016. Student expenditure, student employment (outside the Finnish Universities) and student volunteering generated a further €2.0 billion GVA for the economy of Finland. This supported a further 35,000 jobs across the country.
- **Tourism** - It was estimated that the tourism contribution created by visits to staff and students, business trips and attendance at conferences and events

at the Finnish Universities generated €78 million GVA and supported 2,000 jobs in Finland.

Purposeful benefits (represented by the yellow segments in Figure 1.1): these are associated with the nature of the activity undertaken by the Universities and in a sense they represent the wider added value of the organisations. Some 57% of the economic contribution generated by the Finnish Universities can be classified as purposeful benefits. These are:

- **Knowledge Exchange and Business Services** - Finnish Universities undertake a wide range of knowledge exchange activity to support innovation within the Finnish economy. This includes activities to support the formation of new businesses (spin-offs, start-ups and other university owned enterprises), as well as supporting existing enterprises by providing consultancy support, undertaking contract research and providing staff training. The Universities further support existing enterprises through licensing technology, by providing access to specialised equipment and facilities and through student placements. Their role in providing facilities such as science parks and business incubators also help established and new businesses to grow. It was estimated that these activities together generated a total of €3.4 billion GVA and around 39,000 jobs in Finland.

- The unique characteristics of the Finnish innovation landscape, in particular the close relationships that exist between academia and industry, mean that the full value of knowledge exchange activities is likely to be more than the sum of its parts. Although it is very difficult to put an exact figure on this the analysis presented in this report suggests that it is likely to be at least €3.4 billion and could be as high as €21.7 billion, more than six times the value described in the previous paragraph.

- **Graduate Premium** - This contribution is conceptually different from the others in that it occurs over a much longer period of time. The graduate premium recognises the increased earnings over a lifetime that stems from educating people to degree level. This contribution was estimated to be worth almost €4.0 billion GVA in Finland.

- **Health benefits** - Like the graduate premium contribution this benefit also accumulates over a longer period of time.. The Universities received €167 million in medical research funding. The long-term outcomes of this research will include an increased quality of life for the patients who benefit from the new knowledge and a stimulation of further activity in the healthcare sector. This contribution was estimated to be worth €633 million GVA in Finland.

- **Wider Benefits** - Staff of the Finnish Universities also volunteer to serve on economic and social groups in a civic leadership capacity and generally use their expertise to help improve the way Finland is governed. This often contributes to the legislative process, provides advice to committees and contributes to public consultations. The estimated economic value of this contribution is €47 million GVA.

There are further, wider non-quantifiable benefits stemming from the presence of Universities that are not possible to express in numeric terms such as the social benefits of higher education and the value of the arts.

1.3 Conclusions

The overarching conclusion of this report is that Finland's Universities make a very substantial contribution to Finland's economy. They play a vital role in supporting long-term economic growth and ensuring that Finland maintains its competitive position in the global economy.

The scale of this contribution is however not fixed and could increase or decrease in response to future changes in university funding. While it is of course impossible to predict the future, analysis undertaken as part of this report suggests that any changes in university funding could have disproportionate effects on the Finnish economy.

In a hypothetical situation where the Finnish Universities' core funding was reduced by 10%, this could result in a loss of 16,900 jobs and €1.8 billion GVA in Finland. Such a reduction in the economic impact might be associated with a reduction in taxation revenues of €0.8 billion and so it is likely that a cut in government funding could be counterproductive since the lost taxation receipts could well be greater than the funding cut.

It is also important to acknowledge that in estimating the impacts presented in this report it has often been necessary to err on the side of caution and for this reason the impact presented above is likely to be an underestimate.

This is particularly the case in relation to the Universities' contribution to long-term economic growth where the very high degree of integration that exists between business and academia in Finland means that a significant amount of university/business interaction occurs informally. While this is good for the Finnish economy, the fact that so much of this activity goes unrecorded makes it very difficult to quantify its value.

This means that the impact presented above is likely to underestimate the true value of this activity to the Finnish economy. Quantifying the extent of this underestimate is challenging but one approach suggests that the true value of this activity could be more than six times the estimate presented above (i.e. closer to €21.7 billion than €3.4 billion).

This would imply that the total contribution that the Universities make to the Finnish economy could be closer to €32 billion, more than double the impact presented above. While some caution is necessary in interpreting this figure, it does at least provide a strong basis for concluding that the impacts presented in this report are likely to understate rather than overstate the true value of the Universities to the Finnish economy.

2 INTRODUCTION

This report summarises the findings of a study undertaken by BiGGAR Economics Limited into the economic contribution of the network of 14 public Universities in Finland.

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 Finnish Universities;
- the tourism contribution created by visitors to staff and students, business tourism and attendance at conferences and events held at the Universities; and
- the life-time productivity gains from teaching and learning delivered by each of the Finnish Universities (graduate premium).

The base year for all data was 2016. The study presents a snapshot of the contributions of the Finnish Universities to the Finnish, European and global economy.

2.2 Background

This study was commissioned by:

- **Universities Finland (UNIFI)** – a co-operational organisation that brings together and represents the interests of all 15[3] public Universities in Finland. UNIFI's predecessor, the Finnish Council of University Rectors, was founded in 1969 with the task of promoting co-operation for the benefit of Universities. UNIFI's current aim is to influence the Finnish higher education and research policy and to promote the common interests of Universities.
- **Confederation of Finnish Industries (EK)** – the leading business organisation in Finland with the primary objective of making Finland an internationally attractive and competitive business environment.
- **The Association of Finnish Independent Education Employers (AFIEE) –** represents around 320 Employers in the education and higher education sector in Finland. The Association represents education providers from all levels of education including the 14 Universities covered by this study.

[3] UNIFI represents all 15 of the public Universities in Finland. This includes the National Defense University (NDU) but due to the unique nature of this university it is not considered as part of this study. Future references within this report to the Finnish Universities therefore relate to the 14 Universities (excluding the NDU) rather than UNIFI's entire membership.

- **The Confederation of Unions for Professional and Managerial Staff in Finland (Akava) –** the leading trade union confederation for university educated workers in Finland. Akava represents more than 600,000 people including employees, entrepreneurs, students and professionals.
- **The National Union of University Students in Finland (SYL) –** SYL represents more than 132,000 university students in Finland. Its primary objective is to defend and improve educational, financial, and social benefits and rights for students in Finland.

UNIFI, EK, AFIEE, Akava and SYL established a consultation group for the study which met once a month during the study. The consultation group was chaired by Leena Wahlfors (UNIFI), and the members were Riikka Heikinheimo (EK), Teemu Hassinen (AFIEE), Heikki Taulu (Akava), and Niina Jurva (SYL). Jarmo Kallunki (UNIFI) served as a secretary and an advisor to the consultation group.

2.2.1 Finnish Universities

The 14 Finnish Universities covered by this study (henceforth referred to as the 'Finnish Universities') are:

- Aalto University
- University of Helsinki
- University of Eastern Finland
- University of Jyväskylä
- University of Lapland
- Lappeenranta University of Technology
- University of Oulu
- Hanken School of Economics
- University of Arts Helsinki
- Tampere University of Technology[4]
- University of Tampere
- University of Turku
- University of Vaasa
- Abo Akademi University

Together, the 14 Finnish Universities have a full-time student population of approximately 148,100 and a staff complement of 32,000 people. The combined annual budget for the organisations is approximately €2.7 billion. Funding for each University generally comes from three public sector sources: direct from the Ministry of Education, from the Academy of Finland and from Tekes (the innovation agency). In recent years direct University funding has been cut and this has resulted in some job losses.

[4] The University of Tampere and the Tampere University of Technology are to merge in 2019.

A brief description of the origins of each institution, its scale, structure and main research focus is contained in Appendix B of this report.

2.2.2 University Locations

Universities bring an important cultural life and vibrancy to towns and cities in which they are located. There are 11 major university locations across the country: Helsinki, Espoo, Lappeenranta, Turku, Tampere, Vaasa, Jyväskylä, Kuopio, Joensuu, Oulu, and Rovaneimi.

In addition there are a further six towns where groups of Universities operate as a consortia to further extend the reach of higher education into these areas. Within the consortium each institution has their own area of specialisation. The University Consortia operate in:

- Kajaani – Universities of Oulu, Eastern Finland, Jyväskylä and Lapland;
- Kokkola – Universities of Jyväskylä, Oulu and Vaasa;
- Seinajoki – Universities of Tampere, Helsinki, Vaasa and the Tampere University of Technology;
- Mikkeli – Universities of Aalto, Helsinki and Lappeenranta;
- Pori – Universities of Aalto, Tampere, Turku and the Tampere University of Technology; and
- Lahti – Universities of Helsinki, Aalto and Lappeenranta.

Two further consortia of Finnish Universities operate outside Finland in Tallinn and St Petersburg.

2.2.3 Reputation of Finnish Education

The Finnish education system has been founded on the basis of equality and equity with the long-held belief that everyone should have access to education regardless of their social background, place of residence or family wealth. At the school level, this has created an equitable system whereby the disparity between low and high-achieving pupils is minimised: “everyone does well” so there is a collectively high average level of educational attainment. The result is that Finland has one of the highest-performing school systems in the world.

Every three years the Organisation for Economic Cooperation and Development (OECD) tests 15-year-olds from 72 countries around the world on their maths, science and reading abilities. This is called the Programme for International Student Assessment, or PISA test. The latest results are for 2015 and show that Finnish pupils are the third best in the world in science, the second best in reading and in seventh position in mathematics. There are small shifts in the latest ranking compared to the previous one in 2012, but no remarkable change overall.

Much of the credit for this success is due to the fact that Finnish teachers are also considered to be amongst the best in the world, reflecting the high-quality of teacher education across the country. In general education all teachers in Finland are required to have a Master's degree.

It could also be argued that the wide geographic distribution of the Universities has contributed to this performance by helping to make higher education more accessible to a larger proportion of the population. In some areas it is also likely

that the presence of the Universities has helped to create a critical mass of expertise in particular areas of industry and technology.

Teacher education is a role for several of the Universities, resulting in teacher education being dispersed across the country. This, in turn, helps with teacher recruitment in more remote, rural areas. Findings from research into education and teaching methods are translated into practice through initial teacher education and in-service training.

2.2.4 Collaboration

Collaboration between Universities, local municipalities and businesses has been an embedded part of the culture in Finland over many decades and this has fostered an integrated, strategic approach to business and economic development in the country. Trust and understanding has grown between these different interest groups.

An interesting example of this is the University of Oulu, which is part of Oulu Innovation Alliance. Created in 2009, this is a unique collaboration between 8 partners that includes the City of Oulu, University of Oulu, Oulu University of Applied Sciences, VTT Technical Research Centre of Finland, Technopolis plc, the Finnish Environment Institute, Oulu University Hospital and Osekk (the Regional Joint Authority for Education). It's objectives for 2016 to 2020 are to enhance Oulu's attractiveness by supporting the establishment, development and internationalisation of companies based on state-of-the-art expertise.

To accomplish this, five ecosystems have been created: Northern City with Attractive Opportunities; Agile Commercialisation; ICT and Digitalisation; Industry 2026 and OuluHealth. The Alliance generates global business through joint research, development and innovation projects. Businesses and public organisations meet in joint projects and ventures that combine different industries and scientific fields. These involve professionals as well as ordinary people via the living lab concept.

National funding instruments such as Tekes have supported the close collaboration between education and industry. However, funding for Tekes has recently been cut and Universities have sought other sources of funding to replace this gap. This has included more international business engagement.

Universities have been encouraged by Government to profile their strengths. Most have done this and have decided to focus on key themes, usually on a multi-disciplinary basis. These centre on areas of competitive advantage. Some examples are communications, ICT (all Universities, especially Tampere near Nokia), ship-building (Turku), forestry and health (Eastern Finland), sport and health (Jyväskylä), Arctic studies (Lapland), sustainable business and technology (Lappeenranta).

The link between Universities and economic development is considered in more depth in Section 4.

2.2.5 Knowledge Exchange

Within this structure of collaboration, Finnish Universities have a highly integrated approach to knowledge exchange and business development. This has been happening as a matter of routine over many years. As a result, it is difficult to accurately measure the economic contribution that stems from the knowledge exchange activities of the Universities.

The case of Cerebricon and its links with the University of Eastern Finland provides a useful example to illustrate this point. Cerebricon was launched in 2003 when two students from the University of Kuopio set up their own business to focus on diseases of the central nervous system. The company provides contract research to global bio/pharmaceutical organisations that are outsourcing their research and development activities. The business was bought over by Charles River in 2009 and now employs around 110 people. The University doesn't play much of a role in the company's day-to-day activities but it is key in providing training and expertise. The company founders and many of the staff are graduates from Kuopio and the company would not be in Kuopio if the University were not there. It is difficult, therefore, to definitively establish how much of the economic impact of the company is attributable to the University.

2.2.6 Innovation

The Universities are also key collaborators in providing innovation and business start-up support services as the following examples show:

- HILLA Programme at the University of Oulu - a 5-year acceleration and investment program focusing on smart specialisation and utilising ICT;
- Aalto Start-Up Centre at the University of Aalto – active since 1997, the centre supported 250 start-ups between 2010 and 2016;
- Demola/New Factory at the University of Tampere and Tampere University of Technology – an extensive incubator facility founded in 2008. Demola teams work on real-life cases together with partner companies to create and refine business concepts, develop new products, or build demos and prototypes;
- SparkUp at the University of Turku – in collaboration with partners and including Abo Akademi University, this service is directed at companies in the initial and early stages.
- Primo at the University of Arts, Helsinki – acts as an agency for providing arts students and groups of performers for music and arts events at the early stages of their careers.

2.3 Higher Education Policy and Economic Development in Finland

In Finland the role of universities in developing the economy has been long understood and actively managed by successive governments since the 1960s; this was one of the main arguments for the geographical expansion of the university system. Education is considered to be the key to keeping the country strong[5] and the country prides itself on having an internationally renowned education system. Historically, education has always been seen as a tool for social mobility and the development of the country as a whole.

[5] Kooij, J (2015), *European Higher Education Policy and the Social Dimension: A Comparative Study of the Bologna Process*, 5.1.1

This policy has continued to the present day when universities are seen as central actors in the Finnish knowledge-based economy and core parts of the Finnish innovation system[6].

2.3.1 1960s – 1990s: Widening Participation

Beginning in the 1960s, the institutionalisation of science and technology policy was part of a broader policy programme that the Finnish government undertook to address the economic stagnation of the post-war period[7]. The expansion of the higher education system was high on the government's agenda and education. Policies focused on ensuring equality of opportunities both socially and geographically through regionalisation, increasing access rates, through the development of the non-university higher education sector, lifelong learning and increasing the participation of people from immigrant backgrounds.

The focus of the first Higher Education Development Plan from 1967-1986 was on ensuring "social and geographical equality by increasing access to" higher education to develop the country[8]. The ministry set a 25% entry rate into higher education as a primary objective.

At the end of the 1950s all universities were in the south of Finland, which made access to higher education difficult for people in the north. As part of regional policy "major provinces were allowed to establish a university of their own in the 1960s-1980s"[9].

Six of the Universities in the UNIFI network were founded during this time, University of Oulu (1958), Tampere University of Technology (1965), University of Jyväskylä (expanded in 1967), University of Vaasa (1968), University of Lappeenranta (1969) and the University of Lapland (1979). A seventh, the University of Eastern Finland, was formed from the merger of two Universities that were also established during this time: the University of Joensuu (1969) and the University of Kuopio (1972).

The second development plan for 1987-1992 added other priorities to higher education policies such as ensuring access to higher education for everyone, for example by establishing the Open University in the country. Subsequent development plans continued to emphasise ensuring access independently of "age, place of residence, language and economic standing, to participate in high-standard education and training"(Finnish Ministry of Education, 2004).

In the 1990s the establishment of the non-university higher education sector was the most significant reform in higher education in Finland to make vocational education more appealing for young people.

[6] Source: Valimaa, J. (2001). A historical introduction to Finnish higher education. In J. Valimaa (Ed.), Finnish higher education in transition: Perspectives on massification and globalisation (pp. 13–54). Jyväskylä: Institute for Educational Research. Available online: http://files.eric.ed.gov/fulltext/ED461347.pdf
See also: Valimaa & Hoffman (2008). Knowledge society discourse and higher education. Higher Education, 56: 265–285. DOI 10.1007/s10734-008-9123-7

[7] Patrucco, P (2017), *The Economics of Knowledge Generation and Distribution: The Role of Interactions in the System Dynamics of Innovation and Growth*, Section 4.

[8] Valimma, 2005, quoted in op.cit.

[9] Op. cit.

Throughout these decades, the Finnish economy has experienced an impressive expansion in the face of several periods of economic stagnation and recession[10]. Part of this resilience is believed to come from the country's transformation from a resource-based to a knowledge-based economy throughout these years. This was assisted by an active national policy to both support (Tekes) and finance innovation (Finnvera).[11]

2.3.2 2000 - 2020: Mergers and Internationalisation

More recently, the Universities Act of 2009 introduced a period of radical change, merger and consolidation into the University network throughout the country. The Act has provided universities with independent legal status, changed their relationship with the government, affected university governance arrangements, and altered the relationship between staff and their university employers.

Although radical in nature, many of the changes were invisible to those outside the sector. The aim was to build up a better and more effectively performing higher education system with an enhanced focus on internationalisation, research and innovation.

The most notable change that resulted from the Act was a reduction in the number of Universities from 21 to 15 at present. Within this, four new institutions were formed:

- Aalto University (a merger of Helsinki School of Economics, University of Art and Design and the Helsinki University of Technology),
- University of Eastern Finland (a merger between the Universities of Joensuu and Kuopio),
- University of Turku (a merger of the University of Turku and Turku School of Economics); and
- University of Arts, Helsinki (a merger of the Finnish Academy of Fine Arts, the Sibelius Academy and the Theatre Academy Helsinki).

One further merger is planned in 2019 between the University of Tampere and the Tampere University of Technology.

The Finnish Ministry of Education's Strategy for the Internationalisation of higher education institutions for 2009-2015 set out five primary aims:

- a genuinely international higher education community;
- increasing the quality and attractiveness of higher education institutions;
- promoting the export of competence;
- supporting a multicultural society; and
- promoting global responsibility.

While the number of higher education institutions is reducing, government guidelines still prioritise regional access with tailor-made research, development

[10] Patrucco, P (2017), *The Economics of Knowledge Generation and Distribution: The Role of Interactions in the System Dynamics of Innovation and Growth*, Section 4.
[11] Ibid.

and innovation activities to meet regional needs. Within the sector, the aim is that there will be no more than 15 Universities in Finland by 2020 and with one final merger planned, it looks set to meet this target. These are to be strong units with clear research priorities and a strong focus on internationalisation.

2.4 Report Structure

The remainder of the report is structured as follows:

- section three summarises the framework for analysis that has influenced our approach to this study;
- section four describes the approach methodology adopted for this study;
- section five describes the economic contribution arising from the core activities of the Finnish Universities. This includes the contributions associated with direct income and employment, the Universities expenditure on 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 and volunteering;
- section seven assesses the combined contribution of the Finnish Universities to tourism from family visits to students and staff, business tourism and from expenditure at conferences and events hosted at each university;
- section eight describes the contribution of knowledge exchange activities, enterprise and innovation associated with the Finnish Universities and their employees using their knowledge to benefit other organisations, including the contributions from spin-off and start-up companies, university-owned enterprises, technology licensing, services to businesses, science parks and student placements;
- section nine considers the role of Universities as drivers of long-term economic growth in Finland;
- section ten describes the economic value of the health benefits associated with the medical research undertaken by the Finnish Universities;
- section eleven 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 twelve highlights some of the wider benefits generated by the Universities that are more difficult to quantify;
- section thirteen summarises the estimated total economic contribution of the Finnish Universities in Finland;
- section fourteen explores the relationship between government funding for the Universities and the economic contribution they make and discusses how this could be affected by future changes in funding;
- section fifteen summarises the quantifiable economic contribution of the Finnish Universities in Europe and globally; and

- section sixteen contains the conclusions of the analysis.

Appendix A provides a guide to abbreviations and terms used.

Appendix B contains brief summary descriptions for each Finnish University.

Appendix C contains a methodological appendix.

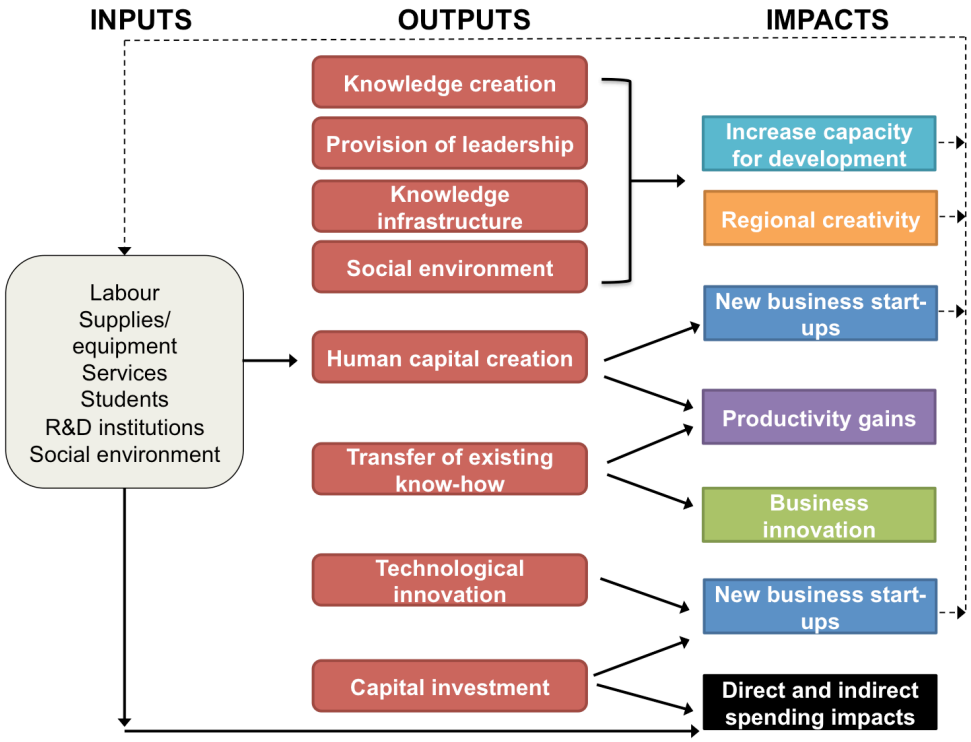
3 FRAMEWORK FOR ANALYSIS

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 begins by presenting a theoretical framework that describes the various ways in which universities generate economic benefit and then goes on to consider how these benefits are realised at both the regional and national level.

3.1 Theoretical Framework

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 3.1.

Figure 3.1: University Outputs and Expected Economic Impacts



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

3.2 Incidental and Purposeful Benefits

The economic impacts associated with any learning institution are often seen to be incidental. Local job creation and increased cultural opportunities for example, while desirable from an economic development perspective, are secondary to the Universities' core mission of teaching, research and knowledge exchange.

These types of effects are associated directly with the Universities' expenditure in the economy and that of their staff and students. They arise largely as a result of the existence of the Universities as large organisations and are in many ways

comparable to the activities of any other large organisation with an extensive supply chain, significant staff complement and a large consumer base. For this reason these type of benefits are could be described as "incidental benefits" and are considered in chapters 5, 6 and 7 of this report. These benefits include:

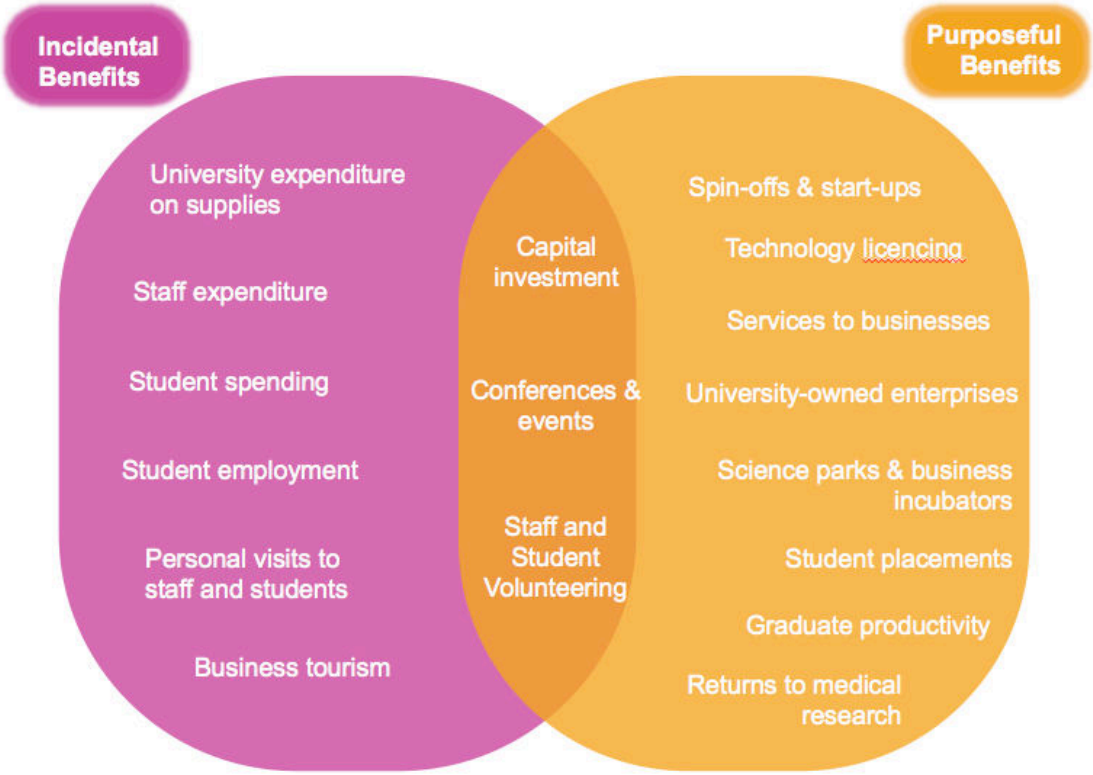
- the core operational effects of the Universities, including the people they employ and their expenditure and that of their employees on goods and services;
- the effects generated by students at the Universities including the impact of student expenditure on goods and services and the contribution that students make to the local economies in which they live by working or undertaking voluntary activity during the course of their studies;
- the contribution that visitors to the Universities and their students and staff make to the Finnish tourism sector.

The Universities also undertake a variety of activity with the explicit purpose of creating positive economic impacts in the local area and further afield. This type of activity is conceived specifically with the aim of driving innovation and productivity growth within the economy. These benefits are associated with the nature of the activity undertaken by universities rather than their existence as organisations and might therefore be described as "purposeful benefits". These type of benefit are described in chapters 8 - 12 of this report. These benefits include:

- the contribution that the Universities make to long-term economic growth by supporting innovation and the creation and development of businesses within the Finnish economy;
- the economic value of the health benefits generated by medical research undertaken by the Universities; and
- the contribution that graduates from the Universities make to the productivity of the Finnish economy as a result of the skills and experience they gain during their time at University.

The division between "incidental" and "purposeful" benefits is depicted in Figure 3.2, which illustrates that the distinction is not always clear-cut. Some of the tourism benefits described in chapter 7 for example are associated with conferences and events that are directly related to core areas of research or knowledge exchange activity. Similarly, students and staff who decide to volunteer do so independently of the Universities – but their ability to do so often rests on skills or knowledge gained during their work or studies.

Figure 3.2: Incidental and Purposeful Benefits



Source: BiGGAR Economics

3.3 Productivity and Innovation

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[12] 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

[12] Stiglitz and Greenwald (2014), *Creating a Learning Society: A New Approach to Growth, Development, and Social Progress*.

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.[13]

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.

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).

3.3.1 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.

3.3.2 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.

3.3.3 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.

3.3.4 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

[13] HM Treasury, Department for Business, Innovation & Skills (2014), *Our Plan for Growth: Science and Innovation*.

organisations. This ensures a coordinated economic development approach helping to match skills with regional needs and vice versa.

3.3.5 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.

3.4 Conclusion

Universities are major drivers of knowledge and innovation. This is 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). This role is considered in further detail in chapters 8 to 11 of this report, which quantify the value of this contribution to the Finnish economy.

4 APPROACH AND METHODOLOGY

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

4.1 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 70 leading institutions in the UK, Ireland and Europe, 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 so 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 our assessment of the economic contribution made by the combined group of 21 Universities who are members of LERU (2014)[14], the League of European Research Universities. Other examples are the Nederlandse Federatie Van Universitair Medische Centra (NFU, the organisation representing the Medical Research Centres in the Netherlands) study[15], the Russell Group 2010 report on the impact of research[16] and the 2014 report on the economic impact of capital projects[17], Universities Scotland[18] 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[19].

[14] League of European Research Universities (2015), *Economic Contribution of the LERU Universities*

[15] 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)

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

[17] 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)

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

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

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 out in European Commission Guidance[20] on major projects, which highlights the importance of assessing the fullest range of potential economic effects possible.

From this, BiGGAR Economics has established credibility with policy makers and sector organisations. Our impact studies have been used to demonstrate the value that universities and institutions have to stakeholders, policy makers and the public as well as being used in support of funding applications.

4.2 General Approach

The overarching objective of this research is to illustrate the scale and breadth of the economic contribution made by Finnish Universities. 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 contribution.

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.

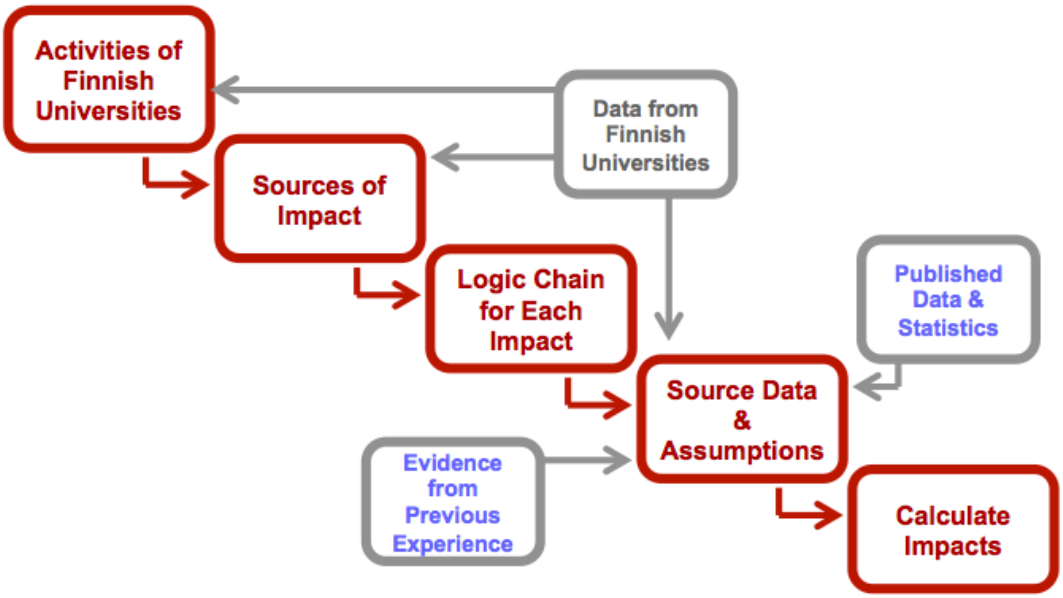
Where possible source data was obtained directly from the Finnish Universities. Where this was not possible an appropriate assumption was made based on the data provided by other Finnish Universities and BiGGAR Economics previous relevant experience of other comparable institutions elsewhere in the world. 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 Finnish Universities.

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 contribution for each institution. Each type of contribution was then aggregated in order to produce an estimate of the total contribution of all Finnish Universities. This process is illustrated in Figure 4.1.

[20] 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 4.1 – Approach



Source: BiGGAR Economics

4.3 Quantifiable Vs Non-Quantifiable Benefits

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

- 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 estimated by subtracting the non-labour costs of the organisation from the organisation's total revenue. In the case of Finnish Universities this is estimated by subtracting the non-staff operational expenditure (€0.9 billion) from the total income of the Universities (€2.7 billion); and

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

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.

4.3.1 Wider Benefits

Through their work UNIFI 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 six Finnish Universities are involved in medical research and work in close collaboration with local hospitals. These are the Universities of Helsinki, Jyväskylä, Eastern Finland, Oulu, Turku and Tampere. This research often results in spin-out companies and/or licence deals, the contribution 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 Finnish Universities 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.

Finnish Universities 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 Finnish Universities is understood as part of this wider context.

4.3.2 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 Finnish Universities 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 Finnish Universities 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.

Finnish Universities 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 Finnish Universities it is necessary to use a dynamic approach to economic analysis.

4.4 Methodology for Estimating Quantifiable Benefits

The methodology used to estimate the economic contribution of the Finnish 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.

4.4.1 Baseline Year, Measures and Geography

The economic contributions described in this report are for 2016, 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 2017.

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

- GVA to turnover ratio – this is used to estimate the GVA contribution 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 contribution 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 contribution 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 estimated by BiGGAR Economics using input-output tables for Finland.

These terms are defined further in Appendix A. The economic contributions quantified in this report are those at the level of the Finnish, European and global economy.

4.4.2 Timescale of Contributions

Some of the activity undertaken by the Finnish Universities generates economic activity immediately. For example, purchases made by the Finnish Universities generate activity amongst the suppliers of the Finnish Universities almost immediately.

However, much of the activity undertaken by the Finnish Universities does not generate immediate economic effects. For example, the additional income that the graduates of Finnish Universities will earn as a result of the enhanced skills they gain while studying will be generated over their entire working lives and not just in the year after graduation. Similarly, the benefits of knowledge transfer activity, such as services to businesses will not be realised immediately.

The timeframe of the economic contributions quantified in the report are summarised in Table 4-1.

Table 4-1: Timescale of Economic Contributions

Contributions realised in 2016	Contributions realised in the Future
Core Operations	Graduates
Students	Services to Businesses
Tourism	Returns to Medical Research
Spin-outs	
Science Park and Incubator Facilities	
University Owned Enterprises	
Licensing	
Staff Volunteering	
Student Placements	

4.4.3 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[21].

4.4.4 Avoiding Double Counting

Given the approach summarised in Figure 3.1 above, it was 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 contribution has been counted only once.

4.4.5 Consistency of Approach and Activities Included

The Finnish Universities are based in different locations with different operating systems. One of the important principles of the method adopted was to ensure that there was a consistency in the approach to estimating economic contributions, across the systems in which the Finnish Universities 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 Finnish Universities. 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 Finnish Universities 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

[21] 22nd General Conference on Weights and Measures, 2003.

locations. The economic contributions in this report include medical teaching and research; however, healthcare delivery has been excluded.

4.5 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 contributions 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 Finnish 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.

4.6 Sources of Quantifiable Contributions

The economic contributions quantified in this report were based on several sources of contribution 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 exchange, enterprise and innovation activity created by and arising from the Finnish 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 methodology for each of these calculations is briefly described throughout the report as each contribution is discussed. A more detailed discussion is contained in the methodological appendix at the end of the report.

5 CORE CONTRIBUTION

The core contribution covered in this chapter includes:

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

In terms of the framework for analysis set out in section 3.2, the benefits considered in this chapter are considered "incidental benefits". The possible exception to this is capital investment, which is sometimes undertaken with the aim of achieving specific economic development objectives.

5.1 Direct Effect

The direct contribution of a group of organisations (or a single organisation) is the value it adds to the economy and the number of jobs it supports in a given time frame. This value 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 Finnish Universities. Non-staff operating expenditure excludes staff costs, interest payments, depreciation, expenditure on capital projects and any payments to students, such as scholarships or bursaries.

In 2016, the 14 Finnish Universities had a total operational income of €2.7 billion which covered teaching, research, estates and other income (Table 5.1). The Direct GVA and the employment directly supported by the Finnish Universities are shown in Tables 5.2 and 5.3.

Table 5-1: Finnish Universities: Direct Effect Assumptions – Income

	Total (€ m)
Total Income	2,692

Source: The Finnish Universities

Table 5-2: Finnish Universities: Direct Effect – GVA

	Total (€ m)
Total Income	2,692
Less Non-staff operational cost	866
Direct GVA	1,826

Source: The Finnish Universities

Table 5-3 Finnish Universities: Direct Effect – Employment

	Total
Finnish Universities employment (headcount)	32,000
Finnish Universities employment (full-time equivalent jobs)	29,600

Source: The Finnish Universities

In 2016, the Finnish Universities supported 32,000 jobs (or 29,600 full-time equivalent jobs) in the economy and had an output of €1.9 billion. The further effects arising from this employment and level of output are estimated in the next section.

5.2 Supplier Effect

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 Finnish Universities.

The inputs used to estimate the supplier effect are shown in Table 5.4. In cases where Universities were unable to provide information about the location of their suppliers, an average was applied which was estimated from those who were able to supply more detailed data.

Expenditure on goods and services (excluding rent, depreciation, scholarships) was €534 million in 2016. Across all Finnish Universities it is estimated that 93% of this expenditure was placed with companies based in Finland, a further 6% was with companies based in Europe and 1% was with companies from outside Europe.

The expenditure was analysed by sector since the GVA supported should reflect the differing GVA to turnover ratios for each sector of the economy. The direct GVA contributions were estimated by dividing the expenditure in each sector by the appropriate GVA to turnover ratio. Direct employment was estimated by dividing the direct GVA by the turnover/employment ratio in the industries relevant to the expenditure.

The initial expenditure by the Finnish Universities creates multiplier effects throughout the economy. The indirect effect reflects the increased demand on the suppliers of the Finnish Universities and so on down the supply chain. As a result of the direct and indirect effects the level of household income throughout the economy will increase as a result of increased employment. A proportion of this increased income will be re-spent on final goods and services, which is the induced effect. These multiplier effects were estimated by applying GVA and employment multipliers appropriate to the sectors in which the expenditure occurred.

Table 5-4 Finnish Universities: Supplier Effect – Assumptions

Amount spent on goods and services (€m)	Total
Total Expenditure on Goods and Services	€534 million
Location of Suppliers	
Finland	93%
Rest of Europe	6%
Rest of World	1%

Source: Finnish Universities and BiGGAR Economics Assumptions

The total supplier effect for the Finnish Universities is shown in Table 5.5. It is estimated that spending on goods and services for the 14 Finnish Universities supports €461 million GVA and 7,000 jobs in Finland.

Table 5-5 Finnish Universities: Supplier Effect – Total Contribution (Direct & Multiplier)

Finland	GVA (€m)	Employment (jobs)
Supplier Contribution	461	7,000

Source: BiGGAR Economics Analysis

5.3 Staff Spending

The staff employed directly by the Finnish Universities spend their wages and salaries in the wider economy and this also increases turnover and supports employment in local businesses and throughout Finland as a whole. For the purpose of the analysis it is assumed that all staff live in Finland.

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.

An adjustment is then made to account for the VAT element in this expenditure to ensure that the estimates are in line with Eurostat data. The economic contribution of staff spending as measured by GVA and employment supported, is estimated by applying economic assumptions as described above. It was assumed that staff would spend their salaries across the whole economy, rather than in any particular industry.

The key assumptions used in calculating this contribution are shown in Table 5.6.

Table 5-6 Finnish Universities: Staff Spending – Assumptions

Staff Numbers	
Number of jobs (headcount)	32,000
Staff Costs (€ million)	1,690
VAT	
VAT as a proportion of staff expenditure	11%
Location of Spending	
Finland	95%
Rest of Europe	99%
Rest of World	100%

Source: Finnish Universities and BiGGAR Economics Assumptions

These expenditure figures can 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 estimated by dividing the GVA contribution by an estimate of the average GVA/employee and finally multipliers are applied to capture the effects of subsequent spending rounds.

This results in a staff spending contribution of €1.4 billion in GVA and 18,000 jobs in Finland. These figures are summarised in Table 5.7.

Table 5-7 Finnish Universities: Staff Spending – Total Contribution

Finland	GVA (€m)	Employment
Staff Spending Contribution	1,385	18,000

Source: BiGGAR Economics Analysis

5.4 Capital Contribution

There are two elements to the economic contribution made by capital expenditure for or on behalf of the Finnish Universities – money spent on buildings and estates and money spent on equipment (research infrastructure).

5.4.1 Estates Investment

Capital investment in estates for the Finnish Universities is managed by three separate companies:

- AaltoCRE –which is wholly owned by Aalto University and manage all of their estates;
- University of Helsinki Properties – which is wholly owned by the University of Helsinki for the same purpose; and
- SYK Oy – established in 2009 to lease and develop premises primarily for Universities and higher education institutions outside the Greater Helsinki region. It is two-thirds owned by 10 Universities outside Greater Helsinki[22] and one-third owned by the Finnish government. Its portfolio comprises some 380 university buildings and its aim is to turn campuses into attractive and sustainable environments that support the Universities and are part of the Cities they belong to. Recently, the company has invested heavily in repairs and renovation projects and improved the energy management of its properties.

In 2016, the estates companies that provide premises for the Finnish Universities spent €214 million on buildings-related capital projects across all UNIFI sites. Although the nature of the capital projects varies from year to year, this figure is broadly typical of average annual expenditure and as such can be used to estimate an annual contribution.

Capital spending provides an important income stream for the Finnish construction sector and it is possible to convert this into GVA by applying a ratio of turnover to GVA for the construction sector. 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 this expenditure can then be estimated by applying GVA and employment multipliers for the construction sector. In this way it can be estimated that the total contribution of construction expenditure to provide and

[22] University of Eastern Finland, University of Jyväskylä, University of Lapland, Lappeenranta University of Technology, University of Oulu, University of Tampere, Tampere University of Technology, University of Turku, University of Vaasa and Åbo Akademi University.

improve buildings for the Finnish Universities amounts to €282 million in GVA, and 1,000 jobs, all of which occur in Finland.

The assumptions used in calculating this contribution are summarised in Table 5.8 and the contributions are summarised in Table 5.9.

Table 5-8 Finnish Universities: Capital Spending – Assumptions

Capital Spending	
Annual Capital Expenditure, 2016 (€m)	214
Location of Spending	
Finland	100%

Source: SYK Oy, AaltoCRE, University of Helsinki Properties and BiGGAR Economics Assumptions

Table 5-9 Finnish Universities: Capital Spending Contribution

Finland	GVA (€m)	Employment
Capital Spending Contribution	282	1,000

Source: BiGGAR Economics Analysis

5.4.2 Research Infrastructure

The Finnish Universities also invest in capital equipment each year. Across the group this covers a very wide range of purchases from technical scientific equipment to musical instruments. The common theme is that this money is being invested in improving the infrastructure at the Universities, excluding investment in the physical buildings themselves. Total annual expenditure on research infrastructure across the group is €53 million in 2016. Of this, 74% is sourced from companies in Finland, a further 21% from companies elsewhere in Europe and 5% from companies elsewhere in the world. Table 5.10 summarises the assumptions made for these calculations.

Table 5-10 Finnish Universities: Research Infrastructure Spending – Assumptions

Capital Spending	
Average Annual Research Infrastructure Expenditure, 2016 (€m)	53
Proportion of Research Infrastructure Purchased from...	
Finland	74%
Europe	95%
Global	100%

Source: SYK oy, AaltoCRE, University of Helsinki Properties and BiGGAR Economics Assumptions

This investment creates supports a further round of GVA and jobs through multiplier effects which can be attributed to each location according to data provided by the Universities. In this way it is estimated that expenditure on research infrastructure supports €78 million in GVA and around 1,000 jobs in Finland.

Table 5-11 Finnish Universities: Research Infrastructure Spending Contribution

Finland	GVA (€m)	Employment
Research Infrastructure Contribution	78	1,000

Source: BiGGAR Economics Analysis

5.5 Summary of Core Contributions

The contribution 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 €4.0 billion in GVA and 60,000 jobs in Finland. These figures include the multiplier effects of the core activity.

The core contributions are summarised in Table 5.12.

Table 5-12 Finnish Universities: Total Core Contribution – Summary

Finland	GVA (€m)	Employment
Direct Contribution	1,873	32,000
Supplier Contribution	463	7,000
Staff Spending Contribution	1,385	18,000
Sub-Total Core Contribution	3,674	57,000
Estates & Research Infrastructure Contribution	361	3,000
Total Core Contribution (including Estates & Research Infrastructure)	4,034	60,000

Source: BiGGAR Economics Analysis (numbers may not sum due to rounding)

6 STUDENT CONTRIBUTION

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

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

In terms of the framework for analysis set out in section 3.2, the benefits considered in this chapter are considered "incidental benefits". The possible exception to this is student volunteering, which is sometimes encouraged to support important regional development objectives.

6.1 Student Population

This report only considers the economic contribution associated with the full time students of the institutions. Part-time students have been excluded as their courses are a secondary aspect of their activities.

The combined full-time student population of all 14 Finnish Universities in 2016 was 148,100 people (Table 6.1). Just over half (52%) were studying for undergraduate degrees and a further 44% were studying for masters and doctoral (or equivalent) degrees. The remaining 4% were studying for a licentiate or other qualification.

Table 6-1 Finnish Universities: Total Student Population

	Total
Undergraduate (full time)	77,300
Postgraduate (full time)	65,500
Licentiate & Other	5,300
Total (full time)	**148,100**

Source: The Finnish 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 staff which creates further multiplier effects in the local economy.

The basis for calculating the student spending contribution is a study undertaken by the Finnish Ministry of Education and Culture in 2014 that looked at Higher Education Students' Livelihoods in Finland[23]. The study found that, on average, students required €890 per month to cover accommodation, entertainment, food, transport, living expenses, hobbies, etc. This profile of expenditure was applied to the number of students at the Finnish Universities to provide an overall estimate

[23] Finnish Ministry of Education & Culture, *Student Research 2014 Livelihood and Study of Higher Education Students*
Opetus- ja kulttuuriministerion julkaisuja 2014:10

for total student expenditure. The key inputs used in making these calculations are shown in Table 6.2.

Table 6-2 Finnish Universities: Student Spending – Assumptions

	Value
Total number of students	148,100
Student Expenditure Profile	
Rent	43%
Food	23%
Other regular living expenses (clothing, hygiene, etc)	8%
Transport	8%
Hobbies & leisure	7%
Phone/IT/Internet	3%
Health & Childcare	3%
Loan repayments	3%
Books/ Study materials/ Fees/ Sundries	2%
Total	100%
Monthly Student Expenditure	
Total	€890
VAT	
VAT as a proportion of student expenditure	11%
Student Spending by Area	
Finland	95%
Rest of Europe	99%
Rest of World	100%

Source: Finnish Universities

Applying this expenditure profile to the student numbers for each institution gives us a total student spending figure for each university. This is estimated for term-time only. A deduction was then made to allow for the proportion of students who are also employees of the university as the impact of this spending has already been included in the staff spending estimates for the core impact. VAT is then removed from spending figures to allow the estimates to be in line with Eurostat economic data.

We then estimate how much GVA this level of expenditure provides and how many jobs it supports across the relevant sectors of the economy using national level input-output ratios for each sector. See the Supplementary Technical Appendix report for 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 supported indirectly through this level of spending (the indirect effect) and this is estimated by applying sector-specific multipliers to the direct contribution. A larger proportion of the second level of

spending is expected to impact on the Country more widely to reflect the fact that students often return to their home address outside term-time. 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 Finnish Universities: Student Spending Contribution

Finland	GVA (€m)	Employment
Student Spending Contribution	1,054	16,000

Source: BiGGAR Economics Analysis

This results in a student spending contribution of €1.1 billion GVA and 16,000 jobs in Finland.

6.3 Part-time Work

Students working part-time can make an important contribution to the local labour market by helping local businesses and organisations to deliver their goods and services. Research commissioned by the Finnish Ministry of Education and Culture suggests that 55% of students work to supplement their income and that they work, on average, for 11 hours per week[24].

Based on data provided by the Universities it is estimated that 4.1% of students work for their Universities. The economic activity supported by this group has been captured in the staff spending analysis in the previous section on core contribution; therefore these jobs have been excluded from this section of the analysis to avoid double counting.

Consultations regarding the labour market conditions for the towns and cities where the Universities are based suggests that the students are generally not displacing other potential employees; however, it is reasonable to assume that some jobs may otherwise have been filled by non-students. In order to reflect this we have taken a view on the additionality of student jobs and assume it is inversely related to the level of youth unemployment in each area. As a result the level of additionality used varies between the areas, typically within the range of 59% - 66%.

The analysis of the contribution of part-time work is based on the number of students living in each area as it is assumed that students take part-time jobs locally to where they live. International students have not been considered in this analysis due to the restricted hours that they are able to work. The key assumptions used in calculating the contribution of student part-time work are shown in Table 6.4.

[24] Finnish Ministry of Education and Culture, 2014, *Student Research 2014: Livelihood and Study of Higher Education Students*

Table 6-4 Finnish Universities - Student Part-time Working – Assumptions

	Value
Number of Students	148,100
Percentage of students who undertake part-time work (excluding international students)	55%
Percentage of students who undertake part-time work with Finnish Universities	4.1%
Additionality of part-time work	59% -66%
Average hours worked per week	11

Source: Finnish Universities, Finnish Ministry of Education and Culture

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 €884 million and 19,000 jobs in Finland (Table 6.5).

Table 6-5 Finnish Universities - Student Part-time Working – Contribution

Finland	GVA (€m)	Employment
Student Working Contribution	884	19,000

Source: BiGGAR Economics Analysis

6.4 Student Volunteering

Students make a contribution to society through volunteering. There are two important sources of research that have informed our assumptions on the value of student volunteering. The first is the Study on Volunteering in the European Union (Country Report Finland[25]) which suggests that young people spend, on average, 20 hours per month on voluntary activities and that the average monetary value of these hours is €15 per hour. The second source is the Student Barometer for Finland, which suggests that 19% of students engage in voluntary activities. The assumptions used to arrive at the estimated contribution from student volunteering are shown in Table 6.6.

Table 6-6 Finnish Universities: Student Volunteering – Assumptions

	Value
Number of Students	148,100
Percentage of students who undertake voluntary work (excluding international students)	19%
Estimated number of hours volunteered per month	20
Estimated value per hour volunteered	€15

Source: Finnish Universities, Finnish Ministry of Education and Culture

[25] GHK (for the European Commission) (2012) *Study on Volunteering in the European Union, Country Report Finland*

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 €92 million GVA across Finland. 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 contribution rather than an employment contribution. These contributions are summarised in Table 6.7.

Table 6-7 Finnish Universities - Student Volunteering – Contribution

Finland	GVA (€m)
Student Volunteering	92

Source: BiGGAR Economics Analysis

However, in practice the value of student volunteering is greater than this figure suggests as the calculations are only an approximate 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 contributions on service users, as improvements in health and wellbeing will result in cost savings in health and social services.

6.5 Summary of Student Contributions

The contribution associated with student spending, student employment and student volunteering is estimated at €2.0 billion GVA and 35,000 jobs in Finland (Table 6.8).

Table 6-8 Finnish Universities: Total Student Contribution – Summary

Finland	GVA (€m)	Employment
Student Spending	1,054	16,000
Student Working	884	19,000
Student Volunteering	92	-
Total Student Contribution	2,030	35,000

Source: BiGGAR Economics Analysis (numbers may not sum due to rounding)

7 TOURISM CONTRIBUTION

This section considers the contribution that the Finnish Universities make to tourism in Finland. This contribution arises from:

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

In terms of the framework for analysis set out in section 3.2, the benefits considered in this chapter are considered "incidental benefits". The possible exception to this is conferences and events, which are sometimes used as a way of supporting regional economic development.

7.1 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 who are not normally resident in the local area. These visitors spend money in the economy and this spending increases turnover in local businesses, which in turn supports local employment.

In order to estimate this contribution 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 and results are available for Finland. This source suggests that each staff and student member receives 2.63 visits per year from friends and family members. 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 Finnish 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 Finland. 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 assumptions used and the contribution resulting is shown in Tables 7.1 and 7.2.

Table 7-1 Finnish Universities: Visits to Staff and Students - Assumptions

Assumptions	Value
Total number staff & students	180,160
No. visits per staff/student	2.63
Trip spend per visitor (€)	120.38

Source: Eurostat data for Finland, 2015

Table 7-2 Finnish Universities: Visits to Staff and Students – Contribution

Finland	GVA (€m)	Employment
Visits to Staff and Students	53	1,000

Source: BiGGAR Economics Analysis

This results in an estimated contribution from visits to staff and students of €53 million and 1,000 jobs in Finland.

7.2 Conference & Event Contribution

The Finnish Universities organise conferences that generate an economic contribution by attracting people to the area who would not otherwise have visited, bringing additional expenditure to the economy both inside and outside the Universities. The delegates who were employees of the Universities were not included in the analysis as their expenditure would not be additional and has have been considered in the section on staff spending.

Not all the Universities collated information on conference and event attendees, therefore estimates had to be made in order to measure the economic contribution of their activity. This was done by calculating the average number of conference attendees per fte based on the Finnish 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 for data that relate to Finland only) 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.

The Finnish Universities organised conferences and events in 2016 which involved 137,4900 attendees; an estimated 19% of were from outside Finland. Eurostat data provides an estimate for average trip expenditure for visitors from outside the country of €321. Applying these assumptions, we can estimate the additional total turnover generated by people attending conferences organised by the Finnish Universities. This is converted to additional GVA and employment by using ratios and multipliers appropriate to the sector.

This results in a contribution from conferences and event activities of an estimated €7.0 million and 1,000 jobs in Finland. Due to the nature of displacement activity for conferences and events, it is assumed that there was no GVA impact at the global level as the conferences would have happened elsewhere in the world had they not taken place in Finland. The key assumptions used are shown in Table 7.3 and the resulting contributions are presented in Table 7.4.

Table 7-3 Finnish Universities: Conference & Event Contribution – Assumptions

Assumption	Value
No. of delegates to conferences and events organised by Finnish Universities	137,400
Estimated % of International attendees	19%
Trip spend per business trip (€)	321

Source: Finnish Universities and Eurostat data for Finland, 2015

Table 7-4 Finnish Universities: Conference & Event Contribution – Summary

Finland	GVA (€m)	Employment
Conferences & Events	7.0	1,000

Source: BiGGAR Economics Analysis

7.3 Business Tourism

It is estimated that the Finnish Universities attracted 56,400 business trips in 2016. This is based on Eurostat data on the number of business trips to Finland each year and has been apportioned to the Finnish Universities according to their share of total employment in Finland. Approximately 22% of business visitors were from outside Finland.

Applying the business trip expenditure data for Finland from Eurostat, we can estimate the additional total turnover generated by people attending business meetings organised by the Finnish Universities. This is converted to additional GVA and employment by using ratios and multipliers appropriate to the sector.

This results in a contribution from business tourism of an estimated €18 million GVA and 400 jobs in Finland. The key assumptions used are shown in Table 7.5 and the resulting contributions are presented in Table 7.6.

Table 7-5 Finnish Universities: Business Tourism Contributions – Assumptions

Assumption	Value
Estimated number of business visits to UNIFI staff	56,400
Estimated % of International business trips	22%
Trip spend per business visitor (€)	321

Source: Finnish Universities and Eurostat data for Finland, 2015

Table 7-6 Finnish Universities: Business Tourism Contributions – Summary

Finland	GVA (€m)	Employment
Business Tourism	18	<1,000

Source: BiGGAR Economics Analysis

7.4 Summary of Tourism Contributions

The contribution of the Finnish Universities to the economy through attracting domestic, overseas and business visitors results in an estimated €78 million GVA and 2,000 jobs per year in Finland (Table 7.7).

Table 7-7 Finnish Universities: Tourism Contribution – Summary

Finland	GVA (€m)	Employment (jobs)
Visits to Staff and Students	53	1,000
Visits to Conferences & Events	7	1,000
Business Tourism	18	<1,000
Total Tourism Contribution	78	2,000

Source: BiGGAR Economics Analysis (numbers may not sum due to rounding)

8 BUSINESS CREATION & INNOVATION SUPPORT

The shared mission of the Finnish Universities is to *"provide impressive scientific knowledge, high-level expertise and in-depth education"*[26]. This mission reflects the catalytic role that the Universities play in society as drivers of economic development and social progress. This chapter considers how Universities support economic growth by driving innovation within the Finnish economy.

In terms of the framework for analysis set out in section 3.2, the benefits considered in this chapter are all considered "purposeful benefits".

8.1 University Approach to Knowledge Exchange

Evidence gathered as part of this study shows that there are a large number of different innovation models in Finland, with each university typically able to identify at least three or four different programmes. The diversity of the different programmes reflects a recognition that there is not an ideal or national model that will work in all circumstances but rather that there is a need to continually invent new ways of working. The overarching theme therefore is that Finnish Universities are innovative in their approach to innovation models! In parallel with this, Finnish public funding organisations have also been innovative in their "product development". Broadly, however, Universities in Finland support the translation of research by:

- **Supporting the formation of new businesses** – this can include spin-offs based on intellectual property developed by university researchers, start-ups that founded by students or members of staff using knowledge and expertise gained at university or other enterprises founded directly by Universities in order to make the benefits of some area of research more widely available.
- **Providing expert support to existing enterprises –** this can include providing consultancy support, undertaking contract research or providing staff training for existing enterprises. Students can also help to translate university expertise by undertaking work placements and applying the knowledge and skills they have learned in university within their host employer. It is also common for Universities also translate research by licensing technology to businesses and to help businesses to grow by providing them with access to specialised equipment and facilities.
- **Providing facilities to help businesses to grow –** this can include providing incubation space and support services designed to help young businesses to become established. Some Universities also provide space for established businesses to grow by supporting the development of science parks.

These approaches to knowledge exchange are considered in further detail below.

8.2 New Business Formation

The fieldwork undertaken to support this study found evidence that there is a strong culture of entrepreneurship within many Finnish Universities. This was apparent from the range of programmes that have been implemented to support the formation and survival of start-up businesses. These programmes took a variety of different formats ranging from entrepreneurial competitions (including

[26] Universities Finland (2016), the Finnish Universities vision for 2025

the highly imaginative "Polar Bear Pitching" event at Oulu University) to accelerator programmes that provide budding entrepreneurs with bespoke training to help them successfully establish their own business.

Most of the Finnish Universities were also able to point to examples of highly successful spin-off businesses that have been established based on intellectual property developed within the university. The majority of these businesses are fairly small, typically employing fewer than 50 staff, but some of these businesses are extremely successful and generate multi-millions of Euros for the Finnish economy each year.

Table 8-1 provides some summary statistics relating to Finnish university spin-outs. This shows that in 2016 there were more than 300 active university spin-outs operating in Finland and that these businesses generated a total of €313 million for the Finnish economy. It is however important to note that not all of the Universities were able to provide details of spin-outs, particularly if these businesses had been founded some time ago, so this is likely to be an under estimate.

Importantly many of these businesses are also particularly high-value enterprises. According to the data provided the average turnover/employee within university spin-outs was around €161,004. This compares with the average turnover/employee across the Finnish economy as a whole of around €154,400 and illustrates how these businesses help to drive productivity improvements within the Finnish economy.

Finland's success in supporting spin-outs is evident from recent venture capital market statistics that show that venture capital investments in Finland were 0.05% of GDP (2014). This is the third highest value among European member states.

Table 8-1 Finnish Universities: Spin-outs – Summary Statistics

	Value
Total number of active spin-outs	373
Total number of jobs supported	1,939
Total turnover generated	€312 million
Average employment	5.2
Average turnover	€836,960
Average turnover/employee	€161,004

Source: Finnish Universities and BiGGAR Economics Assumptions

8.2.1 Quantifying the Impact of Spin-outs

University spin-outs would not exist if it were not for the intellectual capital emerging from Finnish Universities. It is therefore appropriate to attribute the benefits that these businesses generate entirely to the university sector.

These benefits were estimated based on level of turnover and employment in each business, as reported by the individual Universities. The direct employment impact of each business is simply the number of people it employs. Where turnover information was available this was converted into a direct GVA benefit using a turnover/GVA ratio appropriate to the sector in which the business operates. Where turnover information was not available this was estimated by multiplying the total number of direct jobs supported by the business by a

turnover/employee ratio for the sector in which the business operates. The indirect contribution of each business was estimated by applying sector-specific multipliers to the direct GVA and employment effects.

In this way it was estimated that spin-out businesses associated with the Finnish Universities generated €300 million GVA for the Finnish economy in 2016 and supported 4,000 jobs. This is summarised in Table 8-2.

Table 8-2 Finnish Universities: Spin-outs – Contribution

Finland	GVA (€m)	Employment
Spin-outs	300	4,000

Source: BiGGAR Economics Analysis

8.2.2 University Owned Enterprises

Several Finnish Universities also own one or more commercial enterprises outright. These enterprises differ from start-ups and spin-offs because they are typically based on an area of core university operations (such as research, teaching or professional services) rather than intellectual property or expertise developed within the university.

The information provided for this study suggests that eight of the Universities own 32 of these businesses. These include:

- research organisations that provide commercial research services for industrial clients or undertake clinical trials for the pharmaceutical industry;
- educational subsidiaries that provide education and training, typically aimed at overseas students and/or executive education market;
- print or publishing companies;
- professional service companies, covering areas such as real estate, human resources, conference and events organisation and IT;
- technology transfer companies; and
- companies that provide specialised professional training, mainly in Finland.

These businesses vary greatly in size with some employing just a handful of people and others employing hundreds. The largest of these businesses is the University Pharmacy owned by the University of Helsinki, which employs around 1,100 people. Taken together in 2016 these businesses employed more than 1,700 people and generated €502 million turnover.

The impact of these businesses was estimated using the same approach described in the previous section. As the impact of some of the businesses (e.g. real estate companies and science parks) has been considered elsewhere in this report they were excluded here to avoid double counting.

Using this approach it was estimated that university owned enterprises generated €507 million for the Finnish economy in 2016 and supported around 2,000 jobs in Finland. This impact is summarised in Table 8-3.

Table 8-3 Finnish Universities: University Owned Enterprises – Contribution

Finland	GVA (€m)	Employment
University Owned Enterprises	507	2,000

Source: BiGGAR Economics Analysis

8.3 Supporting Existing Enterprises

As well as supporting the formation of new enterprises Universities in Finland also play an important role in supporting the development of existing businesses. There are three main ways in which they do this by:

- licensing technology to businesses;
- providing consultancy and research services or access to specialised facilities or equipment; and
- arranging student placements.

Each of these areas of activity is considered below.

8.3.1 Licencing

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 university concerned.

In 2016, three Finnish Universities earned €0.2 million in royalty income from licence agreements for technologies. This is however likely to significantly underestimate the total value of university IP. This is because Finnish Universities enjoy a particularly close relationship with industry and have a very collaborative approach to the exploitation of IP. As a result it is common practice for Universities to sign over rights to newly developed IP to business partners. While this has approach is commendable and has obvious benefits for the Finnish economy it does make it does make the task of quantifying the benefits of this activity somewhat more challenging.

To over come this it was assumed that for every licence retained Universities transfer ownership of three potentially commercially valuable technologies to industry. This implies that in 2016 the total value of commercially exploitable technologies developed within Finnish Universities amounted to around €0.5 million.

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 between agreements. In order to agree a licence, 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 but a training manual issued by the World Intellectual Property Organisation states that a common starting point is the *"well known and widely quoted"* 25% rule.

The 25% rule is a general rule of thumb according to which the licensor should receive around one quarter to one third of the profits accruing to the licensee and has been used by IP negotiators for at least 40 years. The rule is based on an

empirical study first undertaken in the 1950s and updated in 2002[27]. The study found that royalty rates were typically around 25% of the licensee's profits, which equates to around 5% of sales from products embodying the patented technology. This implies that royalties paid for a technology typically represent around 5% of the total turnover generated by that technology.

Applying this to the assumptions described above suggests that in 2016 university IP enabled Finnish businesses to generate €14.4 million turnover.

The next step was to convert this turnover into GVA by dividing it by a turnover to GVA ratio for the sectors in which licence agreements are made. The employment contribution was then estimated by dividing the GVA contribution by an estimate of the average GVA added by each employee in these sectors. The effect of subsequent spending rounds was captured by applying GVA and employment multipliers. The effect in each study area was estimated based on the location of the business that licenced each technology.

In this way it was estimated that the licensing activity of the Finnish Universities contributed €3 million GVA to the economy of Finland in 2016 and supported around 30 jobs. This contribution and the assumptions used to estimate it are summarised in Table 8-4 and Table 8-5.

Table 8-4 Finnish Universities: Licensing Contribution – Assumptions

	Value
University licence income	€173,402
% of licence value retained by Universities	25%
Royalties as % of additional turnover generated	5%

Source: Finnish Universities, consultation undertaken by BiGGAR Economics and Goldscheider (2002)

Table 8-5 Finnish Universities: Licensing Contribution – Contribution

Finland	GVA (€m)	Employment
Licensing	3	<1,000

Source: BiGGAR Economics Analysis

8.3.2 Services for Businesses

The industry relevant expertise of Finnish academics means that they are well placed to support the development of businesses in Finland by undertaking contract research and consultancy projects designed to address specific business challenges and opportunities. Universities also support Finnish businesses by enabling them to make use of scientific equipment and facilities and by providing specialised training to help staff to learn new skills.

In 2016 Universities in Finland generated a total of €239 million by providing these types of services to industry. In addition to this the Universities also received €58 million from Tekes, Finland's main funding agency for innovation. As Tekes funding is generally awarded for relatively near-market projects that will involve a high degree of collaboration with industry it is appropriate to consider it as part of this section.

[27] Goldscheider (2002), Use of the 25% rule in valuing IP, les Nouvelles.

It is reasonable to assume that the businesses that invest in this type of support do so because they expected the projects to generate positive returns. Detailed information about the level of these returns is not available; however, an estimate can be made based on the findings of research from similar activity elsewhere.

In 2013 BiGGAR Economics undertook an evaluation of Interface, the agency responsible for brokering relationships between businesses (and other organisations) and universities in Scotland[28]. The connections that Interface has made have covered a range of different types of engagement from small consultancy projects and access to university equipment and facilities through to company sponsored PhDs. The BiGGAR Economics evaluation found that the costs to Interface's clients of participating in this programme was £12.9 million and the direct benefit to these organisations was £46.4 million GVA. Therefore the direct return to investment was 360%. In other words, every £1 invested by businesses generated £3.60 GVA in direct economic benefits.

This finding is similar to other studies done in similar areas. In 2009 PriceWaterhouseCoopers LLP undertook a study for the Department of Business, Enterprise & Regulatory Reform[29], which considered the impact of Regional Development Agency spending. One of the aspects of this report considered the GVA returns to business development and competitiveness interventions between 2002 and 2007. This found that interventions in "Science, R&D and innovation infrastructure had achieved cumulative GVA equivalent to 340% the cost of the projects and that this could increase to 870% if the long-term benefits were taken into account. This suggests that the 360% multiplier estimated by BiGGAR Economics could be conservative.

Although both of these studies related to activity undertaken in the UK rather than Finland, the nature of the collaboration considered in both studies is very similar so the findings of the research are likely to be applicable to this study. In accordance with the approach set out in section 4.2, this impact was modelled using the lowest of the range of possible assumptions (i.e. 340%). Given extent of collaboration between industry and academia in Finland compared to the UK however this multiplier is likely to be conservative.

The assumptions used to estimate the economic benefit of this activity are summarised in Table 8-6.

Table 8-6 Finnish Universities: Services for Businesses – Assumptions

		Value	Source
Total income from business services, of which…		239	See below
	Contract research	158	Finnish Universities
	Consultancy & advice	3.6	
	Facilities and equipment hire	20	
	Professional training	57	
Tekes funding		58	Tekes
Business services multiplier		340%	PWC

Source: As listed

[28] BiGGAR Economics (2013), Evaluation of Interface, the knowledge connection for industry
[29] PriceWaterhouseCoopers, Impact of RDA spending – National report – Volume 1 – Main Report, March 2009, DBERR

By applying these assumptions to the total value of income received for delivering these services it was estimated that services for business delivered by Finnish Universities generated €2.1 billion GVA for the Finnish economy in 2016 and supported 24,000 jobs. This impact is summarised in Table 8-7.

Table 8-7 Finnish Universities: Services for Businesses – Contribution

Finland	GVA (€m)	Employment
Services for Businesses	2,066	24,000

Source: BiGGAR Economics Analysis

8.3.3 Student Placements

In 2016 almost 4,500 students in Finland undertook a work placement during the course of their studies, when they spent time working for a business or organisation in a sector that was relevant to their field of study. Placements provide students with an opportunity to apply what they have learned at university in a work setting and gain valuable work experience that should help to improve their employment prospects after they graduate.

Student placements can also have benefits for host businesses. There is a significant body of evidence[30] about how these benefits are manifested but typically these studies identify four main types of benefit, those relating to:

- **the work undertaken by the student/graduate** – i.e. helping to implement new procedures or completing specific projects, by freeing up time of other staff, doing things that other staff did not have the time to do;
- **the outlook of the graduate or student** – i.e. the idea that students/graduates can bring a fresh perspective that can stimulate organisations to question whether they are doing things in the best way;
- **improved skills, knowledge or experience of existing staff –** e.g. the management experience gained by employees involved in organising or supervising placements, new skills picked up from the student/graduate and the potential for organisations to use placements to vet potential employees;
- **other benefits** – such as direct cost savings or the opportunity to develop a relationship with a higher education institution.

The value that a student delivers for their host organisation will depend on a number of factors including the duration of the placement, the skills of the individual and the nature of the work undertaken. It is however possible to estimate the impact of placements based on the amount of time that students spend working within their host organisations.

The nature and duration of student placements undertaken by students in Finland varies, but for the purposes of this analysis only placements of 12 weeks or longer were considered. This is because it was assumed that placements of a shorter duration would be primarily observational in nature.

To estimate the value of this impact it was first necessary to establish how much time students spent on placement and how many full time staff this time would be equivalent to. Students on placement are likely to be less productive than an

[30] See for example Warwick Institute for Employment Research (November 2009), The impact of graduate placements on businesses in the south west of England.

average worker because they have less experience and require more supervision. The value that students added to their host organisations was then estimated by assuming that students contributed half of the GVA that an average worker in the same industry would generate over the same period of time. Appropriate multipliers were then applied to capture the effect of subsequent spending rounds. The assumptions used to do this are summarised in Table 8-8.

Table 8-8 Finnish Universities: Student Placement – Assumptions

	Value	Source
Total number of students participating in placements of >12 weeks	4,437	Individual Universities
Total number of weeks spent on placement	55,910	
Equivalent number of full time employees	538	
Student productivity as % of fully trained member of staff	50%	BiGGAR Economics

Source: As listed

Using this approach it was estimated that students studying at the Finnish Universities contributed €37 million to the Finnish economy and supported almost 1,000 jobs as a result of undertaking work placements during the course of their studies. This impact is summarised in Table 8-9.

Table 8-9 Finnish Universities: Student Placements – Contribution

Finland	GVA (€m)	Employment
Student Placements	37	<1,000

Source: BiGGAR Economics Analysis

8.4 University Ecosystems

Some Finnish Universities are closely associated with a particular science park. In some cases these parks have been established directly by the University, often in collaboration with research (e.g. university hospitals) and economic development partners (e.g. regional government). These science parks 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.

Ultimately the success of these parks is largely due to the university involved,. 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.

Science parks also often provide an important entry point for industry to access expertise from within a university. 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.

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. Over time this has led to the development of a number of highly successful "innovation ecosystems" that help to drive regional (and in some cases national) economic growth.

According to one definition:[31]

"An innovation ecosystem consists of a group of local actors and dynamic processes, which together produce solutions to different challenges. The main features of the ecosystem include top-level universities and research institutions, sufficient financing for new companies and research plans, a symbiotic combination of large established companies and new start-ups, specialisation of and cooperation among companies, service companies specialised in the needs of local companies, a sufficient local market for new innovative products, and global networking"

One of the most prominent innovation ecosystems in Finland is the one that has grown up in Espoo around Aalto University, which has attracted attention from innovation specialists around the world. The characteristics and success factors of the Espoo innovation ecosystem have been subject to close analysis and a case study of this is provided below.

[31] Oksanen and Hautamäki (2014), Transforming regions into innovation ecosystems: A model for renewing local industrial structures, The Public Sector Innovation Journal, 19(2), 2014, article 5

Case Study 8-1 – Aalto University and the Espoo Innovation Ecosystem

In a 2017[32] study the European Commission (EC) described how central government has played an important role in the development of this ecosystem. Altogether around half of the R&D activities in Finland are undertaken in the 4km^2 Otaniemi area of Espoo. In addition to Aalto University, Otaniemi is home to more than 25 research centres and higher education institutes, including VTT Research, Mikes Metrology, CSC Supercomputing Centre, Laurea University of Applied Sciences, Helsinki Institute of Information Technology and the European Institute of Innovation and technology.

According to the EC study, this concentration of Scientific and Technological Human Capital and research infrastructures in the Otaniemi area of Espoo has been an important factor in enabling the emergence of the local innovation ecosystem. The role of Aalto University is pivotal along with a culture of innovation and risk-taking rooted in the student-led entrepreneurship movement. This movement is acknowledged as a pillar of Espoo's reputation as an entrepreneurial environment. The Aalto Entrepreneurship Society (AaltoES) is a not-for-profit student-run society with over 5,000 members from Aalto University and other Helsinki-based Universities.

Along with Aalto University and its student body, other key players in this innovation ecosystem include Uusimaa Regional Council, Espoo City and Tekes. Key elements of the ecosystem include:

- **The Startup Sauna** - a space offered by the university to the students to promote start-up creation;
- **Aalto Ventures Programme** - initiated by students, during its first four years almost 15,000 people participated in its entrepreneurship programme and events;
- **Aalto Start-Up Center** - Active since 1997, this is Finland's largest business accelerator operating within Aalto University;
- **Design Factory** - multidisciplinary 'factories', of which the 'Design Factory' is the best-known, based at Aalto University's departments but strongly tied to industry;
- **Aalto University Innovation Services** - located in Espoo and Helsinki;
- **Small Business Centre** - a department of the Aalto University School of Business that promotes entrepreneurship and supports start-ups; and
- **Aalto University Executive Education Ltd** - an internationally recognized executive education and leadership development organization.

MIT has also looked at the Aalto innovation ecosystem as an "emerging world leader", pointing to the following success factors[33]:

- **The stimulus of a new university:** Aalto University was formed by the merger of three existing institutions, and was explicitly designed to break the traditional model by being more autonomous and having a stronger focus on innovation for the good of society.
- **An improved national environment for entrepreneurship:** The entrepreneurial environment in Finland changed significantly during Aalto University's establishment. Funding from Tekes was fundamentally important. The downturn in Nokia's fortunes also created opportunities for new developments, particularly in gaming and IT.
- **A long-standing Finnish culture of student activism and community activity:** Finland has a culture of student activism and Finnish student unions have been major players in business developments.

Source: Interviews undertaken by BiGGAR Economics and EC (2017)

[32] European Commission (2017), Place-Based Innovation Ecosystems Espoo Innovation Garden and Aalto University (Finland), JRC Science for Policy Report

[33] Graham, R (2014), Creating university-based entrepreneurial ecosystems evidence from emerging world leaders, MIT Skoltech Initiative, Massachusetts Institute of Technology

8.4.1 Quantifying the Impact of University Science Parks

Four Finnish Universities reported that they were closely involved with science parks or incubation facilities in their regions. The details provided suggest that in total around 733 companies that have not been considered elsewhere in this study[34] were based on these parks and that these businesses employed a total of around 5,450 people.

Unlike spin-outs most of the businesses that are located on university science parks would have existed even if the science park did not. This means that would not be appropriate to attribute all of the economic impact of these businesses to the Universities.

If the science parks did not exist then it is possible that some of the businesses located on the science parks would have chosen to locate elsewhere in Europe or elsewhere in the world instead. It is also likely that colocation with a university has enabled many of these businesses to achieve higher levels of growth than would otherwise have been possible.

In assessing the economic contribution of science parks, it was necessary to consider both of these factors and come to a view about the extent to which this impact was additional. These assumptions are discussed in further detail in the technical appendix. After accounting for this the impact of the businesses located on the science park was then estimated using the same approach used to estimate the impact of spin-outs (see section 8.2.1).

Using this approach it was estimated that the Finnish Universities generated €530 million GVA for the Finnish economy in 2016 and supported around 8,000 jobs through their associated science parks and incubation facilities. This impact is summarised in Table 8-10.

Table 8-10 Finnish Universities: Science Parks & Incubation Facilities – Contribution

Finland	GVA (€m)	Employment
Science Parks & Incubation Facilities	530	8,000

Source: BiGGAR Economics Analysis

8.5 Summary Quantifiable Benefits

By adding together all of the impacts considered in this chapter it was estimated that in 2016 Finnish Universities generated €3.4 billion for the Finnish economy as a result of their business formation and innovation support activities. It was also estimated that around 39,000 Finnish jobs were supported by this activity. This impact is summarised in Table 8-11.

[34] This figure excludes spin-outs from the Universities to avoid double counting because the impact of these businesses was considered above.

Table 8-11 Finnish Universities: Total Innovation Support Contribution – Summary

Finland	GVA (€m)	Employment
Spin-outs	300	4,000
University Owned Enterprises	507	2,000
Licencing	3	<1,000
Services to Businesses	2,066	24,000
Student Placements	37	1,000
Science Parks and Incubation Facilities	530	8,000
Total Innovation Support Benefit	3,444	39,000

Source: BiGGAR Economics Analysis (totals may not sum due to rounding)

9 UNIVERSITIES, INNOVATION AND GROWTH

The previous chapter considered the various different ways in which Universities in Finland support innovation and company formation. The approach taken has been to consider each of these areas of activity in isolation but in reality each of these areas of activity are closely inter-related and mutually reinforcing. This means that the overall contribution that this type of activity makes to the Finnish economy is likely to be much greater than the sum of its parts. The very high degree of integration between industry and academia in Finland also means that a significant proportion of engagement between businesses and Universities is likely to be informal and therefore under recorded. For these reasons, it is likely that the impact presented in the previous chapter will be an underestimate.

9.1 Innovation and Economic Growth

There is a well-established relationship between technological progress and economic growth. Recognition of this relationship can be traced back to the seminal work of Nobel Prize winning economist Robert Solow [35], who demonstrated that 87.5% of the increase in US labour productivity between 1909 and 1949 could not be explained by increases in factor inputs of labour and capital. Solow attributed this to technological change.

Over the years there have been various attempts to model the relationship between innovation and economic growth using measures such as R&D spending and patenting. Most of these studies found that R&D spending makes a significant contribution to productivity growth.

One such study published by the International Monetary Fund (IMF)[36] for example used data on patents and R&D data for 20 OECD countries (including Finland) and 10 non-OECD countries to explore the relationship between countries' R&D efforts, innovation and average income. The results of the study demonstrated a "strong positive relationship" between innovation and GDP per head, providing support for endogenous growth theories such as those proposed by Solow.

A separate study undertaken by economists in Turkey in 2015[37] explored the relationship between R&D expenditure and economic growth across 15 OECD countries (including Finland) between 1990 and 2013. The study found a positive and statistically significant relationship between the two variables in all the countries considered. Overall the study found that, on average, a 1% increase in R&D expenditure leads to an average increase of 0.46% in GDP.

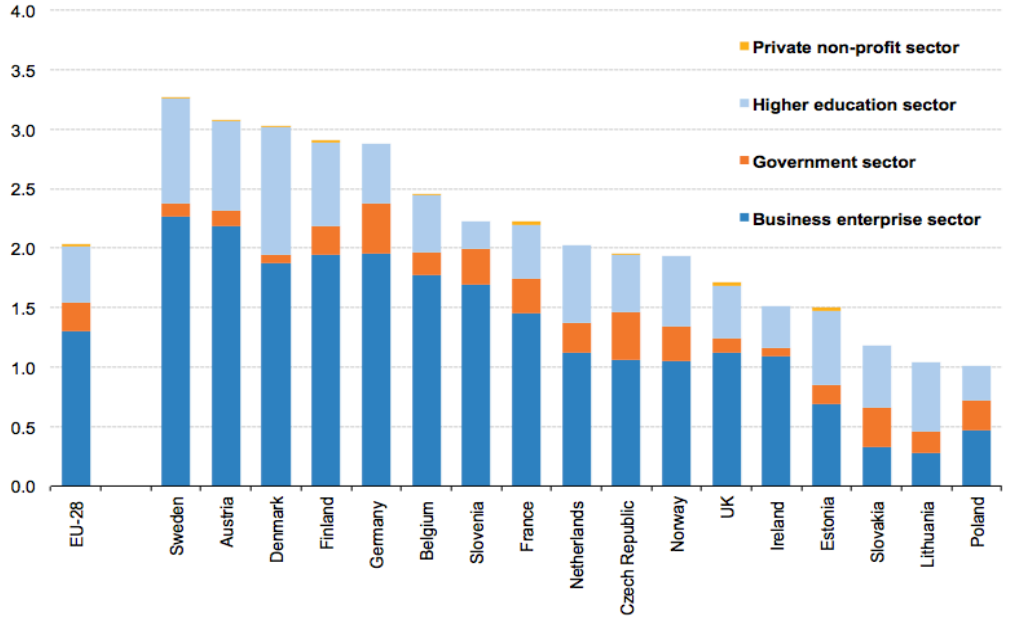
A subsequent study published in 2016 by economists in Serbia[38] drew similar conclusions. This study investigated the influence of R&D expenditure on economic growth in the EU28 during the period of 2002–2012. It found that an increase in R&D expenditure as a percentage of GDP of 1% would cause an increase of real GDP growth rate by 2.2%.

[35] Solow, R. (1957), *Technical Change and the Aggregate Production Function*, Review of Economics and Statistics, pp. 312-20.
[36] Ulku H (2004), R&D, innovation and economic growth: an empirical analysis. IMF working paper WP/04/185
[37] Erdil Sahin B (2015) The Relationship between R&D Expenditures and Economic Growth: Panel Data Analysis 1990-2013
[38] Mladenovic et atl (2016) R&D Expenditure and economic growth: EU28 evidence for the period 2002-2012

9.1.1 Finland's Performance

On average countries in the EU spend around 2% of total GDP on R&D but Finland has consistently outperformed most other European countries on this measure for several years. Figure 9.1 shows the proportion of GDP that selected European countries spent on R&D in 2015. It shows that Finland spent a total of 2.91% of GDP on R&D in 2015, compared to an average of 2.03% across the 28 members of the EU, behind only Sweden, Austria and Denmark.

Figure 9.1 – Expenditure on R&D as % of GDP (selected European countries)



Source: Eurostat

According to Solow's theory, countries that spend more on R&D should achieve higher rates of economic growth over the long term. Comparative statistics for the 28 EU economies show that this has indeed been the case with Finland recording annual average economic growth of 2.5% between 2006 and 2016, compared to an annual average of 2.3% across the EU as a whole[39].

The aim of the reminder of this chapter is to consider the scale of the contribution that Finnish Universities have made to this.

9.2 Universities as Drivers of Innovation

Universities have the potential to play an important role in driving technological progress by undertaking research and contributing to the discovery of new knowledge but, while this is likely to be necessary for increasing rates of economic growth, it is unlikely to be sufficient. This is because academic research typically does not represent the final stage of technology development process. In order to realise the economic benefits of academic research it is first necessary for this research to be adopted and taken forward by industry. The extent to which this occurs will depend on the strength of the knowledge exchange relationships that exist between academia and industry and how effectively academic research is translated into commercial outputs.

[39] Eurostat, GDP at market prices

The importance of effective knowledge exchange was recognised by the 2010 University Act, which marked a fundamental change in the organisation of knowledge transfer in Finnish Universities. The aim of this reform was to encourage the Universities to enhance research translation.

Evidence from the Global Competitiveness Report (GCR)[40] suggests that the Universities have responded well to this challenge. The GCR series, which was established more than 35 years ago, assesses the drivers of productivity and prosperity for more than 100 economies around the world. The GCR is based on a Global Competitiveness Index that combines 114 indicators of productivity and long-term prosperity. Central to this index is an executive opinion survey, which is one of the longest running and most extensive surveys of its kind in the world. The survey provides an additional source of evidence on capture critical concepts, such as the level of university business interaction, for which official statistics are often unreliable, out-dated, or non-existent.

One of the indicators included within the index is university/industry collaboration in R&D. In the 2016/17 Report Finland ranked 2nd on this measure out of 138 economies around the world (down from 1st in 2015/16) indicating that Finland's Universities play an important role in supporting innovation in Finland.

Despite this it is interesting to note that Finland's performance on other, more traditional, measures of university/industry interaction is much less strong. For example, one widely used measure of university/business interaction is the volume of joint research publications. Data published by the Centre for Science and Technology Studies (CWTS) for example (which describes the occurrence of university-industry research cooperation within each of the world's 750 largest research Universities) indicates that Finland's performance is only "average" on this measure[41].

One explanation for the discrepancy between the qualitative results presented in the GCR and the quantitative data published by CWTS is that a significant proportion of university/business interaction in Finland occurs at a structural level facilitated largely through informal and semi-formal networks (an example of which would be the Aalto Innovation ecosystem described in Case Study 8-1). This conclusion was supported by the consultations that were undertaken to support this study and the observations of the BiGGAR Economics team during the course of the field work.

This discussion strongly suggests that the value that the Universities generate for the Finnish economy by supporting innovation and engaging with industry is likely to be higher than estimated in chapter 8 – perhaps significantly so.

Although it is not possible to accurately assess the potential scale of this underestimate, applying the conclusions from the literature on endogenous growth theory discussed above can be instructive.

9.3 Estimating the Value of University Driven Growth

Figure 9.1 illustrates the contribution that different sectors of the economy make to Finland's overall level of R&D. It shows that in Finland the higher education

[40] World Economic Forum (2016), the Global competitiveness report 2016-2017

[41] Analysis of the university-industry research connections 2014 data published by CWTS shows that the 7 Finnish Universities included in the index scored an average of 6.8%. The Index classifies a score of between 5% and 7.5% as average.

sector makes a significant contribution to the overall R&D effort. Indeed, between 2010 and 2015 Universities have accounted for 22% of total R&D expenditure in Finland.

According to the Erdil analysis referred to above, over the period 1990 to 2013 R&D expenditure in Finland has, on average, accounted for 3.3% of GDP[42]. Applying this to the share of R&D delivered by Finnish Universities suggests that around 1.8% of the Finnish economic growth could be attributable to the Universities.

According to the Mladenovic analysis referred to above, a 1% increase in R&D expenditure increases GDP growth by 2.2%. The total value of Finnish GDP in 2016 was €214.1 billion so 2.2% of this would be €4.7 billion. Applying the 1.6% assumption derived from the Mladenovic analysis in the previous paragraph to this suggests that Finnish Universities could have contributed €3.4 billion to the value of the Finnish economy in 2016 – virtually the same as the contribution estimated in the previous chapter.

Further analysis however suggests that this could yet be an under estimate.

According to the Erdil analysis referred to above, a 1% increase in R&D expenditure increases GDP by 0.46%. Applying this to the share of R&D delivered by the Finnish Universities suggests that 10.1% of this effect could be attributed to them.

Applying this assumption to the total value of Finnish GDP (€214.1 in 2016) suggests that **the Universities could have contributed as much as €21.7 billion to the value of the Finnish economy in 2016.** This is considerably higher than the impact presented in chapter 8 and suggests that the true value of innovation support delivered by Universities in Finland could be as much as six times higher than previously estimated.

The wide range of this estimate is a reflection of the difficulty of estimating the impact of this area of activity. To some extent this is a reflection of the very high levels of integration between academic and industrial R&D in Finland, which is its self one of the distinctive strengths of Finland's innovation landscape.

[42] R&D as a proportion of GDP tends to fluctuate over time so it is appropriate to use a long-term average rather than the figure for the most recent year.

10 HEALTH BENEFITS

This study has set out to measure the economic contribution of the Finnish Universities in their broadest sense. A major contribution that they make is in the field of benefits to public health and medical research. In 2016 there were six Finnish Universities that undertook medical research[43] and in total they received €167 million in health and medical research income.. Although the primary goal of this research is social, there is strong evidence to suggest that medical research also generates substantial economic benefits. In 2008 for example the Wellcome Trust published research on the value of medical research in the UK, which considered two types of return: health gains and economic gains[44].

In terms of the framework for analysis set out in section 3.2, the benefits considered in this chapter are all considered "purposeful benefits".

10.1 Value of Health Gains

The value of health gains (net of the health care costs of delivering them) was assessed in the Wellcome Trust report using the quality adjusted life years (QALY) method. This is a widely used method developed by health economists to assess how many extra months or years of life of a reasonable quality a person might gain as a result of treatment. The Wellcome Trust report considered two areas of medical research, cardiovascular disease and mental health.

The value of the health benefit was presented as a return on the initial expenditure on the research (IRR). The best estimate for the IRR of cardiovascular disease research was 9.2% (within a range of 7.7% and 13.9%) and the best estimate for mental health research was 7.0% (within a range of 3.7% and 10.8%). This implies that every £1 invested in medical research would result in health gains valued at €0.08 each year in the UK in perpetuity. In Finland, this figure was revised down in order to reflect a smaller population in which these quality of life improvements could effect.

Therefore the monetary value estimation of the quality of life improvements as a result of medical research undertaken at Finnish Universities is equivalent to €133 million in Finland. This impact is summarised in Table 10.1.

Table 10.1 Finnish Universities - Medical Research – Contribution to Quality of Life

Finland	GVA (€m)
Medical Research – Quality of Life	133

Source: BiGGAR Economics Analysis

10.2 Economic Impact

The Wellcome Trust also considered the effect that medical research expenditure would have on GDP by stimulating private investment in R&D and the social returns to private investment that are stimulated by the publically funded medical research. This found that each €1 of public investment in medical R&D stimulated

[43] These were the Universities of Helsinki, Jyväskylä, Eastern Finland, Oulu, Turku and Tampere.
[44] Wellcome Trust, Medical Research Council, Academy of Medical Sciences (2008), Medical Research: What's it worth?

an increase in private R&D investment of between €2.20 and €5.10. The report also found that the social rate of return to private R&D was approximately 50%.

As with the estimates for health gains IRR, the study found that there is a range of estimates for the IRR for GDP impacts. The lowest estimate for IRR was 20% and the highest was 67% with the best estimate given as 30%. Unlike the health gains research, there were no estimates given for the GDP impacts associated with mental health research so it was assumed that the 30% return would apply to all types of medical research. This implies that each €1 invested in medical research at Finnish Universities generates an increase of €0.30 GDP for the Finnish economy each year in perpetuity.

These economic impacts will be realised in the health sector in Finland. Without the core research that is undertaken at Finnish Universities it is likely that the private health sector in Finland would be come significantly less competitive in the global marketplace. In 2014, it was estimated that there were approximately 500 companies in the health sector in Finland, which employed 20,000 people[45]. The sector had a turnover of €5 billion, of which €2.8 billion was exported. The Finnish health sector has particular strengths in health technologies and pharmaceuticals and these areas are both supported by considerable research and development expenditure. In 2014, the Pharmaceutical industry in Finland invested €197 million in research and development[46] and the Wellcome trust study found that much of this private sector health R&D investment was catalysed by publically funded medical research that takes place in universities or research institutes.

Despite its strengths, the health sector in Finland is not as strong as that found in Denmark or Sweden. In order to improve on its commercial performance, the 2014 report referred to above recognised the need for universities to play a critical role in supporting the development of the wider sector through developing hospital research clusters and innovation ecosystems based on these. It highlighted that areas around university hospitals and their science centres are micro-ecosystems of the sector. In order to attract private sector investment, high quality academic research helps to attract companies in a sector in which investment from international companies is both competitive and fundamental for growth.

The quantifiable value of the contribution of Finnish Universities medical research to the health sector in Finland was estimated using the economic assumptions described above. In this way, it was estimated that this research supported just under €500 million of GVA in Finland, equivalent to 1% of the sector's turnover.

Table 10.2 – Finnish Universities - Medical Research – Economic Contribution

Finland	GVA (€m)
Medical Research – Economic Contribution	499

Source: BiGGAR Economics Analysis

10.3 Total Returns to Medical Research

Adding together the impacts considered above suggests that the medical research undertaken at Finnish Universities could generate a long-term benefit for the Finnish economy of €633 million GVA.

[45] Enterprise and Innovation Department (2014) Health Sector Growth Strategy for Research and Innovation Activities

[46] European Federation of Pharmaceutical Industries and Associations (2016) The Pharmaceutical Industry in Figures

Table 10.3 – Finnish Universities - Total Medical Research Contribution (€m)

Finland	GVA (€m)
Quality of Life	133
Economic Contribution	499
Total Medical Research Contribution	633

Source: BiGGAR Economics Analysis (totals may not sum due to rounding)

11 GRADUATE PREMIUM

One of the most important ways in which the Finnish Universities generate economic impact is through the long-term economic effects of their teaching activity, as realised through their graduates. As discussed in Section 3.3, Finland's transition from a resource-based to a knowledge-based economy has been possible through a focus on education, research and development and innovation and university graduates are a vital component of this.

In terms of the framework for analysis set out in section 3.2, the benefits considered in this chapter are all considered "purposeful benefits".

11.1 Graduate Premium

The education that students at Finnish Universities receive, the skills they 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 Finnish 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.

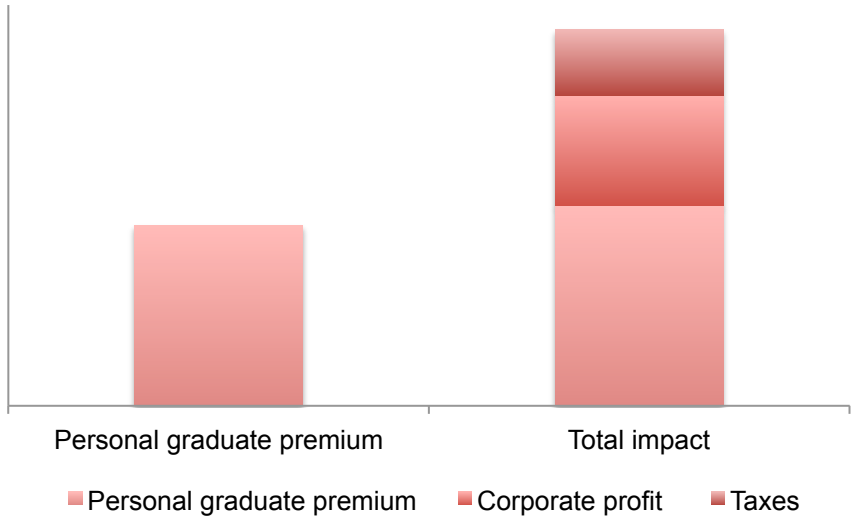
Information about the earnings premium of graduates is readily available from Statistics Finland[47] and can be used to provide a measure of the additional contribution graduates make to the Finnish economy each year.

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. The total graduate premium presented here therefore relates to the combined *personal economic benefit* that the year's 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.

For these reasons (as illustrated in Figure 11.1) the impact presented in this section is likely to underestimate the full impact that graduates from the Finnish Universities generate for the Finnish economy.

[47] Statistics Finland (2015), Structure of Earnings, available at: http://tilastokeskus.fi/til/pra/index_en.html

Figure 11.1: Personal Graduate Premium Benefit Vs. Economic Benefit

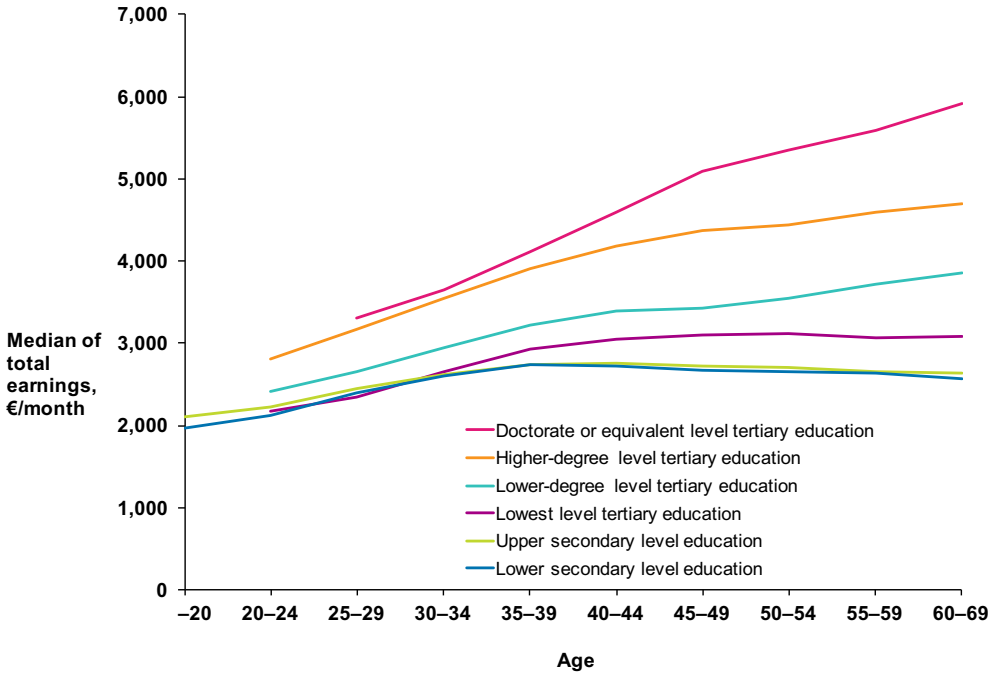


Source: BiGGAR Economics

11.2 Estimating the Graduate Premium

The starting point for estimating the graduate premium of UNIFI students was earnings data by level of education and age, available from Statistics Finland, as summarised in Figure 11.2.

Figure 11.2: Total Earnings by Level of Education and Age, 2015



Source: Statistics Finland (2015), Wages, Salaries and Labour Costs

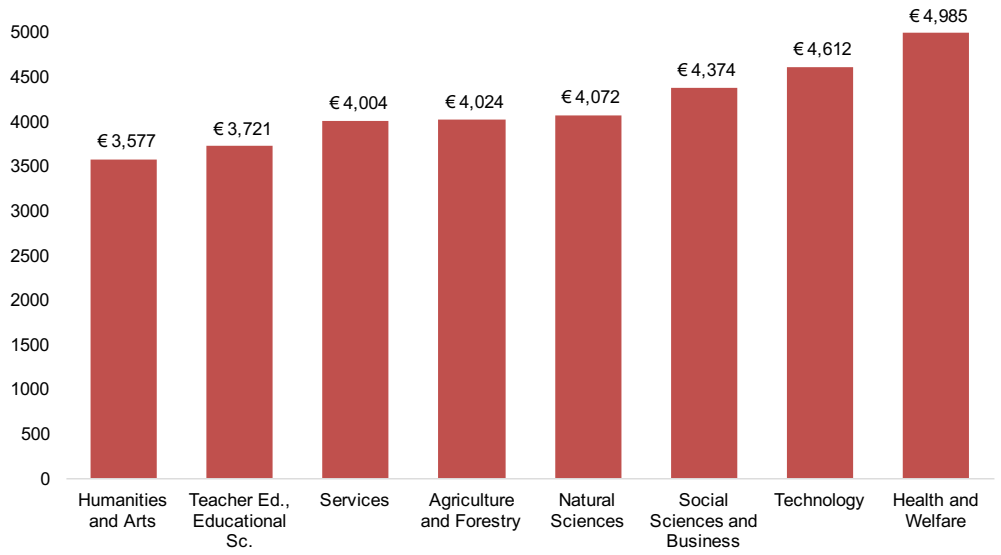
This indicates, for example, that individuals with doctorate or equivalent level tertiary education in Finland earn on average €4,589 per month between the ages of 40 and 44 compared to €2,720 per month for those with lower secondary level education. As well as the earnings difference between those with tertiary and

secondary education, Figure 11.2 also shows that the higher the level of tertiary education attained, the higher the earnings are with this effect becoming more pronounced over the working life of an individual.

Using this information, it was possible to estimate the additional earnings premium from undertaking each further level of education for each age category. This analysis was extended across a working lifetime and an annual discount rate applied in order to estimate the discounted lifetime earnings premium for each level of education attained.

As well as the level of qualification attained, the subject that a student graduates in determines the earnings premium that they can expect to achieve over the course of their working life. Data available from Statistics Finland provides information on the pay differentials for Finnish graduates between different subject areas. Figure 11.3 depicts average monthly pay by subject for graduates of tertiary level education. According to this, the highest average monthly pay (€4,985) was earned by employees educated in the field of heath and welfare.

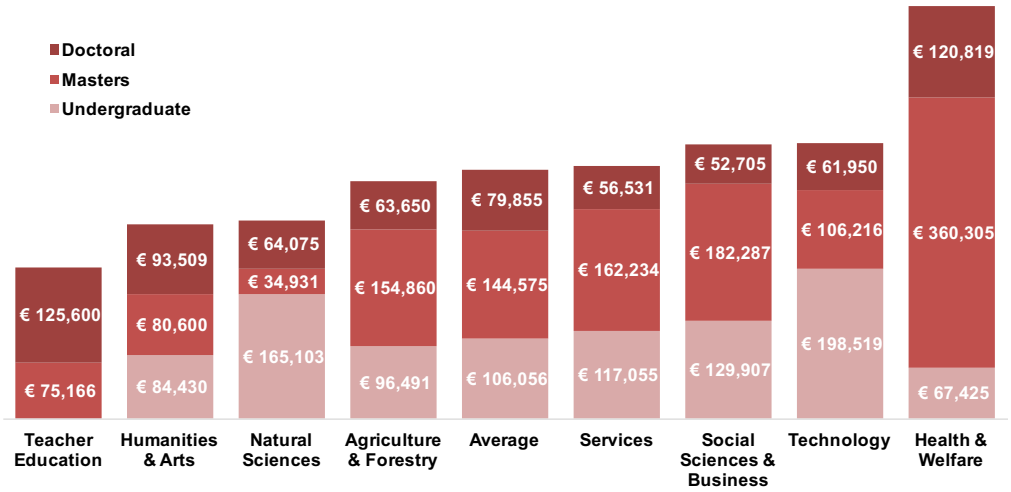
Figure 11.3: Average Monthly Pay for Graduates of Tertiary Level Education by Subject



Source: Statistics Finland (2015), Structure of Earnings

By applying this to the estimated lifetime earnings for each level of education, it was possible to estimate a lifetime earnings premium for each level of education, by degree subject. These figures are summarised in Figure 11.4.

Figure 11.4: The Finnish Universities – Graduate Premium



Source: BiGGAR Economics Analysis and Statistics Finland

In 2015, 32,957 students graduated from the Finnish Universities. A breakdown of graduates by level of qualification is provided in Table 11.1.

Table 11.1: The Finnish Universities – Graduates

	Value
Undergraduate	15,039
Masters	15,316
Licentiate	122
Doctoral or equivalent	1,892
Level unknown	588
Total Graduates	**32,957**

Source: The Finnish Universities

The impact associated with graduates from the Finnish Universities was estimated by applying the graduate premium for each degree subject (Figure 11.4) to the number of graduates in each subject area. In this way it was estimated that graduates of the Finnish Universities have an estimated graduate premium contribution of €3.9 billion in Finland. As this contribution is a productivity gain it is measured in terms of GVA and consequently does not have associated employment gains.

Table 11.2: The Finnish Universities – Graduate Premium

Finland	GVA (€m)
Graduate Premium Contribution	3,900

Source: BiGGAR Economics Analysis

11.3 Estimating the Corporate Profits

As discussed in Section 11.1 and Figure 11.1 the graduate premium contribution estimated in Section 11.2 does not capture the corporate profits associated with employing graduates, and so could underestimate the economic contribution made by graduates.

The sectors in which graduates are employed have a higher share of GVA attributable to staff costs. Analysis of the proportion of GVA that is staff costs in the different industries of graduate employment in Finland found that 75% of the GVA in these sectors was accounted for by staff costs.

This would suggest that the graduate premium, which can be considered a proxy for staff costs, accounts for 75% of the total economic contribution from graduates. Based on this, the additional profits attained by graduate employers of Finnish Universities can be estimated as €1.3 billion. So, in addition to the earnings premium received by graduates over their working lives, the graduates of the Finnish Universities help to generate an additional €1.3 billion GVA which is realised as company profits.

12 WIDER BENEFITS OF HIGHER EDUCATION

There are significant wider, unquantifiable benefits of the Finnish Universities 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. The placement of the Universities has also had an influence on the regional economic development of the country and has influenced the spread of wealth throughout the country.

12.1 Wider Benefits of Higher Education

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.[48] 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.[49] 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.[50] 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 contributions described in this report therefore present only a partial picture of the contribution of the Finnish Universities.

12.2 Staff Volunteering

Staff at the Finnish Universities often contribute their time to other activities and organisations, outwith their contracted hours. For example, staff at the Finnish Universities play an important role in civic leadership by contributing to the legislative process, advising on committees and supporting economic development at the regional and national level through their expertise. Staff also

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

use their expertise to contribute to non-governmental external bodies and professional organisations. As well as the clear social benefits of these interactions there are also economic benefits from the improved efficiency that results from better informed policies and initiatives.

As part of their role in the communities that they are located, staff from the Finnish Universities also frequently engage with the public through a variety of events such as public lectures, festivals and exhibitions.

In 2015, 169,016 hours were volunteered by staff at the Finnish Universities who collect data on this activity. The economic contribution of this is equivalent to the staff costs that public and charitable bodies would have to pay equivalently qualified people. The contribution of staff volunteering was therefore estimated by applying average staff costs to the total hours volunteered by staff.

The total value of staff time which is given voluntarily to external organisations is therefore estimated at almost €47 million. As with student volunteering, the nature of this type of activity is that it will contribute to increasing the productivity of external organisations and so will have a GVA impact rather than an employment impact.

Table 12.1: The Finnish Universities – Staff Volunteering

Finland	GVA (€m)
Staff Volunteering Contribution	47

Source: BiGGAR Economics Analysis

12.3 The Value of the Arts

The Finnish Universities create cultural impact in a number of ways. They make a vital contribution to the creative industries and tourism sectors by providing skilled graduates in the arts. As well as fulfilling the need for a skilled workforce they support cultural engagement at the community level through the events, performances and exhibitions that they support. Both of these aspects are interlinked; in many cases the provision of skilled graduates will make cultural and artistic activities at the local level and management of local cultural assets possible, for the enjoyment of the wider public.

The inherent value of arts and culture is in the intrinsic value that they bring, i.e. how arts and culture illuminate our inner lives and enrich our emotional world. However, there is increasingly scientific research on the connections between art, culture, health and well-being. For example, research has shown that active engagement in the arts can[51]:

- prevent exclusion;
- build better mental health;
- enhance social well-being and quality of life;
- reduce pain;
- improve functional mobility and motor skills; and

[51] Lehikoinen, Kai (2016), Harnessing the Transformative Potential of the Arts in Hybrid Contexts

- and prolong even life expectancy.

At the wider community level the arts and arts education can facilitate social interaction and contribute to community cohesion by enabling intercultural interaction and the dismantling of inter-cultural tensions.

Artistic thinking and creativity have increasing significance for many businesses in post-industrial societies as they operate in the knowledge economy, the creative economy and the experience economy. Artistic interventions in organisations provide experiential new means to co-reflect and co-create, galvanise thinking, generate inspiration, strengthen reputation, improve social and physical environments, instigate learning, stimulate networking and support transformation

A vibrant arts and culture scene therefore supports quality of life which in turn is important for inward investment. The ability to attract key staff is crucial to investment decisions as these type of staff are highly mobile and are able to chose where in Finland or where in the world they want to live and therefore quality of life is an important factor in those decisions. The arts, and by the extension the Finnish Universities, therefore have a key role to play in making Finland an attractive place to live, work, visit and invest and thereby in supporting economic growth.

12.4 Regional Development

Universities are large institutions, with extensive supply chains, that provide the daily focus of activity for thousands of students and staff. Although the impact of this activity has been measured at the national level, in practice a significant proportion of the "institutional" benefits associated with the Universities core operations will occur within the localities in which the Universities are based. It is therefore likely that this concentration of activity has played an important role in supporting the long-term economic development of the regions in which the Universities are based.

Regional economic growth is determined by multiple different factors and disaggregating the contribution of the Universities is challenging but one instructive source of supporting evidence is population change.

12.4.1 Population Change in University Towns in Finland

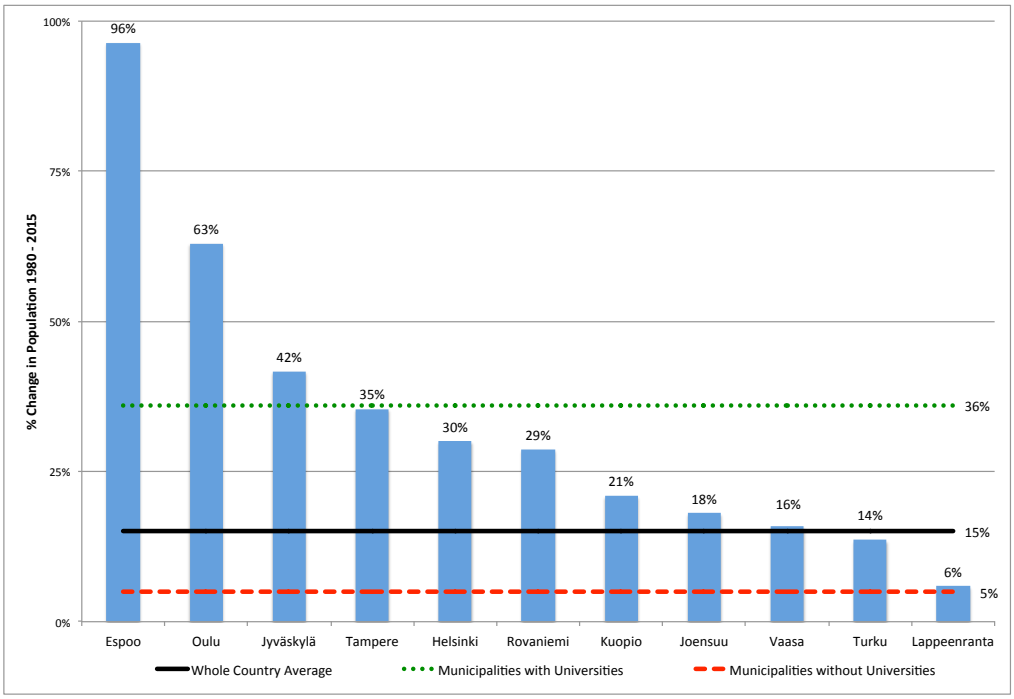
There are many and varied factors behind population change in any country, particularly over a long period of time but it is notable that Finnish towns with Universities have grown more rapidly than those without.

Figure 3.2 presents the percentage growth in population over a 35-year period between 1980 and 2015 for towns that have a university. The rate of change over the same time for towns without Universities and for the country as a whole is shown for comparison. Between 1980 and 2015, the population of Finland grew by 15% (represented by the solid line). For towns that had Universities, the rate of change was over twice this level at 36% (the dotted line) while for towns without a university the population grew by only 5% over the same time (the dashed line). Of the 11 towns that have universities, 9 have grown at more than the national average rate.

Put another way, towns with Universities have grown in population terms at seven times the rate of those that do not have Universities. Much of this is influenced by the rate of growth in Espoo (Greater Helsinki) where the population has almost

doubled in just over three decades. However, beyond Southern Finland and the Helsinki metropolitan area, the university towns of Oulu, Jyväskylä, Tampere, Rovaniemi and Kuopio have grown significantly over these decades. Joensuu, Vaasa and Turku have grown at around the national average rate while only Lappeenranta has grown at the same rate as the non-university towns.

Figure 12.1: Population Change in Finland 1980-2015: Municipalities With and Without Universities



Source: Statistics Finland

12.4.2 Regional Socio-economic Development

Population change is one important indicator of socio-economic development but evidence from the economic literature suggests that there is a positive correlation between other indicators of regional socio-economic development in Finland and innovation. One study[52] published by academics at the University of Helsinki for example considered the impact that innovation has had on the socio-economic development of local areas in Finland. The study provided systematic and comprehensive evidence of the links between regional socio-economic development and innovation concluding that:

"The positive connection between innovation and regional economic development is, thus, clear: GDP, GVA, and income are positively and significantly correlated with indicators of innovation."

The indicators of innovation used in the research included R&D expenditure/inhabitant, % of population with a higher education and patents granted/1,000 inhabitants – all of which are closely associated with the presence of a university.

[52] Makkonen T (2011), Innovation and regional socio-economic development – evidence from the Finnish local administrative units. Bulletin of Geography, socio-economic series no. 15/2011

Interestingly this research also concludes that the causal connection between regional socioeconomic development and innovation is bidirectional. This means that not only does innovation stimulate regional development but also that more developed regions are more able to innovate than less developed regions.

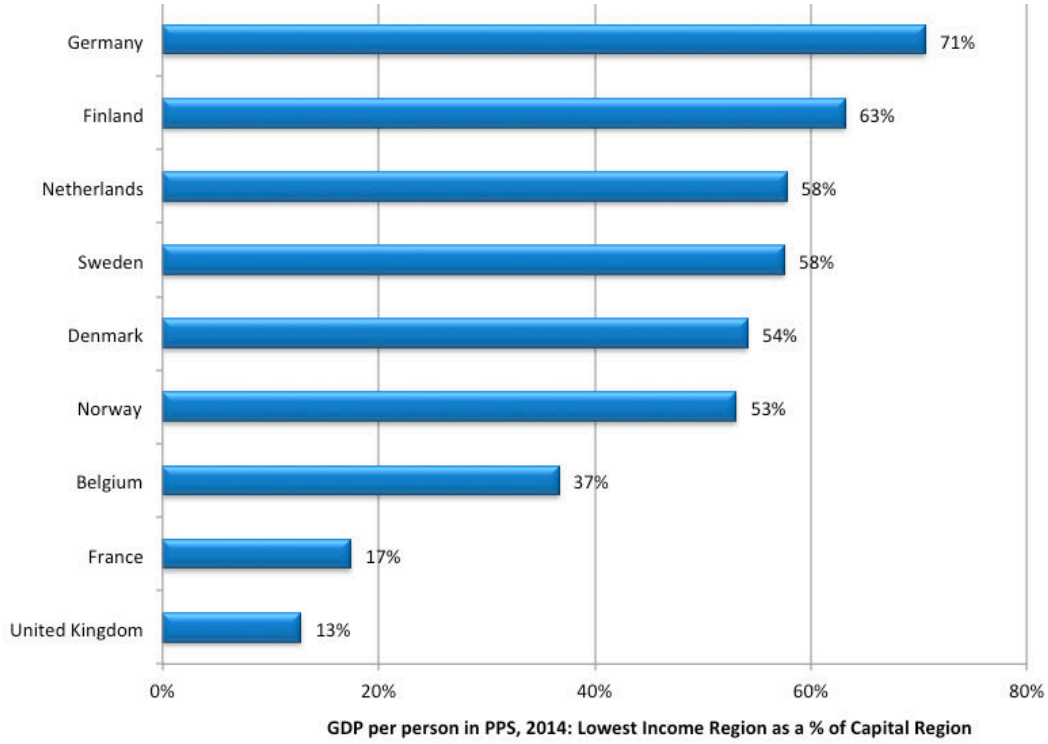
12.4.3 Regional Wealth in Finland & Comparison Countries

Finland performs well with northern and western European countries in terms of the internal distribution of wealth. Figure 3.4 considers the regional distribution of wealth as measured by GDP per capita expressed in terms of purchasing power standard (PPS)[53]. This shows the relationship between the lowest income region and the capital region in selected countries. The closer each figure is to 100% indicates how evenly spread the wealth is throughout the country.

In Finland, GDP per capita (wealth) in the region with the lowest income is 63% of the income per capita in the Helsinki region, making Finland the best performing country in northern Europe in this respect with a lower concentration of wealth in the capital region compared to other countries. It is second only to Germany in this regard, which can be explained by the disparities in income between the former East and West Berlin. In the Netherlands, Sweden, Denmark and Norway GDP per capita is between 54% and 58% of the level in the capital region. By comparison, the extreme concentration of wealth in Paris and London results in major disparities between the lowest income regions in France and the UK and these two cities. Various factors help to explain the more even distribution of wealth in Finland but the evidence presented above suggests that one of the more important of these factors is likely to be the distribution of the Universities.

[53]The purchasing power standard (PPS) is the name given by Eurostat to its artificial currency unit in which the PPPs and real final expenditures for the EU 28 are expressed. Price differences across borders mean that different amounts of national currency units are needed for the same goods and services depending on the country. To compare the relative cost of living between countries, PPS are obtained by comparing price levels for a basket of comparable goods and services that are selected to be representative of consumption patterns in the various countries.

Figure 12.2: GDP per capita in Purchasing Power Standards in Comparator European Countries, 2014 (Lowest Income Region as % of Capital Region)



Source: Eurostat

13 SUMMARY ECONOMIC CONTRIBUTION

This chapter summarises the quantifiable economic contribution of the Universities in Finland and benchmarks this performance against leading European Universities.

13.1 Total Contribution

By bringing together the various sources of economic contribution discussed in this report it can be estimated that in 2016 the Finnish Universities contributed **€14.2 billion GVA** to the Finnish economy and supported a total of **136,000 jobs**.

This implies that:

- for each €1 Finnish Universities generated through their direct operations, they generated almost €8 in total benefits for the Finnish economy; and
- for each person directly employed, the Universities supported more than four jobs throughout Finland.

The total income of the Universities in 2016 was £2.7 billion and so the ratio of total income to total impact was €5.26

A breakdown of the total contribution is provided in Table 13.1.

Table 13-1 – Finnish Universities – Summary Contribution

Finland	GVA (€m)	Jobs
Direct Effect	1,826	32,000
Supplier Effect	463	7,000
Staff Spending Effect	1,385	18,000
Capital Investment	361	3,000
Core Operations	**4,034**	**60,000**
Student Spending	1,054	16,000
Part-time Work	884	19,000
Student Volunteering	92	<1,000
Student	**2,030**	**35,000**
Visits to Staff & Students	53	1,000
Conferences & Events	7	1,000
Business Tourism	18	<1,000
Tourism	**78**	**2,000**
Spin-outs	300	4,000
University Owned Enterprises	507	2,000
Technology Licensing	3	<1,000
Services to Business	2,066	24,000
Student Placements	37	1,000
Science Parks	530	8,000
Innovation Support	**3,444**	**39,000**
Sub-Total	9,586	135,000
Graduate Premium	3,902	-
Returns to Medical Research	633	-
Staff Volunteering	47	-
TOTAL	14,168	136,000

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

13.1.1 International Comparison

To better understand these impacts it is helpful to consider them in relation to other European Universities. In 2015 BiGGAR Economics undertook an impact assessment of the 21 members of the League of European Research Universities (LERU). This study was undertaken using the same methodology used for this analysis so the results are comparable with those presented in this report.

Table 13.2 presents comparable ratios for the Finnish Universities and the LERU Universities. It shows that for each €1 Finnish Universities generated as a result of their direct operations, they generated €7.76 in total benefits throughout Europe. The equivalent figure for the LERU Universities was €5.88, suggesting that Finnish Universities are significantly more effective in driving economic

growth. The higher ratio for the Finnish Universities is primarily due to the higher earnings premium realised by graduates of the Finnish Universities.

The table also shows that for each person directly employed the Finnish Universities supported more than four jobs somewhere in Finland. The equivalent figure for the LERU Universities was 5.68, suggesting that Finnish Universities are somewhat less effective than their European counterparts in creating jobs. This conclusion should however be interpreted cautiously as it relates only to the absolute number of jobs supported and says nothing of their quality. As discussed in Section 8.2.2 there is evidence to suggest that many of the jobs supported by the Finnish Universities are particularly high-value and this should be taken into account when interpreting these ratios.

Table 13.2 – Economic Impact Ratios (Europe)

	UNIFI	LERU
Direct GVA : Total GVA	7.76	5.88
Direct Jobs : Total Jobs	4.24	5.68

Source: BiGGAR Economics

14 FUTURE CONTRIBUTION

The previous chapter summarised the economic contribution of Finnish Universities in 2016 but the scale of this contribution is not fixed and could increase or decrease in response to future changes in university funding. This chapter considers how the impact of Finland's Universities could change as a result of future changes in government funding.

14.1 Approach

Changes in the level of University activity are driven primarily by changes in university income, which is in turn largely dependent on the total value of funding that the Universities receive from the Finnish government. To consider what the future economic contribution of Finnish Universities could be it was therefore necessary to consider both the relationship between:

- government funding and total university income; and
- total university income and the various sources of impact considered in this report.

Once these relationships were established the economic impact model was then re-run in order to model a hypothetical situation in which government funding for Universities in Finland is reduced by 10%.

14.1.1 Government Funding and University Income

Finnish Universities generate income from a variety of different sources. By far the most important source is the Finnish government, which provides direct financial support for research and teaching activities but the Finnish government is not the only source of university income. Universities also receive income from industrial partners in return for providing expert support and advice or undertaking commercial contract research (see chapter 8 for a detailed description). Universities also generate income in other ways including fund raising, financial investments or other commercial services.

The first step in this analysis was to consider how changes in funding from the Finnish government might effect other sources of income. In order to do this it was helpful to differentiate between four main sources of income teaching, research, industrial and other.

At the time of writing students studying at Finnish Universities did not pay university tuition fees so, at the time the analysis was undertaken, the Finnish government was the only source of teaching income for Finnish Universities. From August 2017 this will change and Universities in Finland will be able to charge tuition fees to international (i.e. non-EU) students who choose to study in Finland. This means that in the future Universities could use international recruitment as a way of mitigating the effects of future cuts in government funding for teaching.

In order to model this it was assumed that the relationship between total teaching income and government funding would be around 1:0.95 (i.e. that a €1 reduction in government funding for teaching would result in a €0.95 reduction in total teaching income.

Any reduction in government funding for research is likely to result in a loss of research competitiveness within Finnish Universities, which would make it more difficult for them to secure competitive research funding from international sources. Indeed, there is some evidence that government funding cuts in 2015 and 2016 may have already affected the competitiveness of the sector. Figures from Statistics Finland for example show that the number of Ph.D.-educated Finns who have moved abroad increased by 37% between 2011 and 2015, which some commentators have taken as evidence of a "brain-drain"[54].

This means that any future change in government research funding could have a disproportionate effect on total research income. This was modelled by assuming that the relationship between total research income and government funding would be around 1:1.10.

Any loss in competitiveness would also affect the amount of income that the Universities could hope to secure from industrial partners. Public research funding is often used to leverage in private R&D investment, any reduction in public research expenditure would make Finland less attractive to highly mobile R&D investment by multi-national corporations. The competitiveness of this market means that this effect could be felt very quickly. This was modelled by assuming that the relationship between total industrial income and government funding would be around 1:1.50.

Universities also generate income from a variety of other commercial activities and it is likely that they would attempt to increase these activities to help compensate for any reduction in other sources of income. The scope to achieve this is however likely to be limited and may also be compromised by any loss of overall competitiveness. Given that Finnish Universities have already absorbed substantial funding cuts over the past two years it is likely that any capacity to increase other areas of commercial activity will already have been fully exploited. For this reason it was assumed that the relationship between total other income and government funding would be around 1:1.

By applying these assumptions to the total income of Finnish Universities in 2016 it was estimated that a 10% change in government funding could result in a disproportionate change of 10.5% on the overall income of the sector. The effect on each source of funding is summarised below.

Table 14-1 - Potential Effect of 10% Change in Government Funding on University Income

Source of Funding	2016 (€m)	Future (€m)
Teaching	738	668
Research	612	545
Industry	239	203
Other	1,106	993
Total	2,694	2,409

Source: BiGGAR Economics

14.1.2 University Income and Economic Impact

The consequences of any change to university funding arrangements are difficult to predict since they will depend on the actions taken by the sector in response to

[54] Times Higher Education (19 January 2017), Finland's brain drain.

the changes and the market conditions in which the Universities operate. The relationship between university funding and economic impact will also not necessarily be linear. For example changes in funding could lead to disproportionate changes in the impact of the sector if:

- Universities respond by making efficiency savings that enable them to reduce unit costs; or
- they effect the competitiveness of the sector in the international market for research funding and international (non-EU) students.

In order to model these effects it was first of all necessary to consider which source university funding was most likely to drive each of the main sources of impact considered in this study.

An assumption was then made about the elasticity of the relationship between the primary funding driver and the source of impact. An elasticity assumption of more than 1 implies that the change in the associated impact would be more than the change in income while an elasticity assumption of less than 1 implies that the change in the associated impact would be greater than the change in income. These assumptions and the rationale behind them are presented below.

Table 14-2 – Relationship Between Source of Funding and Type of Economic Impact

Impact	Impact Driver	Elasticity	Rationale
Core operations	Total Income	1.00	Direct relationship between income and activity levels.
Capital investment	Teaching & research income	1.10	Direct cost – outcome relationship but in the short-term capital projects could be delayed to help absorb cuts in other areas.
Students	Teaching income	0.95	Efficiency improvements would enable Universities to absorb some cuts but ability to do this would be limited by recent cuts already implemented.
Tourism	Total Income	1.50	Non-core areas of activity likely to be reduced first to maintain funding to areas directly related to the Universities' core mission.
Wider benefits	Teaching income	1.10	
Knowledge exchange	Research & industrial income	1.50	Universities likely to divert resources from non-core operations like commercialisation support in favour of research.
Health Impacts	Research & industrial income	1.50	
Workforce productivity	Teaching	1.10	Diminished competitiveness would make Finnish Universities less attractive to the best students and have a long-run effect on workforce productivity.

Source: BiGGAR Economics

14.1.3 Potential Impact of Future Changes

The assumptions set out above were then applied in order to illustrate the potential effect of a 10% cut in government funding. The effect of such a cut on each area of impact is presented below. **This illustrates how a 10% cut in government funding for higher education result in a 12.5% reduction in the value of the Finnish economy. This equates to a reduction of around €1.8 billion GVA.**

Table 14-3 – Impact of 10% Cut in Government Funding - GVA

Impact	2016 (€)	Future (€)	Change (%)
Core operations	3,674	3,287	-10.5
Capital investment	361	320	-11.2
Students	2,030	1,847	-9.0
Tourism	78	65	-15.8
Innovation & business formation	3,444	2,818	-18.2
Workforce productivity	3,902	3,494	-10.5
Health Impacts	633	518	-18.2
Wider Impacts	47	42	-10.5
Total	14,168	12,391	-12.5

Source: BiGGAR Economics

The impact on the number of jobs supported by the sector is summarised below. This shows that a 10% cut in government funding for higher education could result in a fall of 12.5% in the total number of jobs supported by the sector, which equates to around 16,900 jobs.

Table 14-4 – Impact of 10% Cut in Government Funding - jobs

Impact	2016	Future	Change (%)
Core operations	57,100	51,100	-10.5
Capital investment	2,600	2,300	-11.2
Students	34,700	31,600	-9.0
Tourism	2,000	1,700	-15.8
Innovation & business formation	39,300	32,200	-18.2
Total	135,700	118,800	-12.5

Source: BiGGAR Economics

It is of course impossible to accurately predict the future so some caution is necessary in interpreting these results. Nevertheless, this approach does serve to illustrate how changes (both increases and decreases) in government funding for higher education could have disproportionate effects on the Finnish economy. Of particular note is the relationship between funding and the impact of innovation support activity undertaken by the Universities. As the two tables above illustrate, a reduction in government funding of 10% might be expected to result in a reduction of more than 18% in the value of innovation support activity. This clearly illustrates how the Universities have a catalytic effect on the Finnish economy and play an important role in driving long-term economic growth.

14.1.4 Net Fiscal Impact of Funding Cut

The analysis set out above shows that a 10% reduction in Government funding could result in a reduction in economic impact of €1,777 million. Such a cut, should it be proposed, would most likely be motivated by the objective of improving the net fiscal balance in Finland. However, it is likely that such a reduction in economic impact would result in the opposite effect, a worsening of the net fiscal position.

OECD figures show that taxation receipts in Finland are equivalent to 44% of national economic output[55]. On this basis, it would be reasonable to expect a reduction in economic output of €1,777 million to be associated with a reduction in taxation receipts of €782 million, before taking account of any dynamic economic growth or multiplier effects. So the net effect on the public finances of a cut in government funding would most likely be a worsening in the net fiscal position, since lost taxation receipts would be expected to considerably exceed the saving in spending.

[55] OECD, Centre for Tax Policy and Administration (2016), Revenue statistics 2016 - Finland

15 EUROPEAN AND GLOBAL CONTRIBUTION

The economic contribution of the Finnish Universities extends beyond Finland, to Europe and the rest of the world.

The contribution of the Finnish Universities in Europe and globally was estimated following the same approach and method outlined throughout the report. These contributions are summarised in Table 15-1.

This shows that the Finnish Universities generated an economic contribution of:

- €15.5 billion GVA and 148,000 jobs in Europe (this includes the Finnish contributions); and
- €16.1 billion GVA and 155,000 jobs globally (this includes both the Finnish and European contributions).

Table 15-1 – Contribution of Finnish Universities in Europe and Globally

	Europe		Global	
	GVA (€m)	Jobs	GVA (€m)	Jobs
Direct Effect	1,826	32,000	1,826	32,000
Supplier Effect	542	9,000	575	9,000
Staff Spending Effect	1,605	20,000	1,701	21,000
Capital Investment	383	3,000	399	3,000
Core Operations	**4,356**	**64,000**	**4,501**	**66,000**
Student Spending	1,155	17,000	1,205	18,000
Part-time Work	951	20,000	985	20,000
Student Volunteering	92	-	92	-
Student	**2,198**	**37,000**	**2,281**	**38,000**
Visits to Staff & Students	58	1,000	61	1,000
Conferences & Events	4	<1,000	-	-
Business Tourism	20	<1,000	21	<1,000
Tourism	**82**	**2,000**	**82**	**2,000**
Spin-outs	329	4,000	342	5,000
University Owned Enterprises	552	3,000	575	3,000
Technology Licensing	10	<1,000	11	<1,000
Services to Business	2,412	28,000	2,581	30,000
Student Placements	44	1,000	46	1,000
Science Parks	629	10,000	729	11,000
Innovation Support	**3,977**	**46,000**	**4,284**	**49,000**
Sub-Total	**10,613**	**148,000**	**11,149**	**155,000**
Graduate Premium	3,999	-	4,004	-
Returns to Medical Research	870	-	909	-
Staff Volunteering	47	-	47	-
TOTAL	15,528	148,000	16,109	155,000

16 CONCLUSIONS

The objective of this study was to assess the economic contribution of the 14 Finnish Universities. To do this the study has considered a wide variety of different types of activity including the Universities core operations and the activity of their students as well as the wider catalytic effects that the Universities have as a result of their teaching, research and knowledge exchange activities.

Taken together it was estimated that these activities generated more than €14.2 billion GVA for the Finnish economy in 2016 and supported around 136,000 jobs. This represents around 6% of the entire value of the Finnish economy. The impact beyond Finland was estimated to be even larger, contributing an estimated €15.5 billion GVA and supporting around 148,000 jobs across Europe and €16.1 billion GVA and supporting around 155,000 jobs world-wide. This implies that:

- for each €1 Finnish Universities generated through their direct operations, they generated €7.76 in total benefits for the Finnish economy; and
- each person directly employed by the Universities supported more than four jobs throughout in Finland.

The economic contribution made by the Finnish Universities compares favourably to other leading Universities elsewhere in Europe. The results of this study were compared with the results of a similar study of the 21 Universities that make up the League of European Research Universities (LERU). This showed that for each €1 Finnish Universities generated as a result of their direct operations, they generated €8.50 in total benefits throughout Europe. The equivalent figure for the LERU Universities was €5.88, suggesting that Finnish Universities are significantly more effective in driving economic growth than their European counterparts.

16.1 Supporting Regional Performance

The Finnish Universities are all large organisations with extensive supply chains, significant staff complements and large consumer bases. As such their expenditure and that of their staff and students makes a significant economic contribution. The deliberate decision to spread Finland's Universities across the country means that this contribution is particularly apparent at the regional level.

The wide geographic distribution of the Universities has also enabled them to play an important role in ensuring the equitable distribution of Finland's wealth. It is for example notable that the Finnish towns and cities that have Universities have experienced a population growth rate of twice the national average. Compared to non-university towns their growth is even more marked: in some cases growing at seven times the national rate. This has also had a very positive impact on the quality of education throughout the country and is a key factor behind the strong academic performance of Finland compared to other countries.

16.2 Driving Long-term Economic Growth

Economic growth in advanced economies is driven by productivity growth, which is in turn driven by knowledge and its diffusion (innovation). The Finnish Universities play a unique role in this by pushing the boundaries of academic discovery and increasing the pool of knowledge available to society and, at least as importantly, diffusing this knowledge throughout the economy to provide the

basis for future productivity improvements and therefore economic growth. The Universities support the diffusion of knowledge by providing high quality graduates for the labour market and undertaking a variety of knowledge exchange activities.

Moreover, the Finnish Universities have created several highly successful innovation ecosystems that are major clusters of industrial activity. They provide a space for discussion and create connections between academics, students and companies. They therefore make the regions in which they are located more attractive to potential investors and are therefore vital to attracting inward investment. These ecosystems are entirely built on the quality of the research undertaken at the Universities, as it is this that attracts students, researchers, businesses and investment, helping to catalyse innovation and create the knowledge sectors of the future.

It is however important to acknowledge that the very high degree of integration that exists between business and academia in Finland means that a significant amount of university/business interaction occur informally. While this is good for the Finnish economy, the fact that so much of this activity goes unrecorded makes it particularly difficult to quantify its value. This means that, while the impact presented above is based on a tried and tested methodology, it is likely to underestimate the true value of this activity to the Finnish economy.

Attempts to quantify the extent of this are fraught with methodological difficulties but one estimate suggests that the true value of this activity could be more than six times that presented in the analysis. This would imply that the total contribution that the Universities make to the Finnish economy could be closer to €32 billion - more than double the impact presented elsewhere in this report. While some caution is necessary in interpreting this figure, it does at least provide a strong basis for concluding that the impacts presented in this report are likely to understate rather than overstate the true value of the Universities to the Finnish economy.

16.3 Wider Benefits

Although the magnitude of the economic impact quantified in this report is considerable, it is likely to underestimate the true value of the contribution that Finland's Universities make to the Finnish economy. This is because many of the impacts generated by the Universities simply cannot be quantified.

The Finnish Universities support a variety of wider benefits that generate real, if unquantifiable, value for society. For example, many of the Universities are involved in medical research that generates significant benefits for society above and beyond its commercial value. The Universities also benefit society by improving social cohesion, facilitating social mobility, encouraging better health and wellbeing and greater civic engagement. Academic staff also play an important role in the civic leadership of Finland by contributing to public policy and practice and helping to improve the quality and efficiency of government and public services.

Finally, each of the Finnish 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. While the value of these outcomes to individuals and the collective contribution to society cannot be quantified, they certainly should not be overlooked.

16.4 The Future

The overarching conclusion of this report is that Finland's Universities make a very substantial contribution to Finland's economy. They play a vital role in supporting long-term economic growth and ensuring that Finland maintains its competitive position in the global economy.

The scale of this contribution is however not fixed and could increase or decrease in response to future changes in university funding. While it is of course impossible to predict the future, analysis undertaken as part of this report suggests that any changes in university funding could have disproportionate effects on the Finnish economy.

In a hypothetical situation where the Finnish Universities' core funding was reduced by 10%, this could result in a loss of 16,900 jobs and €1.8 billion GVA in Finland. Such a reduction in the economic impact might be associated with a reduction in taxation revenues of €0.8 billion and so it is likely that a cut in government funding to the Universities could be counterproductive since the lost taxation receipts could well be greater than the funding cut.

17 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 the economic contribution 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.

Gross Value Added (GVA) is a measure of the value that an organisation, company or industry adds to the economy through its operations. In the case of the Universities this is estimated by subtracting the non-staff operational expenditure (mainly represented by expenditure on goods and services) from the total income of the Universities.

The report used the production approach to measuring the GVA contribution, where the GVA is equal to the value of the service produced less the value of the inputs used. Typically this is estimated by subtracting the non-labour (goods and services) costs of the organisation from the organisation's total income.

Multipliers – every expenditure and employment has a multiplier effect throughout the economy. Multipliers are a numeric way of describing the secondary impacts that stem from a business, industry, service or organisation. For example, an employment multiplier of 1.8 suggests that for every 10 employees in Organisation A, 8 additional jobs would be created in other supplier industries such that 18 total jobs are supported by Organisation A.

Direct effect – this relates to the income and employees directly engaged by the Universities.

Indirect effect – this arises from the business-to-business transactions required to satisfy the direct effect. It is a second round impact that would not occur were it not for the Universities and it relates to the businesses engaged in their supply chain for goods and services.

Induced effect – as a result of the direct and indirect effects the level of household income throughout the economy will increase as a result of increased employment. A proportion of this increased income will be re-spent on final goods and services, which is the induced effect

Multipliers differ between sectors and countries. Each country calculates their individual multipliers in the form of Input-Output tables which form part of the national accounts. The Input-Output tables are quantitative techniques that represent the interdependencies between different branches of a national economy. The multipliers used in this report have been sourced from the Input-

Output tables for Finland for 2017. These are available from the Statistics Finland website.

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.

Turnover/employee is a ratio of the amount of turnover required to support one full-time equivalent job for one year. It varies by sector depending on the relative labour intensities of different industries e.g. agriculture is a relatively labour intensive process compared to oil refining therefore the amount of turnover required to support an oil refining job is much higher than that required to support an agricultural job. The ratios used in this report are taken from the National Accounts for Finland.

Turnover/GVA is a ratio of the amount of turnover required to produce a certain amount of GVA in each sector. This relationship varies between sectors and countries.

18 APPENDIX B – UNIFI MEMBER DESCRIPTIONS

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

18.1 Aalto University

History: Aalto University in Espoo, Greater Helsinki, was established in 2010 as a merger of three major Finnish Universities: the Helsinki University of Technology (established 1849), the Helsinki School of Economics (established 1904), and the University of Art and Design Helsinki (established 1871).

Scale: The University has close to 16,300 full-time students, approximately 4,100 staff members and an annual income of €390.8m in 2016. It also operates several units outside Greater Helsinki in Mikkeli, Pori and Vaasa.

The University is composed of six schools: Arts, Design and Architecture; Business; Chemical Engineering; Electrical Engineering; Engineering and Science.

Rankings: In the QS World University Rankings by Subject 2017, Aalto University's rank for Art & Design rose to 13th place worldwide. Two other subjects were also placed among top 100: Architecture/Built Environment and Business & Management Studies

Research: Aalto University has defined four fundamental competence areas: ICT and digitalisation, materials and sustainable use of natural resources, global business dynamics and art and design knowledge building. Aalto played a significant role in supporting the development of Finland's ICT and mobile communications sector through their collaborative partnership with Nokia.

Innovation Support: A 2014 report by MIT rated the Alto Ecosystem among the top 5 in the world with a large part of its success being attributed to the University's focus on student entrepreneurship. They offer many different support services for innovation including the Start-Up Sauna, the Design Factory, Aalto Ventures Programme; Aalto Start-Up Centre, Aalto University Innovation Services and the Small Business Centre.

18.2 University of Helsinki

History: The University of Helsinki has been located in Helsinki, Finland since 1829, but was founded in the city of Turku (in Swedish Åbo) in 1640 as the Royal Academy of Åbo. It is the oldest and largest university in Finland. It is a founding member of the League of European Research Universities (LERU), which includes such universities as Oxford and Cambridge. The University is internationally renowned for its high quality teaching, research, and innovation.

Scale: In 2016 the University had around 31,000 full-time students, approximately 7,300 staff members and an annual income of €691.0 m. It is based around four campus locations in and around the city of Helsinki and at nine other locations.

The University is composed of 12 faculties: Arts, Educational Sciences, Law, Theology, Social Sciences, Swedish School of Social Science, Science, Medicine, Biological and Environmental Sciences, Agriculture and Forestry, Veterinary Medicine and Pharmacy.

Rankings: International rankings consistently place the University of Helsinki amongst the 20 best universities in Europe and among the top 100 globally (currently ranked in 56th position globally by the Shanghai rankings for 2016).

Research: The main strength of the University of Helsinki is considered to be scientific research and the teaching which is derived from it. Research institutes within the university include the following:

- Aleksanteri Institute – A national centre of research, study and expertise pertaining to Russia and East Europe
- Christina Institute for Gender Studies
- Environmental Change Research Unit
- Erik Castrén Institute of International Law and Human Rights
- Helsinki Center of Economic Research (HECER) – A joint initiative of the University of Helsinki, the Helsinki School of Economics and the Hanken School of Economics
- Helsinki Institute for Information Technology (HIIT) – A joint research institute of the University of Helsinki and the Aalto University
- Helsinki Institute of Physics
- Institute of Biotechnology
- Neuroscience Center
- Rolf Nevanlinna Institute – Research institute of mathematics, computer science, and statistics

Innovation Support: A major part of the University's offering for Helsinki Innovation Services is a one-stop shop for commercialising innovations for the University of Helsinki. Their aim is to identify and evaluate commercially viable research results and to turn them into profitable start-ups or out-licensing opportunities.

18.3 University of Eastern Finland

History: The University of Eastern Finland was formed in 2010 through a merger of two formerly independent universities, the University of Joensuu and the University of Kuopio.

Scale: The University of Eastern Finland has a staff of 2,500 and 14,800 full-time students. It had an annual budget of €230.5m in 2016. In addition to the two main campuses, the University of Eastern Finland also has a smaller research station campus in Savonlinna.

The university offers Bachelor's, Master's and doctoral level education in 13 fields of study: pharmacy, dentistry, humanities, education, economics and business administration, natural sciences, medicine, forest sciences, psychology, theology, health sciences, social sciences, and law.

Rankings: In the rankings of the world's top universities under 50 years of age published by QS World University Rankings and Times Higher Education World University Rankings, the University of Eastern Finland was ranked 46th by QS, and 63rd by THE (2016).

Research: The key interdisciplinary research areas of the University of Eastern Finland are built around four global challenges: ageing, lifestyles and health; learning in a digitised society; cultural encounters, mobilities and borders and environmental change and sufficiency of natural resources. The University of Eastern Finland approaches the above-mentioned challenges through its focused, interdisciplinary research areas. The research areas are:

- Aerosols, climate change and human health
- Cardiovascular and metabolic diseases
- Forests, global change and bioeconomy
- Neurosciences
- Borders, mobilities and cultural encounters
- Photonics: theory, materials and applications
- Sustainable governance of natural resources
- Learning in interactive environments
- Translational cancer research
- Musculoskeletal disorders

The University has research strengths in health sciences (medicine, pharmacy, dentistry, nursing), forestry and natural sciences.

Innovation Support: The Green Hub has been established on the Joensuu Science Park to help realise the benefits from forestry related opportunities and the University of Eastern Finland is one of the partners responsible for establishing the initiative. It has been designed to provide a platform for businesses operating in the sector to collaborate with academics and identify innovative new solutions to business challenges. In time it is expected that the Green Hub will become an important focus for industry/academic collaboration that will play an important role in driving future growth in the sector and ensuring that the benefits of this growth are retained in eastern Finland

18.4 University of Jyväskylä

History: Founded in 1863, the University of Jyväskylä is a university in Central Finland on the western side of the Finnish Lakeland. It has its origins as the first Finnish-speaking teacher training college and later expanded into teaching and researching in the sciences in 1967 when it was renamed under its present title. The faculties and departments are mainly located on three campuses: the Main Campus area in the city centre as well as the nearby Mattilanniemi and Ylistönrinne Campuses.

Scale: The University currently has approximately 2,600 employees and nearly 12,500 full-time students from around 100 countries. It had an annual budget of €211.5m in 2016. Courses are spread across seven faculties.

The university offers a wide range of study programmes for bachelor's or master's degrees, many of which are unique in Finland. Natural Sciences, human sciences, sports and health sciences as well as teacher education are the university's areas of special expertise. The faculty of Sport and Health Sciences is the only one of its kind in the country. The university has strong ties with top national and international research, business and innovation communities.

Rankings: In global rankings, research activity at the University of Jyväskylä is among the top three per cent of all universities.

Research: The University's Strategy outlines the University's core fields of research:

- learning teaching and the learning and growth environments that support development;
- basic natural phenomena and mathematical thinking;
- languages, culture and communities in global change;
- physical activity, health and wellbeing; and
- information technology and the human in the knowledge society.

At present, the City of Jyväskylä has three major capital investment plans that are strongly linked to the work of the University: the Hippos 2020 sports and leisure development; Kangas, a smart urban district initiative; and a new city hospital, Kukkula. The presence of a strong University community supports the long-term sustainability of these developments.

Innovation Support: The University of Jyväskylä is also a key collaborator in providing innovation and business start-up support. The University is continuing to work in this area and has recently established Unifund, a financing company to support the establishment of new businesses.

18.5 University of Lapland

History: Founded in 1979, the University of Lapland is located in the city of Rovaniemi in northern Finland, just six miles south of the Artic circle. It is the most northern university in the European Union.

Scale: The University currently has approximately 600 employees and 4,000 full-time students and it had an annual budget of €51.1m in 2016.

Courses are spread across four faculties: art and design, education, law and social sciences.

Research: The University has an Arctic Centre which carries out internationally recognised, cutting-edge research on the interactions between people and the environment in the Arctic. Research at the Artic Centre focuses on five main themes: global change research, environmental and minority law, sustainable development research, Artic anthropology and Artic governance.

It is important to the university that their research, educational, and artistic activities actively support the local community, businesses, and society in northern Finland.

The Arctic Centre has an extensive multidisciplinary cooperation network around the world and is a member of the China-Nordic Research Centre. Members of the Arctic Centre staff serve as experts around the world.

Innovation Support: The University is part of a consortium that is responsible for implementing the EU's Innovation Programme for the Higher Education Institutions in Lapland.

18.6 Lappeenranta University of Technology

History: Lappeenranta University of Technology (LUT) is a science university in eastern Finland, close to the border with Russia. It was established in 1969 and brings together the fields of science and business.

Scale: There are approximately 900 staff members and 4,300 full-time students in the university. LUT had an annual budget of €78.0m in 2016.

Teaching is organised into three schools: the School of Energy Systems, School of Engineering Science and the School of Business and Management.

Rankings: The Times Higher Education organisation ranks LUT in the top 150 of the world's young universities. It was also identified as one of 20 challenger universities for 2030 by Firetail, a higher education strategy consulting firm (reported in The Times Higher Education World University Rankings).

Research: LUT research focuses on topical issues such as climate change, wind and solar power, recycling nutrients and waste, clean water and energy and sustainable business activities.

The university's Green Campus is a unique research and educational environment where the university's expertise in science and technology can be used to solve environmental problems.

Innovation Support: It promotes the development of research-based start-up companies through the university's own investment company Green Campus Innovations.

18.7 University of Oulu

History: The University of Oulu was founded in 1958 and is located on the north western coast of Finland. There are two main campuses a number of research stations around the country.

Scale: It has approximately 13,500 full-time students and 2,800 staff. It had and annual budget of €221.8m in 2016. The University is divided into ten faculties: architecture; biochemistry and molecular science; medicine; technology; IT and electrical engineering; mining; science; humanities; business and education.

The University of Oulu aims to promote mobility among its students and takes part in a number of international exchange programmes, such as the Erasmus Programme (Europe), Nordplus (Nordic Countries), FIRST (Russia), ISEP and International to International ISEP (USA, South America, Asia), UNC-EP (USA),

north2north (USA, Canada, Russia, Nordic Countries), North-South-South (Africa).

Rankings: It is ranked in the 2016 Academic Ranking of World Universities (Shanghai Rankings) among the top five universities in Finland.

Research: The University highlights five key research areas;

- Information Technology (Machine vision and ubiquitous computing technologies, Wireless communications, High-speed electronics and photonics, Biomedical engineering, Information systems and software);
- Biosciences and Health (Cell-extracellular matrix research, Cardiovascular disease research, Enzyme structure and metabolic research, Genes and the environment);
- Environment, Natural Resources and Materials (Environmental issues, natural resources and energy economy; materials science, properties and behaviour of matter, catalysts and material innovations; modelling and computational science);
- Earth and near-space system and environmental change (seeking to understand how the Sun affects near-Earth space and the Earth's atmospheric regions); and
- Cultural Identity and Interaction (Cultural Identity and Interaction; Language, education, interaction and how we adapt in the face of global, digital, environmental and economic change).

Innovation Support: The University of Oulu has a reputation for providing an environment that fosters innovation in the region e.g. HILLA Programme which is a 5-year acceleration and investment program focusing on smart specialisation and utilising ICT.

18.8 Hanken School of Economics

History: The Hanken School of Economics is a triple-accredited business school based on two campuses: one in Helsinki and one in Vaasa. Both are owned by the School. Hanken was established in 1909 and is the oldest business school in Finland, as well as among the oldest in northern Europe. Hanken's second campus in Vaasa was established in 1980 to develop business education in this region which houses a large proportion of the Swedish-speaking population in Finland. Currently, it is the only independent business school of university standing in Finland. Hanken was the first business school in Finland to introduce a compulsory stay abroad for its bachelor's students and has approximately 120 partner universities for student exchange.

Scale: The School has approximately 2,300 full-time students and 300 staff and it had an annual budget of €31.0m in 2016. Research and teaching is organised into the following departments: accounting and commercial law; economics; finance and statistics; management and organisation; marketing and the centre for languages and business communication.

Ranking: The Financial Times has ranked Hanken's Masters in Management programme no. 67 and 69 in the 2015 and 2016 rankings respectively.

Research: Hanken's areas of strength are finance, economics, management and organisation and marketing.

Innovation Support: The Partner Programme at Hanken offers long-term partnerships between the corporate world and Hanken and is a platform for connecting knowledge and research from the University with students and the corporate world.

18.9 University of Arts Helsinki

History: The University of the Arts Helsinki is mainly located in Helsinki, but it also has two further centres in the city of Kuopio (department of church music) and also in Seinäjoki (department of popular and folk music). It was formed in 2013 following the merger of three academies that were formerly independent universities: The Finnish Academy of Fine Arts, the Sibelius Academy and the Theatre Academy Helsinki. Internationalisation is a strategic priority of the university.

Scale: The University has approximately 1,900 full-time students and 700 staff and offers over 30 degree programmes in the fields of music, fine arts, theatre and dance. It had an annual budget of €76.2m in 2016.

Rankings: The Sibelius Academy of the University of Arts Helsinki has been ranked 10th among the world's universities in performing arts. The QS World University Rankings by Subject ranked the universities offering tuition in performing arts for the second time.

Research: The university has identified three focus areas for research: history of music, artistic research and art education. The University of the Arts Helsinki actively co-operates with other universities and universities of applied sciences.

18.10 Tampere University of Technology

History: Tampere University of Technology (TUT) is Finland's second-largest university in engineering sciences. It is located in Tampere, the largest inland-city in South Western Finland which is an important industrial centre in the country. It was founded in 1965 as a branch of Helsinki University of Technology and became an independent university in 1972. In 2019, Tampere University of Technology, the University of Tampere, and Tampere University of Applied Sciences will merge to create the Tampere New University.

Scale: The university has approximately 8,000 students, 1,800 staff and faculty members and it had an annual budget of €138.9m in 2016.

Its degree programmes are structured around four faculties: business and built environment; computing and electrical engineering; engineering sciences and natural sciences.

Rankings: The Times Higher Education, ranks TUT in 11th position in the world, and 4th in Europe, for industry collaboration.

Research: The University's research mostly focuses on four areas: digital operating environment; energy and eco-efficiency; health technology and light-based technologies. It also has close ties to many different companies (such as

Nokia). Located next to the university campus is the Hermia Business Park[56], housing around 100 companies and 5,000 employees, including a large Nokia research facility.

Innovation Support: A key element in TUT's support to new start businesses is its involvement in the Demola/ New Factory programme along with the University of Tampere, TAMK and UTA. (See University of Tampere's description below for an outline of the Demola/ New Factory programme).

18.11 University of Tampere

History: The University of Tampere was founded in Helsinki in 1925 as a "Civic College" and relocated to Tampere in South Western Finland in 1960. It was renamed as the University of Tampere in 1966 and has offered a multi-disciplinary range of courses since this time.

Scale: It currently has approximately 10,000 full-time degree students and 2,000 staff. It had an annual budget of €184.6m in 2016.

The University is divided into six faculties. These are the Faculty of Communication Sciences; Faculty of Education; Faculty of Management; Faculty of Medicine and Life Sciences; Faculty of Natural Sciences and the Faculty of Social Sciences.

Research: The university publish research papers on their website which reflect current themes in their research programme. These are produced by all faculties and cover topical issues such as the motivations behind a healthy lifestyle, immigration, political and economic uncertainty, cell transplants, genetics.

Innovation Support: The University is a partner in the Demola and New Factory business start-up/ incubator projects in the city along with the Tampere University of Technology, TAMK and UTA. Demola was founded in 2008 to bring project partners, universities and multidisciplinary student teams together to solve real-world challenges. It is open for all types of Project Partners (companies from startups to corporations, municipalities, associations).

New Factory is an innovation centre and business incubator that connects entrepreneurs, students, researchers, mentors, investors and experts from various fields into value co-creation. They run free 3-month "startup bootcamps" for teams and entrepreneurs which offers a coaching/ mentoring service, free access to work space, peer support and access to investors.

New Factory has supported more than 160 start-ups, creating 1,600+ jobs, run more than 340 events and has an active network of 20 mentors.

18.12 University of Turku

History: The University of Turku is located in the city of Turku on the coast in South Western Finland and is the second largest university measured by student enrolment after the University of Helsinki. It was established in the city in 1920 and also has two further campuses in the region in Pori and Rauma. The University has further units all over the country, from northern Lapland to the Archipelago Sea.

[56] http://www.technopolis.fi/en/available-office-spaces/tampere/hermia/companies/

The University of Turku shares a campus with Åbo Akademi University and elements of the Turku Science Park. The area also encompasses Turku University Hospital (TYKS) and the Student Village. The administration building and the surrounding complex was built in the fifties on what came to be known as University Hill. The campus is constantly expanding.

Scale: The University has approximately 15,900 full-time students and 4,500 staff members (3,268 ftes). It had an annual budget of €288.2m in 2016.

In January 2010, Turku School of Economics merged with the University of Turku, forming a seventh faculty of the university. The remaining faculties are humanities, mathematics and natural sciences, medicine law, social sciences and education.

The Pori unit of the University of Turku is part of the University Consortium of Pori, which is a network of 3 800 students, 180 experts and four universities operating in a multi-disciplinary scientific and artistic environment. The universities that are part of the consortium are the University of Turku, Aalto University, the Tampere University of Technology and the University of Tampere.

Rankings: Ranked by subject, nursing at the University of Turku is in 41st position globally in the QS World University Rankings for 2017[57]. The University of Turku ranks in the top one percent of over 20,000 universities in the world.

Research: Research at the University of Turku is diverse and international. Current research themes are: biofuture; digital futures; cultural memory and social change; children, young people and learning; drug development and diagnostics and sea and maritime studies. Politics and policy is also an important output of research from the University.

Innovation Support: The University's SparkUp service offers support to start-up companies and in 2016 more than 600 businesses were assisted through this programme to establish a new business in the Turku region. The University has also organised bespoke services for ICT, bio and life science companies as well as the maritime industry.

18.13 University of Vaasa

History: The University of Vaasa was founded in 1968 and is a multidisciplinary, business-oriented university in Vaasa, on the Western coast of Finland.

Scale: It has a population of approximately 4,800 students and 500 staff and it had an annual budget of €40.2m in 2916.

The university has evolved from a school of economics to a present day university consisting of three faculties: Faculty of Business Studies, Faculty of Philosophy and Faculty of Technology.

Research: The areas in which the University of Vaasa has strong research and education of a high international standard are the fields of management and finance. In addition the University is strongly represented in public-sector management and in communications, which are being developed in line with the University's new strategy. Up-and-coming fields at the University include new energy technology, energy business, and multidisciplinary research and education

[57] The QS Rankings by subject rank the position of 4,438 universities in 46 different subjects. This has been conducted annually since 2011 and considers academic reputation, employer reputation and effectiveness of research.

related to the broader societal impacts of these fields. This emerging area of expertise enables the University to strengthen the region's competence centre in the international energy industry, an area of national importance.

The quality of research will be further reinforced by developing collaboration with universities in Finland and abroad, as well as with research and education networks. Collaborative ventures are planned with Umea University in Sweden, in the fields of business studies and sustainable development and with the Vaasa University of Applied Sciences in the field of technology. The University of Vaasa is also involved in a Nordic-oriented collaboration project (Kvarken) between Finland, Sweden and Norway which is aimed at boosting expertise in sustainable development, languages and culture.

Innovation Support: Vaasa Energy Business Innovation Centre or VEBIC is a new research and innovation platform hosted by the University of Vaasa. It brings together know how from the research and business communities responding to the global needs of efficient energy production, energy business and sustainable societal development. The first stage of the VEBIC research infrastructure will be ready by the end of 2017.

18.14 Åbo Akademi University

History: Åbo Akademi University (ÅAU) in Åbo is the only exclusively Swedish language university in Finland (or indeed outside of Sweden). It was founded by private donations in 1918 and also operates from premises in Jakobstad, Vaasa, Helsingfors and on Åland Islands.

Scale: In 2016 the University had 6,000 students, 1,300 staff and an income of €105.0m in 2016.

It is arranged into four faculties: arts, psychology and theology; education and welfare studies; social sciences, business and economics and science and engineering.

Research: ÅAU is an internationally acknowledged research university with an extensive responsibility for providing education in Swedish in Finland. The activities cover research and education in most disciplines from the humanities, pedagogics and theology to social sciences, natural sciences and technology. ÅAU has identified three focal areas of research:

- Minority research - minority roles and rights in society;
- Molecular process and material technology – chemical engineering in the bioeconomy; and
- Drug development and diagnostics - bioimaging.

19 APPENDIX C – METHODOLOGICAL APPROACH

19.1 Methodological Approach

This Methodological Appendix describes in more detail, the approach and assumptions that are used in the calculation of some of the key economic contributions of the Finnish Universities. The calculations that are described in more detail in this Appendix are those for which the approach is too complicated to be included in the main body of the report. Those contributions that have been described fully in the main report have been omitted from this Appendix.

The remainder of this Appendix is structured as follows:

- section 19.2 outlines the key economic ratios and multipliers used;
- section 19.3 discusses the methodology used to estimate the core university contributions;
- section 19.4 discusses the methodology used to estimate the student contributions; and
- section 19.5 discusses the methodology used to estimate the graduate premium.

19.2 Economic Ratios and Multipliers

Ratios

The main economic ratios used in the report are the ratio between GVA and turnover and the turnover to employment ratio for each sector, which are given in Table C-1. These economic ratios are derived from the total turnover, employment and GVA for the sectors appropriate to this analysis. Turnover, employment and GVA by sector in Finland is available in the National Accounts from Statistics Finland.

Table C-1 – Economic Ratios

Industry	Turnover/GVA	Turnover/Employee (€)
Accommodation and food service activities	2.52	88,042
Activities auxiliary to financial and insurance activities	3.04	246,552
Activities of membership organisations	2.06	88,819
Advertising and market research	2.12	98,450
Agriculture and hunting	3.37	55,523
Air transport	5.53	619,778
Architectural and engineering activities, etc.	1.81	112,325
Audio-visual activities	2.03	178,660
Business management activities	1.79	109,938
Computer and information service activities	1.92	124,160
Construction	1.84	170,528
Cultural activities and gambling	2.60	153,362
Education	2.13	91,081
Electricity, gas, steam and air conditioning supply	1.38	86,929
Electronics industry	2.15	695,156
Employment activities	2.53	424,217
Financial activities	1.28	50,141
Fishing	2.04	220,185
Food industry, etc.	1.68	118,235
Forestry	4.27	297,731
Household service activities	1.40	200,042
Human health activities	1.00	18,837
Industries working with Academia	1.76	91,004
Insurance activities	3.65	399,828
Land transport	1.75	311,000
LERU Supply Chain	2.15	115,431
Manufacture of basic metals	2.07	185,984
Manufacture of chemicals and chemical products	7.00	630,070
Manufacture of coke and refined petroleum products	4.24	592,441
Manufacture of electrical equipment	22.61	3,383,929
Manufacture of fabricated metal products	2.58	268,941

Manufacture of furniture and other products	2.80	151,633
Manufacture of machinery and equipment n.e.c.	2.76	117,842
Manufacture of motor vehicles, etc.	3.27	303,872
Manufacture of other non-metallic mineral products	3.37	220,435
Manufacture of other transport equipment	2.91	205,068
Manufacture of rubber and plastic products	3.67	213,243
Mining and quarrying	3.04	222,059
Other business activities and veterinary activities	3.25	276,308
Other personal service activities	2.28	74,219
Other support services	1.71	65,625
Paper industry	1.72	67,518
Pharmaceutical industry	4.54	640,588
Postal and courier activities	1.39	390,213
Printing	1.90	78,838
Public administration and social security	2.54	126,535
Publishing activities	1.80	121,451
Real estate activities	2.22	176,328
Rental and leasing activities	1.70	541,702
Repair and installation of machinery and equipment	2.30	255,970
Repair of household goods	2.15	146,701
Retail trade (excl. motor vehicles, etc.)	2.17	73,455
Scientific research and development	1.86	72,798
Sewerage and waste management	1.39	146,078
Social work activities	2.19	285,196
Sport, amusement and recreation activities	1.41	56,483
Telecommunications	2.15	110,526
Textile, clothing and leather industries	2.01	349,187
Trade and repair of motor vehicles, etc.	3.22	118,627
Travel agencies, etc.	1.91	107,206
Warehousing and support activities for transportation	4.34	184,500
Water collection, treatment and supply	3.10	226,497
Water transport	1.74	265,385
Wholesale trade (excl. motor vehicles, etc.)	3.44	259,263

Whole Economy	1.90	165,152
Woodworking industry	2.19	154,420

Source: BiGGAR Economics Calculations based on Statistics Finland, (Feb 2017) National Accounts

Multipliers

The economic contribution associated with the indirect and induced impacts are captured in the economic multipliers.

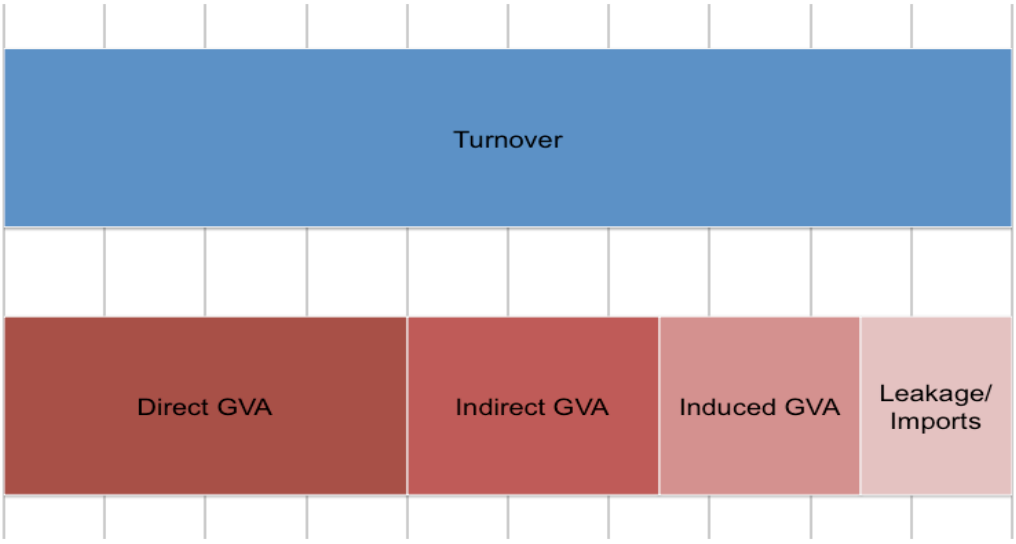
There are two types of multiplier. Type 1 (M_1) multipliers only consider the economic impact in the supply chain, whereas Type 2 (M_2) multipliers also include the spending of the staff involved in the process. The multipliers are expressed as the final figure for both GVA and Employment. For example, if there is a T_2 GVA Multiplier of 1.75, then €1.00 of direct GVA (D_{GVA}) would result in €1.75 of total GVA (T_{GVA}) impact. Therefore in order to extract the pure multiplier effect it is necessary to subtract 1 from the initial figure given as the multiplier.

$$T_{GVA} = \underbrace{D_{GVA}}_{\text{Direct GVA}} + \underbrace{(M_1 - 1) * D_{GVA}}_{\text{Indirect GVA}} + \underbrace{(M_2 - M_1) * D_{GVA}}_{\text{Induced GVA}}$$

The multipliers are important because without them only the direct GVA would be considered. However, the final value of a product includes the values added at each stage of the supply chain. The multipliers enable all of the economic activity to be estimated.

The relationship between the initial turnover and the final GVA varies between sectors and countries. In a totally closed economy (no imports or exports) the sum of the direct and indirect GVA would equal the value of the final turnover. In this closed economy, the induced GVA would mean additional impact, spurred on by the original expenditure. However, most countries are not closed and therefore the direct and indirect GVA will equal less than the turnover. The induced GVA may make up for some of this gap, however there is still likely to be leakage, especially in industries with a high GVA/Turnover ratio.

Figure C.1 – Relationship between Turnover, GVA and Multipliers



Source: BiGGAR Economics

Estimating the Economic Multipliers

The source data for calculating the economic multipliers was the Input Output Tables for Finland, which are provided by Statistics Finland[58]. The multipliers that were estimated using input output tables were Leontief Type 1 GVA and Employment Multipliers and Leontief Type 2 GVA and Employment Multipliers. Type 2 multipliers consider the impact of supply chain and staff expenditure and Type 1 multipliers only consider supply chain expenditure.

The methodology followed for the calculation of the Type 1 & Type 2 Multipliers is described below. More detail on the methodology is given in the Scottish Government's Input-Output Methodology Guide[59].

In order to estimate the GVA and employment multipliers, the values in the Input-Output tables were converted to their equivalent direct GVA and employment statistics for each industry using the ratios described in Section 7.1.

For those industries that are based on a combination of sectors, namely LERU Supply Chain and Industries working with Academia, the multipliers were not estimated directly from the Input Output tables but were based on weighted averages of the sectors involved. These industries are marked with a (*) in the table below.

The Direct Requirements Matrix (A)

The direct requirements matrix considers how much input from each sector is required to produce one unit of output from the first sector. The level of input that is required by industry is taken from the consolidated Input-Output tables.

For example, if the accommodation and food service activities sector had a total output of €1,000 and this required €50 of goods and services bought from the

[58] Statistics Finland (Feb 2017) National Accounts
[59] The Scottish Government, *Input-Output Methodology Guide,* September 2011 (available http://www.gov.scot/Resource/Doc/919/0116738.pdf)

construction (C) sector, the direct requirements entry for the construction sector in accommodation and food services would be 0.05.

$$A_{FB} = \frac{Input\ of\ (A) consumed\ by\ industry\ (F)}{Total\ output\ of\ industry\ (F)}$$

$$A_{FB} = \frac{50}{1{,}000}$$

$$A_{FB} = 0.05$$

Completing this operation for each entry in the Input Output matrix gives the resulting square A Matrix.

$$A = \begin{bmatrix} A_{AA} & \cdots & A_{MA} \\ \vdots & \ddots & \vdots \\ A_{AM} & \cdots & A_{MM} \end{bmatrix}$$

In order to estimate the GVA and employment multipliers, the values in the Input-Output tables were converted to their equivalent direct GVA and employment statistics for each industry using the ratios described in Section **Error! Reference source not found.**.

Identity Matrix (I)

The identity matrix is the equivalent of '1' in matrix algebra. Therefore when any matrix (M) multiplied by the identity matrix (I) the result is the original matrix (M), in the same way that if any number is multiplied by '1', the result is the original number.

The identity matrix is simply one that has all entries as 0, apart from those on the diagonal, which have a value of 1.

$$I = \begin{bmatrix} 1 & \cdots & 0 \\ \vdots & 1 & \vdots \\ 0 & \cdots & 1 \end{bmatrix}$$

Also as with numbers, the inverse of any number (x) is the one that gives the result below. For example, the inverse of 2 is 0.5.

$$x * x^{-1} = 1$$

Therefore the inverse of any matrix (M) is the one, which gives the result below.

$$M * M^{-1} = I$$

Leontief Matrix (L)

The Leontief Matrix is the Inverse of the Identity matrix minus the A Matrix.

$$L = (I - A)^{-1}$$

In the formula above *L* is the Leontief Inverse Matrix, *I* is the Identity Matrix and *A* is the direct requirements matrix.

The overall multiplier for any industry is the sum of its headed column in the Leontief Matrix.

$$L(A) = \sum_{i=A}^{M} L_{Ai}$$

Multipliers used

The resulting multipliers are given in Table C-2.

These multipliers were used throughout the analysis to estimate the multiplier effects (i.e. the indirect and induced effects). The total economic contribution is therefore the sum of the direct contribution and the multiplier effects.

Table C-2 – Economic Multipliers

Multiplier Industry	Type 1 Employment	Type 1 GVA	Type 2 Employment	Type 2 GVA
Accommodation and food service activities	2.38	1.96	1.72	1.53
Activities auxiliary to financial and insurance activities	2.51	2.07	2.65	2.20
Activities of membership organisations	2.02	1.61	1.61	1.39
Advertising and market research	1.95	1.59	1.64	1.43
Agriculture and hunting	2.73	2.35	1.61	1.53
Air transport	3.36	2.79	4.65	3.86
Architectural and engineering activities, etc.	1.80	1.47	1.67	1.41
Audio-visual activities	1.88	1.59	2.07	1.74
Business management activities	1.79	1.48	1.69	1.44
Computer and information service activities	1.80	1.50	1.99	1.65
Construction	2.39	1.97	2.16	1.85
Cultural activities and gambling	2.04	1.69	1.61	1.42
Education	1.53	1.24	1.46	1.23
Electricity, gas, steam and air conditioning supply	1.72	1.56	4.00	3.34
Electronics industry	1.70	1.47	2.63	2.14
Employment activities	1.54	1.20	1.30	1.14
Financial activities	1.89	1.59	2.28	1.87
Fishing	1.58	1.49	1.58	1.49
Food industry, etc.	3.43	2.89	4.68	4.21
Forestry	1.37	1.29	1.58	1.44
Household service activities	1.32	1.00	1.08	1.00
Human health activities	1.80	1.44	1.61	1.37
Industries working with Academia*	2.30	1.95	2.68	2.27
Insurance activities	1.61	1.42	2.45	2.01
Land transport	1.90	1.59	1.71	1.51
LERU Supply Chain*	1.92	1.60	2.03	1.74
Manufacture of basic metals	3.63	3.06	4.07	3.42
Manufacture of chemicals and chemical products	2.15	1.86	3.13	2.62
Manufacture of coke and refined petroleum products	2.78	2.38	4.48	3.72

Manufacture of electrical equipment	1.82	1.55	2.16	1.81
Manufacture of fabricated metal products	2.34	1.92	2.04	1.75
Manufacture of furniture and other products	2.19	1.80	1.72	1.51
Manufacture of machinery and equipment n.e.c.	2.41	2.01	2.84	2.38
Manufacture of motor vehicles, etc.	2.14	1.77	2.03	1.73
Manufacture of other non-metallic mineral products	2.37	1.98	2.32	1.97
Manufacture of other transport equipment	2.59	2.09	2.31	1.95
Manufacture of rubber and plastic products	1.99	1.67	1.96	1.67
Mining and quarrying	2.72	2.30	2.92	2.48
Other business activities and veterinary activities	2.18	1.80	1.63	1.48
Other personal service activities	1.61	1.44	1.34	1.25
Other support services	1.79	1.45	1.44	1.27
Paper industry	3.56	3.07	5.45	4.59
Pharmaceutical industry	1.29	1.19	2.14	1.78
Postal and courier activities	1.92	1.55	1.55	1.36
Printing	2.28	1.87	1.83	1.58
Public administration and social security	1.79	1.48	1.74	1.47
Publishing activities	2.11	1.75	2.24	1.89
Real estate activities	1.59	1.47	3.44	2.96
Rental and leasing activities	1.93	1.70	2.51	2.20
Repair and installation of machinery and equipment	1.83	1.50	1.75	1.47
Repair of household goods	1.89	1.57	1.43	1.29
Retail trade (excl. motor vehicles, etc.)	1.86	1.54	1.42	1.27
Scientific research and development	1.45	1.22	1.62	1.32
Sewerage and waste management	1.91	1.68	2.51	2.14
Social work activities	1.60	1.25	1.33	1.16
Sport, amusement and recreation activities	2.02	1.68	1.73	1.51
Telecommunications	1.95	1.72	2.99	2.50
Textile, clothing and leather industries	2.20	1.82	1.63	1.45
Trade and repair of motor vehicles, etc.	1.79	1.49	1.61	1.41
Travel agencies, etc.	3.16	2.55	2.33	2.01

Warehousing and support activities for transportation	2.84	2.36	2.91	2.47
Water collection, treatment and supply	1.48	1.33	1.94	1.65
Water transport	2.39	1.96	2.52	2.12
Wholesale trade (excl. motor vehicles, etc.)	1.84	1.55	2.02	1.70
Whole Economy	2.13	1.80	1.92	1.65
Woodworking industry	4.45	3.88	3.09	2.70

Source: BiGGAR Economics analysis of Statistics Finland (Feb 2017) National Accounts

19.3 Core University Contributions

Expenditure on Supplies

The Finnish Universities have an impact on the economy through the goods and services that they purchase from their suppliers.

The economic impact associated with any expenditure is dependent on the sector in which the money is initially spent. Therefore, it was requested that the Finnish Universities provide a split of their supply chain expenditure by industry. If the Universities were not able to provide a split, or could not provide a split in sufficient detail, BiGGAR Economics used the industrial split of Higher Education institution expenditure that was derived from their previous work for the League of European Research Universities (LERU).

In this analysis, the expenditure of 21 European Universities was considered and the resulting distribution of expenditure between industries is given in Table C-3.

Table C-3 – LERU Supply Chain Expenditure by Summary Category

Industrial Category	Proportion
Administrative and support service activities	16%
Professional, scientific and technical activities	27%
Real estate activities	5%
Information and communication	3%
Accommodation and food service activities	5%
Transportation and storage	4%
Wholesale and retail trade; repair of motor vehicles and motorcycles	16%
Construction	1%
Electricity, gas, steam and air conditioning supply	4%
Other	19%
Total	**100%**

Source: BiGGAR Economics analysis of LERU Members

In the economic ratios and multipliers, this mix of industries is referred to as 'LERU Supply Chain'.

The economic contribution associated with this expenditure was estimated in line with the methodology described in Table C-4.

Table C-4 – Economic contribution of expenditure on supplies

Formulas
$$GVA = \sum_{a} (Exp_{(a)} * \frac{G_{i(a)}}{T_{i(a)}} * M(G)_i^2)$$ $$Employment = \sum_{a} (Exp_{(a)} * \frac{E_{i(a)}}{T_{i(a)}} * M(E)_i^2)$$
Inputs
$$Exp_{(a)} = Expenditure\ \ on\ commodity\ (a)$$ $$\frac{G_{i(a)}}{T_{i(a)}} = \frac{GVA}{Turnover}\ ratio\ in\ industry\ assocaited\ with\ commodity\ (a)$$ $$\frac{E_{i(a)}}{T_{i(a)}} = \frac{Employment}{Turnover}\ ratio\ in\ industry\ assocaited\ with\ commodity\ (a)$$ $$M(E)_i^2 = Type\ 2\ Employment\ Multiplier\ in\ industry(i)$$ $$M(G)_i^2 = Type\ 2\ GVA\ Multiplier\ in\ industry(i)$$

Source: BiGGAR Economics

Staff Spending

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

Data given by the Finnish Universities provided a breakdown of staff salaries paid in Finland and the rest of Europe. The next step was 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 Finland and 99% in Europe. This is based on BiGGAR Economics' earlier analysis for LERU.

VAT is deducted from staff spending to ensure that the estimates are in line with Eurostat and Finnish statistical data. A European Commission study[60] indicates that 11.0% of general household expenditure in Finland is spent on VAT and this proportion is therefore deducted from total staff salaries.

[60] European Commission (2013), A Study on the Economic Effects of the current VAT rates structures

Although some staff earnings will be saved and not spent immediately it has been assumed that money earned and saved in previous years could be spent this year.

Capital Spending

The Finnish Universities invest in properties and manage their estates through three estates companies, namely:

- AaltoCRE – which is wholly owned by Aalto University and manage all of their estates;
- University of Helsinki Properties – which is wholly owned by the University of Helsinki for the same purpose; and
- SYK Oy – a company owned by 10 Universities and the Finnish State.

The economic impacts associated with the construction and maintenance of these companies was included in the economic impact calculations. In order to avoid double counting, the rents paid by the Finnish Universities was removed from the supply chain impact calculations.

The economic impacts associated with AaltoCRE and University of Helsinki Properties were both exclusively attributed to their parent institutions, the University of Aalto and the University of Helsinki. However, because the SYK Oy company has multiple academic shareholders it was necessary to distribute this economic impact between the shareholder universities.

SYK Oy invests around €120 million per year in estates development and spent an additional €52.5 million on the operational costs associated with the maintenance of these estates[61]. This expenditure generated €222 million GVA within Finland and supported almost 1,200 jobs.

The distribution of the economic impacts was assumed to be proportional to the value of rent paid to the SYK Oy from each of the partner institutions. This enabled a long-term view of the investment priorities of SYK Oy to be reflected, rather than short term construction projects associated with any particular University dominating the results. On an analysis of rental income paid, the Universities that had the greatest contribution to SYK Oy were:

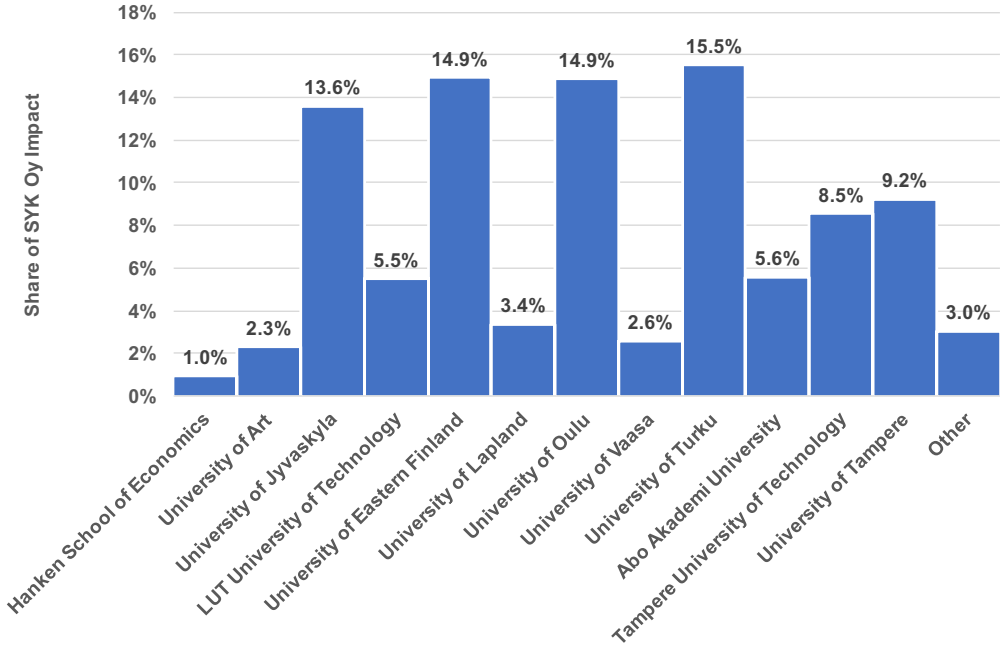
- University of Turku;
- University of Oulu;
- University of Eastern Finland; and
- University of Jyväskylä.

These institutions paid €112 million in rent to SYK Oy in 2016 and account for 59% of the total economic impact of the company. For example, 15.5% of the economic impact was attributed to the University of Turku, which was equivalent to €34.5 million GVA and 184 jobs in Finland.

The SYK Oy Annual Report 2015 found that not all of the rental income to the company was from academic clients. Therefore a proportion of the impact was attributed to 'Other' and not included in the reported totals.

[61] SYK OY (2016) Balance Sheet Book 2015

Figure C-2 - Distribution of impact of SYK Oy by University



Source: BiGGAR Economics of data from Finnish Universities

19.4 Student Impacts

Student Employment

This contribution will consider the impact that students have on the economy through being active members of the labour market. This is estimated by applying the average GVA per employee to the number of equivalent average employees in each sector where students work.

It is assumed that students are employed in the same study area in which they reside.

Additionality of Student Employment

Student employment is not all additional. Some of the employment that the students could take up by residents at the local area. The proportion of student employment is assumed to be inversely proportional to the level of youth unemployment in the area. That is, the higher the level of youth unemployment the lower the additionality as more people in the area are likely to be in a position to fill these roles.

It was assumed that at 50% youth unemployment, the additionality of student labour would be 10% because there would be a significantly large pool of workers. However, not all of the positions that are filled by students could be easily filled by the wider workforce, therefore there is a minimum additionality set at 10%. At 0% youth unemployment the additionality of student labour would be 100%.

The level of youth unemployment in Finland is available for the regions and this was used to calculate the additionality of student labour (Table C-6).

Table C-5 – Calculations of Student Labour Additionality

Formulas
$LSA_{(Study\ Area)} = 10\% + (1 - \frac{1}{50\%} * Min\{YUR_{(StudyArea)}, 50\%\}) * (1 - 10\%)$
Inputs
$LSA_{(Study\ Area)} = Labour\ Supply\ Additionality\ in\ study\ area$
$YUR_{(Study\ Area)} = Youth\ Unemployment\ Rate\ in\ study\ area$

Source: BiGGAR Economics

Table C-6 – Student Part Time Employment Additionality

Study Area	Youth Unemployment *	Student Work Additionality
Manner-Suomi	22.5%	59.5%
Länsi-Suomi	24.1%	56.6%
Helsinki-Uusimaa	19.1%	65.6%
Etelä-Suomi	22.7%	59.1%
Pohjois- ja Itä-Suomi	25.1%	54.8%
Finland	22.4%	59.7%

*Source: BiGGAR Economics analysis, *Eurostat*

Industries of Student Employment

The industries that students work in play a significant role in their economic output. As part of their study on student employment, the UK Government Department of Business, Innovation and Skills (BIS) surveyed the industries that the students worked in. The industrial split is given in the table below and enables the economic ratios and multipliers to be matched with the appropriate sectors.

It was assumed that students in Finland were employed in similar industries during their studies.

Table C-7 – Industries of Student Employment

Sector	Proportion of student employment
Arts, entertainment and recreation	6.2%
Retail trade, except of motor vehicles and motorcycles	37.6%
Residential Care Activities	12.1%
Office administrative, office support and other business support activities	6.0%
Education (private provision only-excludes local authority and central govt bodies)	3.6%
Services to buildings and landscape activities	1.8%
Food and beverage service activities	32.6%
Total	100%

Source: BiGGAR Economics analysis of BIS Research Paper Number 142: Working While Studying (October 2013)

The hours that the students worked in these sectors was translated into the equivalent number of employees in these sector. Data in the OECD Employment Outlook found that the average worker in Finland spent 1,646 hours a year at work. The part time student employees hours were totalled and then divided by this figure to give an average worker equivalent.

The induced impacts associated with student expenditure are already considered as part of the student expenditure calculations and therefore the multiplier impacts are limited to the indirect Type 1 Multipliers, which only consider the implications for the supply chain.

The GVA contribution of these additional jobs was estimated by applying an estimate of the average GVA/employee for sectors in which students typically work. Indirect effects were then captured by applying appropriate multipliers. This methodology is outlined in Table C-8.

Table C-8 – Calculations of Student Labour Contribution

Formulas
$$Employment = M(E)_i^1 * (SW * \frac{\langle Hrs_{St} \rangle}{\langle Hrs_F \rangle} * LSA_{(Study\ Area)} * \frac{\langle Months\ studying \rangle}{12})$$
$$GVA = M(G)_i^1 * (Employment * \frac{G_i}{E_i})$$
Inputs
$$LSA_{(Study\ Area)} = Labour\ Supply\ Additionality\ in\ study\ area$$
$$Employment_{(Equivalent)} = Equivalent\ employment\ in\ industries\ of\ student\ work$$
$$SW = Number\ of\ full\ time\ students\ with\ part\ time\ job$$
$$M(E)_i^1 = Type\ 1\ Employment\ Multiplier\ in\ industry(i)$$
$$M(G)_i^1 = Type\ 1\ GVA\ Multiplier\ in\ industry(i)$$
$$\langle Hrs_{St} \rangle = Average\ weekly\ hours\ worked\ by\ students$$
$$\langle Hrs_F \rangle = Average\ weekly\ hours\ of\ employment\ in\ industries\ of\ student\ work$$
$$\langle Months\ studying \rangle = Average\ months\ of\ the\ year\ spent\ at\ University$$
$$\frac{G_i}{E_i} = \frac{GVA}{Employment}\ ratio\ in\ industries\ of\ student\ work$$

Source: BiGGAR Economics

19.5 Graduate Premium

The skills and knowledge given to students at university enables students to become more productive employees after graduation. The method used to quantify this is additional productivity is the additional earnings potential of the graduates of the Finnish Universities. As is described in the main report, this does not capture all of the additional productivity as there will be components of profit and taxation that are not captured in this analysis.

Estimating the Graduate Earnings Premium

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[62]. The starting point for estimating the graduate premium of

[62] Official Statistics of Finland (OSF): Structure of Earnings [e-publication]. ISSN=1799-0092. Helsinki: Statistics Finland [referred: 4.5.2017]. Access method: http://www.stat.fi/til/pra/index_en.html

students at the Finnish Universities was earnings data by level of education and age, available from Statistics Finland.

The total earnings premium associated with each level of education was estimated over the working life of a graduate for each level. The working ages were assumed to be between 25 and 65 in order for all levels of education to be considered. It was assumed that the education process was linear and therefore for example those individuals who had achieved a doctorate or equivalent tertiary education had previously achieved a higher-degree level tertiary education. Therefore the graduate premium associated with each level of education is measured against the earnings potential of those individuals whose education level was one level below that being estimated. The degree equivalence and what it was measured against are given in Table C-9.

Table C-9 – Graduate Premium Education Levels

Reported Degree Level	Statistics Finland Equivalent	Measured against
Under-graduate	Lower - degree level tertiary education	Upper secondary level education
Masters	Higher - degree level tertiary education	Lower - degree level tertiary education
Licentiate Degree	Lowest - degree level tertiary education	Upper secondary level education
Doctoral or equivalent	Doctoral or equivalent tertiary education	Higher - degree level tertiary education
Level Unknown	Lowest - degree level tertiary education	Upper secondary level education

Source: BiGGAR Economics

The lifetime graduate premium associated with each degree level was estimated by summing the additional earnings at each stage of life that an individual could expect above the next lowest level of education. This is a long term impact and in order to reflect best practice, the discount rate of 5% was applied to the annual premium[63].

The formula used to estimate this impact are given in Table C-10.

[63] Nordic Council of Ministers (2007) Nordic Guidelines for Cost-benefit analysis 2007

Table C-10 – Calculations of Graduate Premium per Subject

Formulas
$$GP^{Ed(x)} = \sum_{Y} (E_{Age}^{Ed(x)} - E_{Age}^{Ed(x-1)}) * (1-D)^{Y}$$
Inputs
$$GP^{Ed(x)} = Graduate\ Premium\ with\ Education\ level\ (X)$$ $$E_{Age}^{Ed(x)} = Earnings\ in\ appropriate\ age\ bracket\ with\ Education\ (X)$$ $$E_{Age}^{Ed(x-1)} = Earnings\ \ in\ appropriate\ age\ bracket\ with\ Education\ level\ one\ below\ (X)$$ $$Y = Working\ Years, between\ 25\ and\ 65$$ $$D = Discount\ Rate$$

Source: BiGGAR Economics

The resulting graduate premiums for each level of study are given in Table C-11.

Table C-11 – Graduate Premium Values

Education Level	Graduate Premium
Under-graduate	€106,056
Masters	€144,575
Doctoral or equivalent	€79,855
Other	€30,673

Source: BiGGAR Economics

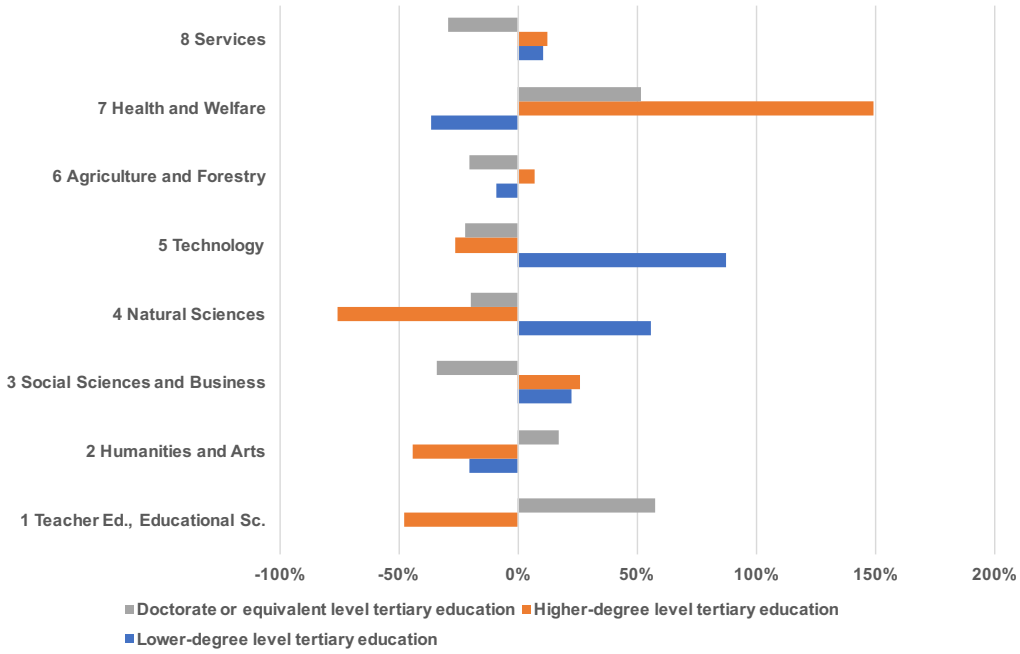
The subject studied is also a factor in the potential earnings of graduates. Statistics Finland provides data on the median monthly earnings of graduates by subject area and highest level of education[64]. This shows that the premium varies between subject type and also by education level within that subject type. For example, the median monthly earnings of an individual with a lower degree level earnings premium in technology based subjects is €3,870, which is €1,004 more than an equivalent individual with a just upper secondary level education. However, an average individual with a lower level tertiary education earns just €536 per month more than somebody with just an upper secondary level education. Therefore the average premium for those who have a lower-degree level tertiary education with a technology subject is 87% higher than the average.

[64] Official Statistics of Finland (OSF): Structure of Earnings [e-publication]. ISSN=1799-0092. 2011, Pay differentials also within educational levels between fields of education. Helsinki: Statistics Finland [referred: 4.5.2017]. Access method: http://www.stat.fi/til/pra/2011/pra_2011_2013-04-05_kat_001_en.html

However, this additional earnings premium for technology graduates is not consistent across all levels of education and the premium associated with higher level tertiary education for technology graduates is not as high as the average across all graduates of this level of education.

The earnings premium deviation from the average of that level of education is given in Figure C-3.

Figure C-3 – Variation of subject studied to average earnings by education level



Source: Statistics Finland

The lifetime graduate premium for each subject and level of study was estimated by applying the deviation of that subject and level of study from the average graduate premium for that level of study. For example:

- the average graduate premium of those with an Undergraduate degree is €106,056;
- as shown in Figure C-3, Technology graduates at this level of education have an earnings premium 87% higher than average;
- therefore the lifetime graduate premium is 87% higher than €106,056;
- therefore the undergraduate premium for technology graduates is **€198,519**.

Similar calculations were undertaken for each subject and level of study and the resulting graduate premiums are given in Table C-12.

Table C-12 – Graduate Premium Values by subject and level of study

Subject	Undergraduate	Masters	Other	Doctoral or equivalent
Teacher Ed., Educational Sc.	€ 0	€ 75,166	€ 0	€ 125,600
Humanities and Arts	€ 84,430	€ 80,600	€ 22,317	€ 93,509
Social Sciences and Business	€ 129,907	€ 182,287	€ 23,267	€ 52,705
Natural Sciences	€ 165,103	€ 34,931	€ 68,851	€ 64,075
Technology	€ 198,519	€ 106,216	€ 40,580	€ 61,950
Agriculture and Forestry	€ 96,491	€ 154,860	€ 26,320	€ 63,650
Health and Welfare	€ 67,425	€ 360,305	€ 29,722	€ 120,819
Services	€ 117,055	€ 162,234	€ 39,429	€ 56,531
Average	€ 106,056	€ 144,575	€ 30,673	€ 79,855

Source: BiGGAR Economics

The total graduate premium associated with the Finnish Universities was then estimated by applying the number of graduates of each subject level by the corresponding graduate premium for that subject level as shown in Table C-13.

Table C-13 – Calculations of graduate premium contribution

Formulas
$$GVA = \sum_{d} (G_d * P_d)$$
Inputs
$$G_d = Number\ of\ gradautes\ in\ with\ degree\ (d)$$ $$P_d = Graduate\ premium\ for\ with\ degree\ (d)$$

Source: BiGGAR Economics