BiGGAR Economics

Economic Contribution of the Estonian Universities

A report to

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CONTENTS **Page**

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1 EXECUTIVE SUMMARY

In late 2016 BiGGAR Economics was invited to assess the economic contribution generated by Estonia's public universities on behalf of Universities Estonia, the representative body for the group[1]. The Universities included in this study are: Tallinn University, Estonian University of Life Sciences, Tallinn University of Technology, University of Tartu, Estonian Academy of Music and Theatre and the Estonian Academy of Arts. This report presents the findings for the unified group of six institutions as a whole.

1.1 Key Findings

In 2016, the Estonian Universities had a full-time student population of approximately 33,200 students, a staff complement of around 7,700 people and a combined annual income of €295.1 million.

The key finding of the report is that in 2016[2] the Estonian Universities contributed:

- €1.4 billion GVA and around 37,000 jobs in Estonia; and
- at the global level their contribution was even larger at €1.6 billion GVA and 43,900 jobs.

This implies that:

- for each €1 the Estonian Universities generated through their direct operations in GVA terms, they created almost €7 in total benefits for the Estonian economy;
- each person directly employed by the Universities supported almost five jobs elsewhere in Estonia; and
- the total income of the Estonian Universities in 2016 was €295.1 million and so the ratio of total income to total impact was €4.59.

To put this in some context, the combined contribution of the Estonian Universities represented an estimated 6.4% of Estonian GDP and around 5.8% of Estonian employment in 2016.

The Universities are an embedded part of the cities and towns where they and their regional colleges are based and bring an added vibrancy to these locations. They are also active contributors to the wider economic, social and commercial life of the country.

For many years the Universities 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. They have also had a major influence on the rapid transformation of the Estonian economy from a resource-based to a knowledge-based economy.

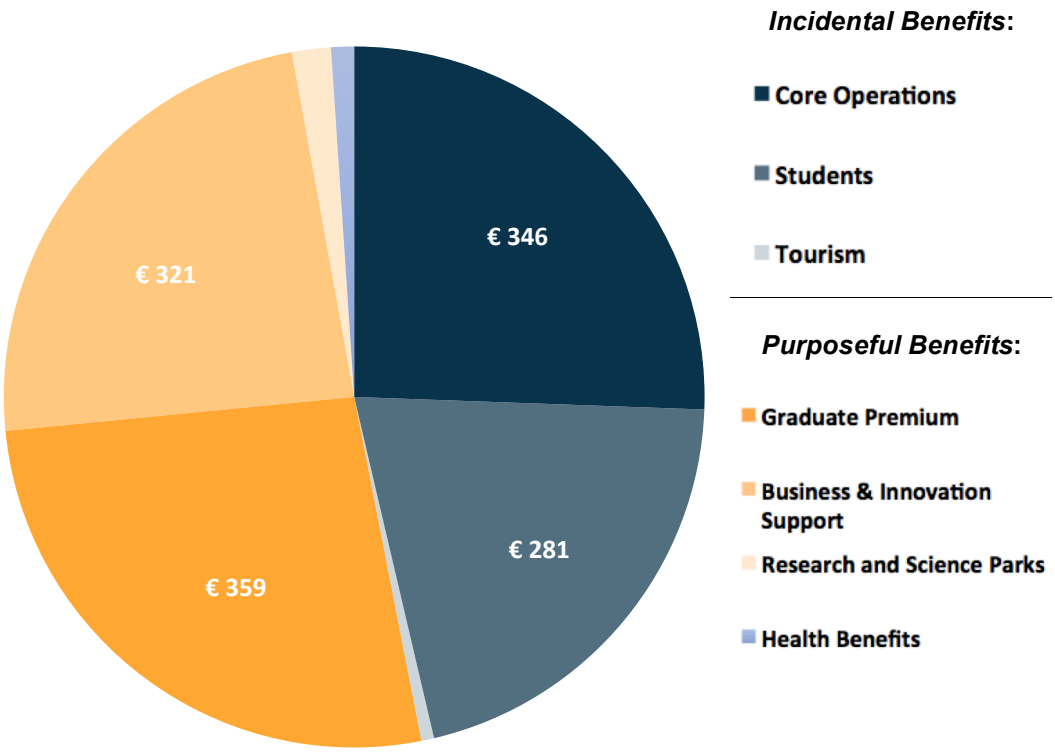
[1] As an extension to this project two Universities in the group requested their own assessments: The University of Tartu and the Estonian University of Life Sciences. These are available as separate documents from each of the two Universities.
[2] Throughout the report 2016 refers to the academic year 2015/16.

The larger Estonian Universities of Tallinn University, Tallinn University of Technology and Tartu have established a network of regional colleges in order to extend the reach of higher education to people living beyond the main urban centres.

1.2 Sources of Impact

The economic contributions generated by the Estonian Universities, fall into two main categories: ***Incidental benefits*** and ***Purposeful benefits***. These are illustrated in Figure 1-1 and described below.

Figure 1-1: Sources of Economic Contributions in Estonia, €million GVA (Incidental & Purposeful Benefits)



Total Contribution in Estonia = €1.4 billion

Source: BiGGAR Economics

Incidental benefits (represented by the darker 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 Estonian Universities, approximately 46% of their total economic contribution in Estonia can be classified as incidental benefits. These are:

- **Core Contribution** – the core contribution of the Estonian Universities includes the activity directly supported by them as well as the activity supported by their combined expenditure on supplies and capital projects and the expenditure of their combined staff complement. It was estimated that in 2016, these activities generated €346.0 million GVA and supported around 15,000 jobs in Estonia.

- **Student Contribution** – there were 33,200 full-time students studying at the Estonian Universities in 2016. Student expenditure, student employment (outside the Estonian Universities) and student volunteering generated a further €281.0 million GVA for the economy and supported a further 15,700 jobs in Estonia.

- **Tourism Contribution** – it was estimated that the tourism contribution created by visits to staff and students, business trips and attendance at conferences and events at the Estonian Universities generated €8.0 million GVA and supported 400 jobs in Estonia.

Purposeful benefits (represented by the lighter 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 54% of the economic contribution generated by the Estonian Universities can be classified as purposeful benefits. These are:

- **Business and Innovation Support** – Estonian Universities undertake a wide range of knowledge exchange activity to support innovation within the Estonian 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. Good examples of this type of support are the IdeaLab and STARTER projects, run by the University of Tartu but involving 7 universities in Estonia and the Mektory project at the Tallinn University of Technology. The recently launched ADAPTER programme also provides a portal through which Estonian Businesses can access the combined expertise of the Universities.

- 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 €344.9 million GVA and supported around 5,600 jobs in Estonia.

- **Research and Science Parks** – there are two major science parks that are associated with the Estonian Universities, Tallinn Science Park (which is associated with Tallinn University of Technology) and Tartu Science Park (associated with both the University of Tartu and the Estonian University of Life Sciences). The Universities' combined role in these parks is estimated to be worth €24.3 million GVA and 1,600 jobs in Estonia;

- **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 €359.0 million GVA in Estonia.

- **Health Benefits** – like the graduate premium contribution this benefit also accumulates over a longer period of time. One Estonian University, the University of Tartu engages in medical research and it received €11.9 million in medical research funding in 2016. 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 €14.3 million GVA in Estonia.

In addition to these measureable benefits, there are further, wider non-quantifiable benefits stemming from the presence of the Universities that are not possible to express in numeric terms such as the social benefits of higher education and the value of the arts sector in supporting the cultural heritage of the country.

1.3 Conclusions

The overarching conclusion of this report is that the Estonian Universities make a very substantial contribution to Estonia's national economy. They have played a fundamental role in driving the country's transition into a modern economy and are an essential ingredient in strengthening and deepening Estonia's competitive position in both the European and global economies.

1.4 Report Structure

The remainder of the report is structured as follows:

- section two sets out the background and context for this study, and outlines the social and economic context for the study that have direct implications for the higher education sector;
- section three summarises the framework for analysis that has influenced our approach to this study;
- section four describes the methodology adopted for this study;
- section five describes the economic contribution arising from the core activities of the Estonian 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 economy, working part-time in local businesses and volunteering;
- section seven assesses the Estonian Universities' contribution to tourism from family visits to students and staff and from expenditure at conferences and events hosted at the Universities;
- section eight describes the contribution of knowledge exchange activities, enterprise and innovation associated with the Estonian 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 discusses the economic contribution arising from the increased earnings generated during the working life of graduates as a result of having a university level education;
- section ten describes the economic value of the health benefits associated with the medical research undertaken by the Estonian Universities;

- section eleven summarises the estimated total economic contribution of the Estonian Universities in Estonia;
- section twelve sets out the economic contribution of the Estonian Universities at the European and Global levels;
- section thirteen considers the role of the Universities as drivers of long-term economic growth and explores the role of innovation ecosystems;
- section fourteen describes the wider, non-quantifiable benefits of higher education; and
- section fifteen contains the conclusions of the analysis.

Appendix A provides a guide to abbreviations and terms used.

Appendix B contains brief summary descriptions for each University that has been included in this study.

The methodology used to calculate these contributions are described in detail in a separate Supplementary Technical Appendix which accompanies this report.

2 INTRODUCTION

This report summarises our assessment of the economic contribution made by the network of six Estonian Universities. It was commissioned in late 2016 by Universities Estonia with the aim of gaining a clearer and broader understanding of the combined economic value generated by its members.

2.1 Objectives

The objectives of the study were to quantify the economic value of the Universities in terms of:

- their core contribution to income and employment from expenditure on staff, on supplies of goods and services and on capital and infrastructure projects;
- their student-related contribution from students spending, working and volunteering;
- the tourism contribution created by visitors to staff and students, business tourism and attendance at conferences and events held at the Universities;
- the knowledge exchange, enterprise and innovation activity created by and arising from the Estonian Universities; and
- the life-time productivity gains from teaching and learning delivered by the Estonian Universities (graduate premium).

The base year for all data was the academic year 2015/16. Throughout the report this is referred to as 2016. The study presents a snapshot of the contributions of the Estonian Universities to the Estonian, European and global economy.

2.2 Background

This work was commissioned by Universities Estonia, an umbrella body which brings together six of the public universities in the country. The purpose was to demonstrate the impacts that the universities have on the national economy and their collective role in supporting and growing national productivity.

The Universities that are included in this study are:

- Tallinn University
- Estonian University of Life Sciences
- Tallinn University of Technology
- University of Tartu
- Estonian Academy of Music and Theatre
- Estonian Academy of Arts

Together, the six institutions have a student population of 33,200 and a staff complement of 7,700 people. The group had a combined total income of €295.0 in 2016.

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

The Universities bring an important cultural life and vibrancy to the towns and cities in which they are located. There are two major university locations in Estonia, Tallinn and Tartu. In addition the larger universities have established a network of regional colleges that were set up to further extend the reach of higher education outside the two main urban centres. The regional colleges operate in:

- Haapsalu and Rakvere – University of Tallinn;
- Kuressaare, Virumaa , Tartu– Tallinn University of Technology; and
- Narva, Parnu, Viljandi (Culture Academy) – University of Tartu

The remainder of this section describes the national context in which the economic contribution of the Universities takes place. The following relevant topics are briefly outlined:

- key features of the general education system, particularly the embedded value of education within the national mindset and the extremely strong school performance record in Estonia as evidenced by the PISA scores;
- the major population decline that has occurred since 1991 and the challenge this has presented for the Universities in recruiting students and staff;
- the key changes that have taken place within the higher education system since Estonian independence in 1991 including an expanded focus on internationalisation, rationalisation in the number of institutions and the establishment of regional colleges;
- the major economic trends in Estonia that relate to the higher education sector, in particular it's alignment with the communications and technology sector.

2.3 General Education in Estonia

2.3.1 Historic Context

Estonian education has a long and impressive history. The first academic schools were founded in Tartu in 1630 and in Tallinn in 1632. These were soon followed by the first Estonian folk schools with the aim of providing education in the native language so that students could read the Bible. At the time of the census in 1897, the level of literacy in Estonia was 80% which was the highest in the Tsardom of Russia (compared to 56% in Moscow and 62% in St Petersburg)[3].

In the last century, the compulsory duration of schooling rose from six grades in 1920 to eight grades in 1959 and then to nine grades from 1968. During the Soviet occupation the Estonian education system retained its own character: teaching was in Estonian, textbooks were by Estonian authors and a strong emphasis was placed on arts, music and foreign language.

[3] *Estonian Education System 1990-2016: Reforms and their Impact*, 2016, Mihkel Lees, Estonian Ministry of Education and Research Adviser to the Minister MA of Educational Management.

In the present day, most schools in Estonia are public schools (96% compared to an average of 82% across the OECD). Fundamentally, public opinion in Estonia towards education is strong and favourable. Education is greatly valued and parents' expectations are high:

- 90% of 25-64 year olds have at least a secondary education - the highest in the EU (OECD average is 75%);
- 45% of 25-64 year old women have a higher education (OECD average is 34%);
- the country has the lowest proportion of students without basic education in the world: only 5% don't achieve a basic education;
- grade repetition is among the lowest in the OECD with only 3.5% of 15 year olds repeating a grade at least once compared to the OECD average of 12%[4];
- the difference between rural and urban students' education levels is the world's smallest;
- the socio-economic background of students' parents has little influence on their progress.

Much of the credit for this success is due to the focus on ensuring children from all backgrounds have very similar educational experiences[5] coupled with highly qualified teachers[6]. Post-independence, Estonia looked to Finland to learn about building a more effective education system. This included reforming the process for teacher education.

2.3.2 Current School Performance: PISA

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.

Estonia has taken part in the tests since 2006 and its results are extremely impressive. The country's performance has improved over time and it ranks well above the OECD average for the quality of its education system. Between 2006 and 2015 the country's ranking for all three subjects has risen in both the European and the Global spheres (Table 2-1).

[4] Source PISA 2012.
[5] https://www.theatlantic.com/education/archive/2016/06/is-estonia-the-new-finland/488351/
[6] Lees, M, 2016, *Estonian Education System 1990-2016: Reforms and their Impact*

Table 2-1 – PISA Rankings for Estonia, 2006 – 2015

EU Ranking	2006	2009	2012	2015
Reading	8th	5th	4th	3rd
Maths	6th	7th	4th	2nd
Science	2nd	2nd	2nd	1st
Global Ranking	**2006**	**2009**	**2012**	**2015**
Reading	13th	13th	11th	6th
Maths	14th	17th	11th	9th
Science	5th	9th	6th	3rd

Source: OECD

In 2015 Estonia was placed in third position globally for its education system behind Singapore and Japan. The results for this year also show that Estonian pupils are the best in Europe for science, the second best for maths and third best for reading.

The conclusion is that the basic education system in Estonia is one of the best in Europe and in the world. The results are even more remarkable given the financial resources available to the education system in the 1990s and 2000s. The education reforms of the 1990s are likely to have contributed to the country's high PISA scores that have been achieved in the most recent assessments.

2.4 Population Decline

One of the major challenges faced by the Universities in Estonia has been the steep decline in the population, particularly that of young people which is the key market for potential new university students.

Figure 2-1 shows the change in the total population of Estonia and its age composition between 1990 and 2017. During this timeframe the Estonian population has fallen dramatically: by 16.2% in 27 years from 1.570 million people in 1990 to 1.315 million people at present in 2017. To put this in context, the population of the EU28 countries grew by 7.4% during the same timeframe[7].

The main reason for the fall in population was the emigration of 150,000 people who were mainly ethnic Russians, Ukrainians and Belarusians[8]. Much of the decrease in population occurred between 1990 and 2000 (Figure 2-1) when the population fell by 10.8%. The emigration of younger people at this time has had a knock on effect throughout the successive decades.

In more recent years the rate of change has been less pronounced. Between 2010 and 2017 the total population decreased by just 1.3%.

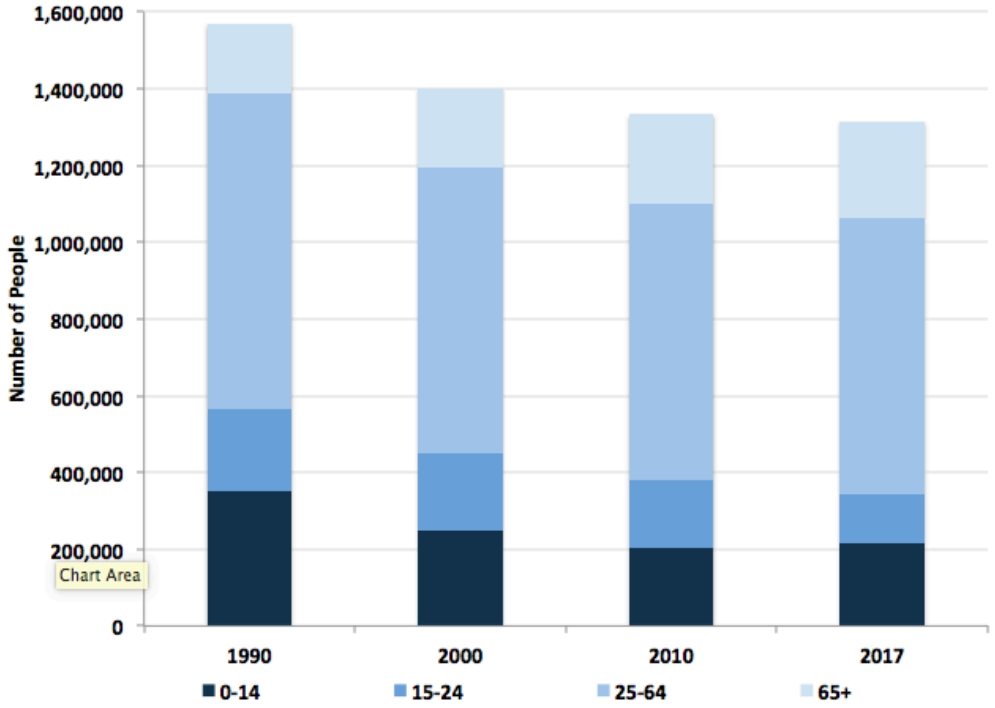
Within this overall figure the age structure has altered substantially. In short, there are fewer younger people and a larger number of older people. In 1990, 36% of the population were aged under 24 and 12% were aged 65 and over. In 2017, just

[7] Source; Eurostat database.
[8] In the 20th Century, Estonia's ethnic make up was altered radically by the policies implemented by the Soviet government. Large numbers of ethnic Russians were incentivised to move into the non-Russian republics, including Estonia.

26% of the Estonian population were aged under 24 and 19% were aged 65 and over.

The decrease in the number young people aged between 15-24 is especially marked: falling by 39.7% between 1990 and 2017. In 1990 there were 215,000 people in this age group: by 2017 it is estimated that there are 130,000 people. This has presented a significant challenge for the Estonian Universities and they have had to adapt their scale and their approach to student recruitment to meet this change.

Figure 2-1 – Population by Age Structure in Estonia, 1991-2017

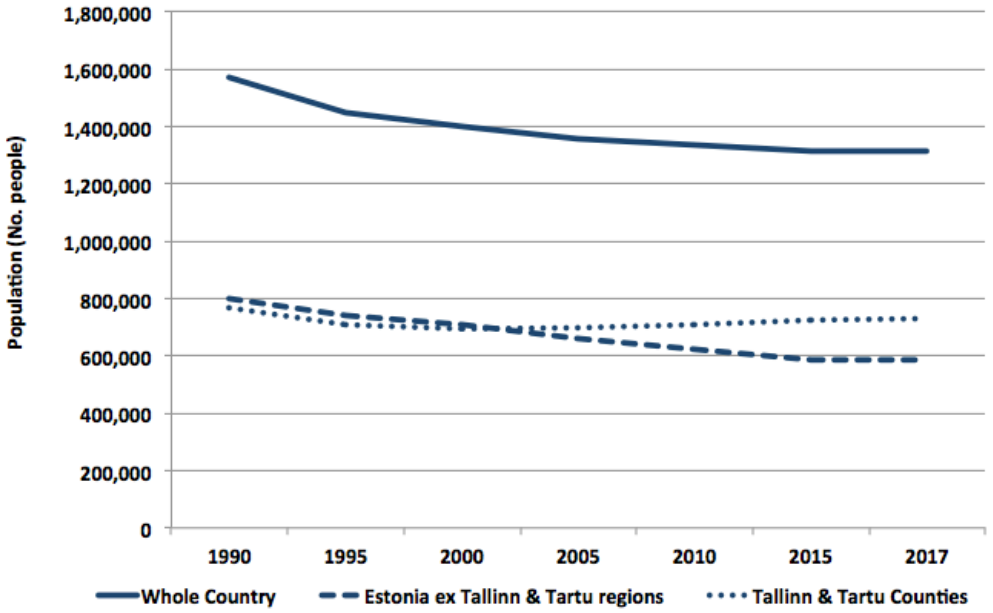


Source: Statistics Estonia

Another key trend to emerge is the gradual shift in the population towards the more urban areas (Figure 2-2). In 1990, 49.0% of the Estonian population lived in the counties containing the two largest cities (Tallinn and Tartu). This proportion has gradually risen over time to stand at 55.3% in 2017. Within this context, the regional colleges of the larger Estonian Universities have a role to play in bringing higher education to the more rural areas and helping to stem this population flow.

The latest population estimates from Statistics Estonia suggests there were 1,315,600 people living in the country as at 1 January 2017. This was 300 people less than the year before and included a positive figure for net migration for the second year in a row. The population decreased as a result of a negative natural change (i.e. the number of deaths exceeded the number of births).

Figure 2-2 – Population Change in Estonia, 1991-2017: Urban vs Rural Areas



Source: Statistics Estonia

2.4.1 Population Projections

The population of Estonia is projected to decline further, by approximately 2.4% between 2017 and 2040 compared to a 3.3% growth in population which is forecast for the EU28 region as a whole over the same time (Table 2-2). Therefore the Universities will have an on-going need to attract students from outside the country in order to maintain their student populations over the coming decades.

Table 2-2– Population Projections for Estonia, 2017 - 2040

	Estonian Population	% Change in Estonia	% Change in EU28
2017	1,316,000	-	-
2020	1,318,000	0.2	0.8
2030	1,306,000	-0.9	1.6
2040	1,284,000	-1.7	0.9
2017 - 2040	**-31,800**	**-2.4**	**3.3**

2.5 Higher Education in Estonia, 1990 – 2016

Higher education in Estonia is divided between professional HE institutions and universities. Both can award degrees (with the exception of doctoral degrees which are limited to universities) and are accessible to graduates of general and vocational upper secondary schools.

There have been several phases to the reform and rebuilding of the higher education sector in Estonia since independence:

2.5.1 1990s – Early Independence and Decentralisation

1989 – 1995 – this period was characterised by separation from the Soviet system and establishing a new legal framework for education (the 1995 Universities Act)[9]. Progress was made within the Universities towards developing new curricula, textbooks and teaching materials and developing new links with Western donors and partners.[10] The Universities had a high degree of autonomy during this time. By 1995 there were 26 higher education institutions in Estonia[11].

1996 – 1999 – this period saw further expansion of higher education in combination with the further refinement of a legal framework for university autonomy and quality assurance mechanisms for the sector. A new award structure emerged that was more flexible and consistent with Western models. The research institutes of the Estonian Academy of Sciences were integrated with the Universities resulting in substantial gains in research and stronger Universities. [12]

As well as this, the Universities of Tartu, Tallinn and the Tallinn University of Technology began to establish regional colleges at this time to extend the reach of the Universities beyond the main urban centres. As a result, the regional colleges of public universities have become an embedded part of these economies[13]. They follow the triple helix model of engagement between university, industry and government. Over time the more regionally embedded HEIs have been resilient and managed to grow despite the 2008-10 economic crisis and the severe economic decline[14].

All of these developments meant that by 1999 there were 41 higher education institutions in Estonia.

2.5.2 2000s – Quality Improvement and Consolidation

2000 – 2005 – Having granted Universities autonomy at the time of independence the need later arose for control at a national level in aligning the priorities of the institutions with public priorities and with the changing shape of the population. As a result, the Higher Education Reform Plan was launched in 2001 to rationalise the number of institutions in the sector. In 2005 there were 44 institutions of higher education across Estonia, by 2016 the number had decreased to 21[15].

In 2005 the OECD noted pointers for the future development of HE in Estonia: this involved prioritisation of R&D on certain fields of science and technology to reflect the prospects for international competitiveness and the relevance to future needs in Estonian society. They also highlighted a need to strengthen the links between HE and the labour market.

[9] McGuinness A,C, 2015, *Education Reform in Estonia, Latvia and Lithuania,* OECD
[10] Ibid
[11] Statistics Estonia, Available at: http://pub.stat.ee/px-web.2001/Dialog/varval.asp?ma=ES27&ti=HIGHER+EDUCATIONAL+INSTITUTIONS+BY+TYPE+OF+INSTITUTION&path=../I_Databas/Social_life/02Education/08Higher_education/&lang=1
[12] Op cit.
[13] Raagmaa G & Keerberg A, 2016, *Regional higher education institutions in regional leadership and development*, in Regional Studies
[14] Ibid.
[15] Lees, M, 2016, *Estonian Education System 1990-2016: Reforms and their Impact*

Since the mid-2000s the regional colleges of the HEIs have joined forces and improved their capabilities in assisting local industries and authorities. They have succeeded in proving their usefulness as the implementing agents of the Estonian regional development strategy[16]. The total student population of the regional colleges was approximately 3,500 students in 2014.

2006 – 2015 – during this time, reforms were designed to address the three main challenges of: falling student numbers due to demographic changes; strengthening the international dimension of the sector (attracting staff, students, student exchange programmes, participation in global research networks) and securing additional funding for infrastructure and HR. Consequently, this period has seen a significant increase in the number of international students studying at Estonian higher education institutions; from around 900 in 2006/7 to 3,500 in 2016/17.

Later reforms in HE have identified a need for greater alignment with the Estonian economy to address identified skill shortages. The three areas with the greatest employment prospects have been identified as the social sciences, science and technology and business and law.[17]

Some 90% of Estonian study programmes are subsidised from state funding and do not charge fees to students. In response to concern over the long-term sustainability of this funding approach, since 2013 Universities in Estonia have been permitted to charge fees for programmes that are taught in English.

2.5.3 Present and Future – Internationalisation & ICT

2017 and beyond – Going forwards, three continuing challenges have been identified for the Estonian education system:

- an ageing staff profile and a need to make teaching a more attractive profession for younger people to avoid future shortages of qualified teachers;
- further incorporation of IT into the learning process by further integrating IT into the curriculum;
- adapting to the decreasing number of school-age children[18].

2.6 Economic Trends

While the population of Estonia has shrunk, the economy has grown dramatically since the country gained independence from the USSR in 1991 such that it is now deemed by the IMF to be an advanced economy. This is evidenced by Estonia's impressive growth in GDP per capita which has risen from 13.7% of the average for the EU28 countries in 1995 to 54.1% of the EU28 average in 2013 (Figure 2-3). In short, the Estonian economy is catching up with its EU neighbours in terms of income per head.

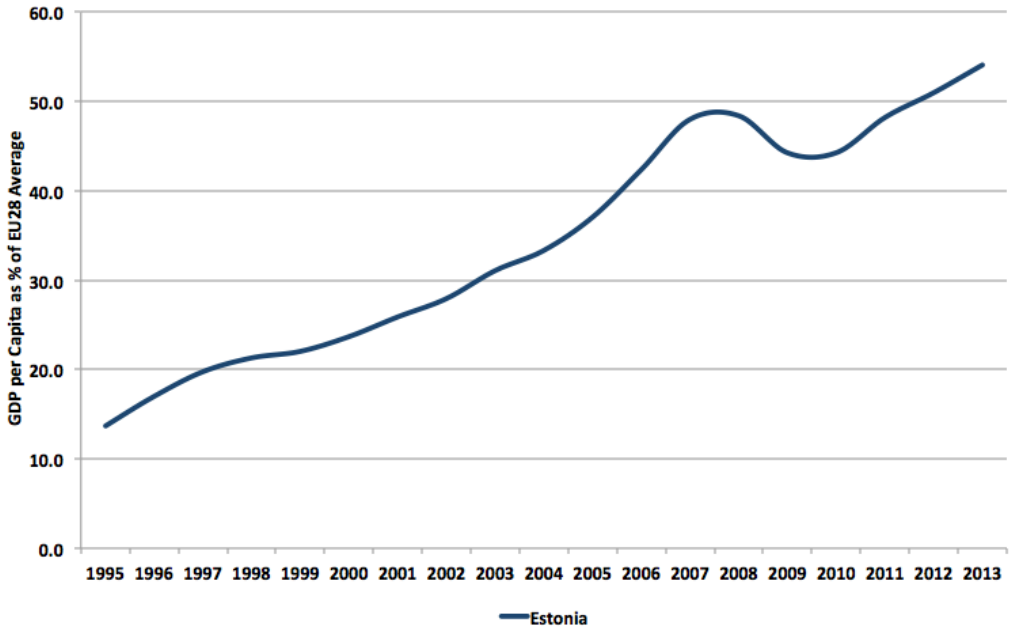
A key component of this growth in this is thought to be the well developed IT sector that is often exemplified by the global prominence of Skype which is an Estonian invention[19]. The country's rapidly developing IT sector, means that Estonia is now one of the world's most digitally advanced societies. Foreign

[16] Op cit
[17] Lees, M, 2016, *Estonian Education System 1990-2016: Reforms and their Impact*
[18] Ibid
[19] National Centre on Education & the Economy, ncee.org

investors, mostly Nordic, have made considerable investments into high technology and communication networks in order to modernise the IT communications infrastructure in Estonia. As a result, the Estonian telecommunications sector is one of the most developed in Central and Eastern Europe.

International analysts consider Estonia to be the leader in Eastern Europe for broadband DSL access. In terms of DSL penetration per telephone line, Estonia presently ranks among the top ten in the world[20]. It is claimed that Estonia has the most start-ups per person in the world.

Figure 2-3 – GDP per Capita in Estonia as a % of EU28 Average, 1995 - 2013



Source: Eurostat

Within this context, there has been a national strategy to develop an education system that supports a high-tech, high-skill, high wage economy. This plan was evidenced as far back as the 1998 Estonian Education Scenario Strategy which envisaged developing an information society by 2015.

2.7 Summary Points

Education has been long respected and highly valued in Estonia. In the latest PISA tests, the country ranks in the top three countries in Europe for its performance in reading, maths and science among 15 year olds. As a result, Estonia's education system is very highly regarded in European and global terms.

There has been a dramatic population decline in Estonia since 1991, especially in younger age groups. The smaller pool of potential students has had major implications for the education sector which has respond by reducing the number of institutions and targeting more recruitment programmes aimed at attracting international students.

Since independence in 1991 the country's higher education sector has responded to major economic and social changes that has resulted in a period of dramatic

[20] Ministry of Foreign Affairs, 2016 *Estonian Economy Overview*

restructuring and reform. The larger institutions have established a network of regional colleges to extend the reach of education beyond the main urban areas.

Against this background, the economy has grown rapidly since independence, and is catching up with other EU countries in terms of general wealth (GDP per capita). The country's performance in IT is a particular strength and the Universities have taken active measures taken to align the higher education offering with national economic priorities.

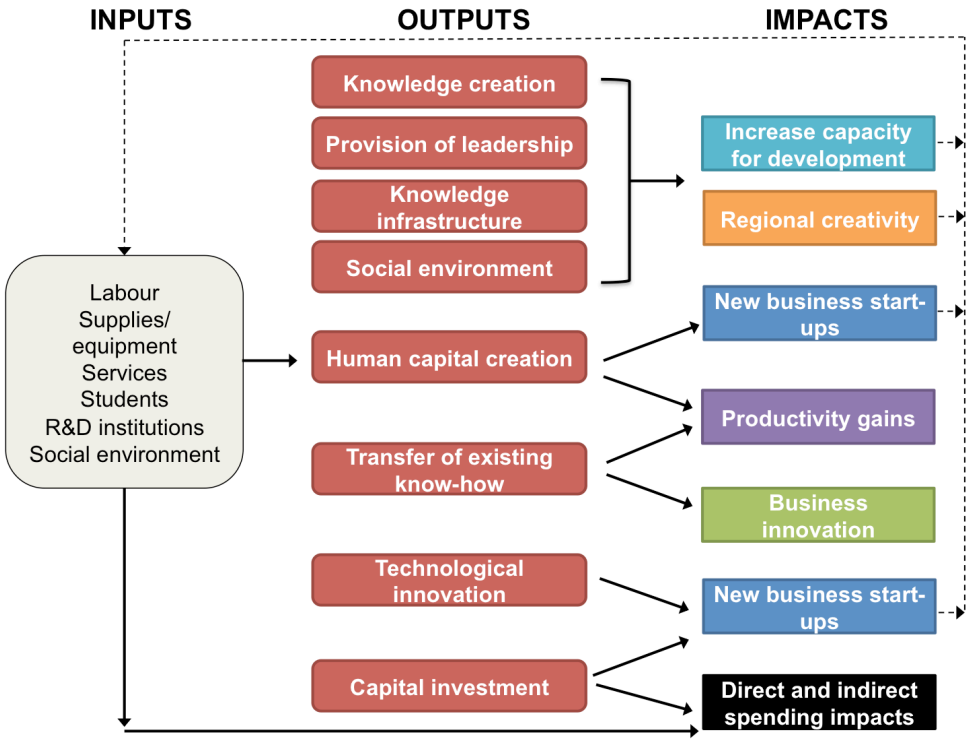
3 FRAMEWORK FOR ANALYSIS

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 presents a theoretical framework that describes the various ways in which universities generate economic benefits for the economy.

3.1 Theoretical Framework

Universities have wide and far-reaching impacts on the economy, which are often interrelated. The outputs and the 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

Within this model is it possible to categorise the resulting economic contributions into two categories: *incidental benefits* and *purposeful benefits*.

3.2.1 Incidental Benefits

These types of contributions 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 types of benefits could be described as “incidental benefits” (these are considered in chapters 5, 6 and 7 of this report). This includes:

- the core operational effects of the Universities, including the people they employ and their expenditure on goods and services;
- the contribution 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 by working or undertaking voluntary activity during the course of their studies;
- the tourism contribution made by visitors to staff and students at the Universities.

The economic contributions associated with any learning institution are often seen as 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.

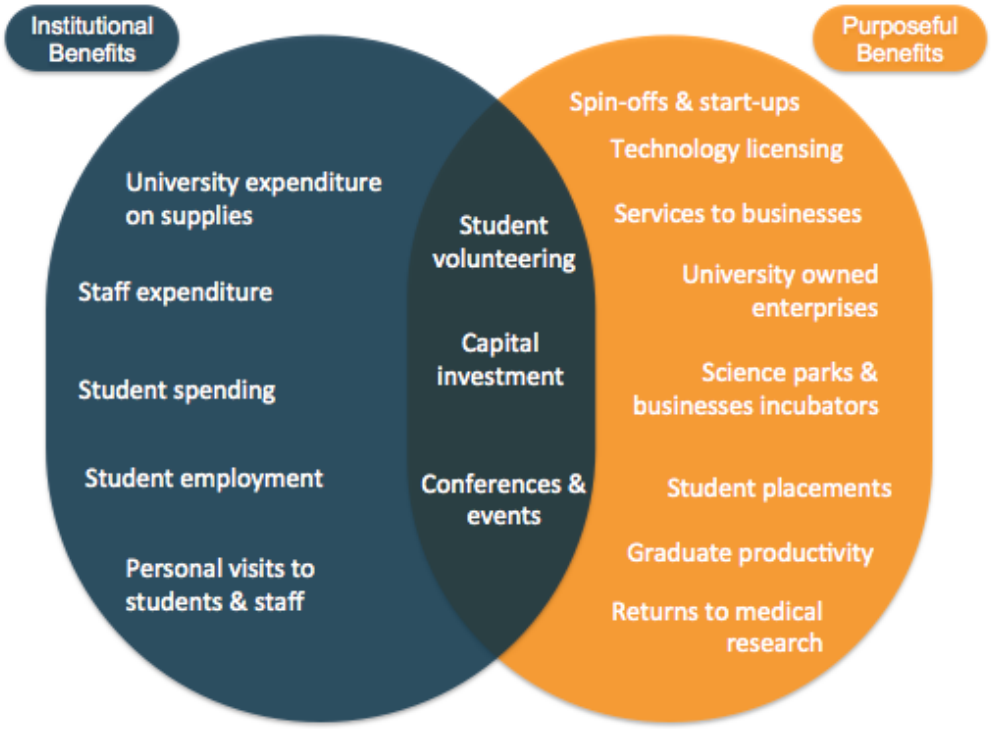
3.2.2 Purposeful Benefits

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 types of benefit are described in chapters 8, 9, 10 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 Estonian economy;
- the contribution that graduates from the Universities make to the productivity of the Estonian economy as a result of the skills and experience they gain during their time at University; and
- the economic value of the health benefits generated by medical research undertaken by the Universities.

The division between “incidental” and “purposeful” benefits is depicted in Figure 3-2, which also 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[21] has argued that productivity is the result of learning and consequently, a focal point of policy should be to increase learning within the economy. The observation is made that even within countries and within industries there can be large gaps between the most productive and the others. This means that the diffusion of knowledge is as important as pushing the boundaries of knowledge. Moreover, since productivity growth is what drives growth in the economy, this indicates that there is considerable scope for higher rates of economic growth. As an illustration of this,

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

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.[22]

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 Exchange of Existing Knowledge and Technological Innovation

Over and above these fundamental activities universities also work to exchange 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 organisations. This ensures a coordinated economic development approach helping to match skills with regional needs and vice versa.

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

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).

The benefits that result from the work of universities can be categorised into incidental benefits and purposeful benefits. Incidental benefits arise from large scale employment activity: purposeful benefits arise from the added value work that they undertake.

In Estonia, the Universities have actively supported the country's transition from a resource-based to a knowledge-based economy through a focus on education, research and development and innovation. They have also managed the geographic distribution of their regional college facilities throughout the country to ensure the widest possible access to higher education. This has played a role in supporting Estonia's wider regional 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)[23], 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[24], the Russell Group 2010 report on the impact of research[25] and the 2014 report on the economic impact of capital projects[26], Universities Scotland[27] 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[28].

[23] League of European Research Universities (2015), *Economic Contribution of the LERU Universities*
[24] 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)
[25] Russell Group (2010), The economic impact of research conducted in Russell Group *universities* (available at http://www.russellgroup.ac.uk)
[26] 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)
[27] Universities Scotland (2013*), Grow Export Attract Support: Universities' contribution to Scotland's economic growth* (available at http://www.universities-scotland.ac.uk)
[28] Viewforth Consulting Ltd (April 2014), *The Impact of Universities on the UK Economy* (available at http://www.universitiesuk.ac.uk/highereducation)

BiGGAR Economics has also recently finalised a report for UNIFI to assess the economic contribution made by the network of 14 publicly owned universities in Finland (June 2017).

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[29] 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 the Estonian Universities. The starting point for doing this was to consider the various activities undertaken by the Universities and identify those that are likely to generate an 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 process followed is illustrated in Figure 4-1.

Once the scope of activities was known, 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 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.

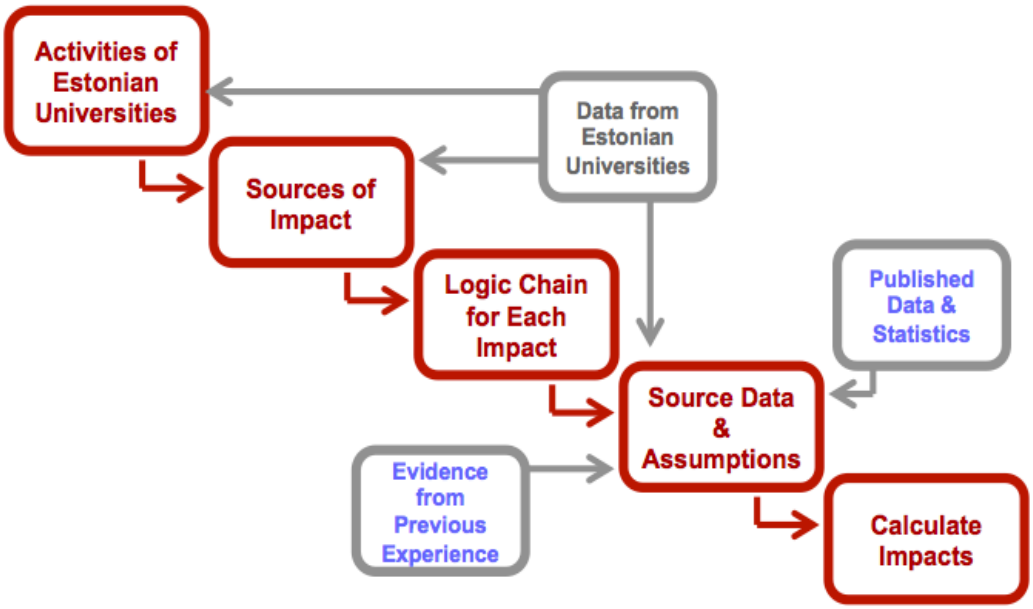
Where possible, source data was obtained directly from the Universities. Where this was not possible an appropriate assumption was made based on the data provided by other members of the Estonian Universities group and/or BiGGAR Economics previous relevant experience of other comparable institutions 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 the Estonian Universities.

The data required for the general assumptions used in the model was obtained either from official statistical sources (e.g. Eurostat, Eurostudent, OECD or Statistics Estonia) 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 the Universities.

[29] 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 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 and volunteering;
- the tourism contribution created by visitors to staff and students from family members, business tourism and attendance at conferences and events held at the Universities;
- the knowledge exchange, enterprise and innovation activity created by and arising from the Estonian 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 a separate Methodological Appendix which accompanies this report.

4.4 Quantifiable Vs Non-Quantifiable Benefits

As far as possible this report has attempted to quantify the economic value generated by the Estonian 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 the Estonian Universities this is estimated by subtracting the non-staff operational expenditure (€95.8 million) from the total income of the Universities (€295.1 million); 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 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.

4.4.1 Wider Benefits

Through their work the employees of the Estonian Universities generate a wide variety of benefits for the Estonian, European and global economies. 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 one of the Estonian Universities (Tartu) is involved in medical research. This type of research often results in spin-out companies and/or license 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 the University 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.

Estonian Universities also make an important contribution 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 the Universities is understood as part of this wider context.

4.4.2 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 the Universities is focused on long-term outputs that often take 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 the Estonian Universities are 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. 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.

Estonian Universities also generate significant benefits through open innovation – by providing an environment and actively encouraging knowledge transfer between academia and industry. In some cases this has led to the development of 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 the Universities it is necessary to use a dynamic approach to economic analysis.

4.5 Methodology for Estimating Quantifiable Benefits

The methodology used to estimate the economic contribution of the Estonian Universities is described as each element of the contribution is discussed throughout the report. A fully detailed Supplementary Methodological Appendix was prepared and is available from Universities Estonia on request.

4.5.1 Baseline Year, Measures and Geography

The economic contributions described in this report are for 2016 (or the academic year 2015/16), 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 expenditure 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 from expenditure in an 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 Eurostat input-output tables for Estonia.

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

4.5.2 Timescale of Contributions

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

However, much of the activity undertaken by the Estonian Universities does not generate immediate economic effects. For example, the additional income that the graduates of the Estonian 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	Graduate Premium
Students	Services to Businesses
Tourism	Returns to Medical Research
Spin-outs	
Science Park and Incubator Facilities	
University Owned Enterprises	
Licensing	
Student Placements	

4.5.3 Number Formats

This report has been produced using UK number formatting, i.e. €1 million is presented as €1,000,000.00 where the symbol for the decimal marker is a point on a line[30].

4.5.4 Avoiding Double Counting

Given the approach summarised in Figure 4-1 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 a University also has a license agreement with a University and is based on a university-linked science park, the associated contribution has been counted only once.

4.5.5 Consistency of Approach and Activities Included

The Estonian 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 Estonian Universities operate.

There are also differences in the scope of activities undertaken by the Estonian 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.

[30] 22nd General Conference on Weights and Measures, 2003.

4.6 Economic Contribution and the Counterfactual

The question that arises from any study of economic contribution 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 the Universities with that made by other organisations or sectors. Rather, the counterfactual position is to imagine an alternative situation where the Estonian 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 University 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 the Universities 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 Universities.

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 described in this chapter are considered to be "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 any organisation or group 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 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 Estonian Universities had a total operational income of €295.1 million which covered teaching, research, estates and other income (Table 5-1). The Direct GVA and the employment directly supported by the Estonian Universities are shown in Table 5-2 and Table 5-3.

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

	Total (€ m)
Total Income	295.1

Source: The Estonian Universities

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

	Total (€ m)
Total Income	295.1
Less Non-staff operational cost	95.8
Direct GVA	199.3

Source: The Estonian Universities

Table 5-3 Estonian Universities: Direct Effect – Employment

	Total
Estonian Universities employment (headcount)	7,700
Estonian Universities employment (full-time equivalent jobs)	6,300

Source: The Estonian Universities

In 2016, the Estonian Universities supported 7,700 jobs (or 6,300 full-time equivalent jobs) in the economy and had an output of €199.3 million. 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 Universities.

The inputs used to estimate the supplier effect are shown in Table 5-4. Expenditure on goods and services (excluding rent, depreciation, scholarships) was €71.0 million in 2016. Within the Estonian Universities it is estimated that 90% of this expenditure was placed with companies based in Estonia, a further 8% was with companies based in Europe and 2% was with companies from outside Europe.

The expenditure was analysed by sector as a different amount of GVA will be supported depending on the GVA to turnover ratio for each sector. The direct GVA contributions were estimated by multiplying 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 Estonian Universities creates multiplier effects throughout the economy. The indirect effect reflects the increased demand on the suppliers of the Estonian 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 Estonian Universities: Supplier Effect - Assumptions

Amount spent on goods and services (€m)	Total
Total Expenditure on Goods and Services	€ 71.0 million
Location of Suppliers	
Estonia	90%
Rest of Europe	8%
Rest of World	2%

Source: Estonian Universities and BiGGAR Economics Assumptions

The total supplier effect for the Estonian Universities is shown in Table 5-5. It is estimated that spending on goods and services for the Estonian Universities supports 2,600 jobs and €53.0 million GVA in Estonia.

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

	GVA (€ m)	Employment (jobs)
Estonia	53.0	2,600

Source: BiGGAR Economics Analysis

5.3 Staff Spending

The staff employed directly by the Estonian Universities spend their wages and salaries in the wider economy and this also increases turnover and supports employment in local businesses and throughout Estonia as a whole. From data provided by the Universities it is estimated that 94% of staff live in Estonia.

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. The methodological appendix contains a detailed description of how these were applied to the different geographies.

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 Estonian Universities: Staff Spending - Assumptions

Staff Numbers	
Number of jobs (headcount)	7,700
Staff Costs (€ million)	166.9
VAT	
VAT as a proportion of staff expenditure	13%
Location of Spending	
Estonia	92%
Rest of Europe	7%
Rest of World	1%

Source: Estonian 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 €69.3 million in GVA and 3,600 jobs in Estonia. These figures are summarised in Table 5-7.

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

	GVA (€ m)	Employment
Estonia	69.3	3,600

Source: BiGGAR Economics Analysis

5.4 Capital Contribution

Money spent on providing new and/or upgraded buildings, estates and equipment (research infrastructure) for the Estonian Universities also creates an economic contribution throughout the construction sector and the wider supply chain.

Analysis of data from the Estonian Universities suggests that there has been a cyclical nature to capital expenditure on buildings-related capital projects over time with large variations from year to year (see the Supplementary Technical Appendix for further discussion). To reflect this variability a 10-year average capital expenditure figure has been used in our analysis which covers expenditure in the years from 2011 to 2020.

Capital spending provides an important income stream for the Estonian 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 is estimated that the total contribution of construction expenditure to provide and improve buildings for the Estonian Universities amounts to €24.5 million in GVA, and 1,100 jobs, all of which occur in Estonia.

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 Estonian Universities: Capital Spending - Assumptions

Capital Spending	
Annual Capital Expenditure, 10-year average (€m)	35.3
Location of Spending	
Estonia	100%

Source: Estonian Universities and BiGGAR Economics Assumptions

Table 5-9 Estonian Universities: Capital Spending Contribution

	GVA (€ m)	Employment
Estonia	24.5	1,100

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 €346.0 million GVA and 15,000 jobs in Estonia. These figures include the multiplier effects of the core activity.

The core contributions are summarised in Table 5-10.

Table 5-10 Estonian Universities: Core Contribution Summary

Estonia	GVA (€ m)	Employment
Direct Contribution	199.3	7,700
Supplier Contribution	53.0	2,600
Staff Spending Contribution	69.3	3,600
Capital & Estates Contribution	24.5	1,100
Total Core Contribution	346.0	15,000

Source: BiGGAR Economics Analysis

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 described in this chapter are considered to be "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 Universities. Part-time students have been excluded as their courses are a secondary aspect of their spending activities.

The combined full-time student population of the Estonian Universities in 2016 was 33,200 people (Table 6-1). Almost two-thirds (63%) were studying for undergraduate degrees and a further 31% were studying for masters (or equivalent) degrees. The remaining 6% were studying for a PhD or equivalent qualification.

Table 6-1 Estonian Universities: Total Full-time Student Population

	Total
Undergraduate	21,000
Masters	10,200
PhD	2,000
Total	**33,200**

Source: The Estonian 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 Eurostudent[31] on the spending profile of students on different items such as accommodation, food, transport, social activities and other living costs. A profile is provided for students living at home and also for those living outside the home during term-time. The study found that, on average, students living at home required €279 per month to cover these items while those living away from home required €667 per month. The Estonian Universities provided data on the residence of their full-time students. This profile of expenditure was applied to the number of students at the Estonian Universities to provide an overall estimate for

[31] Eurostudent, *National Profile – Estonia*

total student expenditure. The key inputs used in making these calculations are shown in Table 6-2.

Table 6-2 Estonian Universities: Student Spending - Assumptions

		Value
Total number of students		33,200
Student Residence		%
% of full-time students living at home during term-time		18
% of full-time students living outside the home during term-time		82
Student Expenditure Profile		
Item	At Home	Outside Home
Accommodation	-	26%
Food	31%	27%
Transport & Communication	17%	12%
Social/Leisure & other regular living costs	37%	19%
Fees and other miscellaneous costs	15%	15%
Total	100%	100%
Total (Euros)	€279	€667
VAT		
VAT as a proportion of student expenditure		15.2%

Source: Estonian Universities

Applying this expenditure profile to the student numbers for each institution gives us a total student spending figure for the Estonian Universities. 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 Universities 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 Estonia 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 Estonian Universities: Student Spending Contribution

	GVA (€ m)	Employment
Estonia	109.1	5,900

Source: BiGGAR Economics Analysis

This results in a student spending contribution of €109.1 million GVA and 5,900 jobs in Estonia.

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 by Eurostudent suggests that 56% of students work to supplement their income and that they work, on average, for 18 hours per week[32].

Based on data provided by the Estonian Universities it is estimated that 2.9% of students work at the 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 to avoid double counting.

Consultations regarding the labour market conditions for the area 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 additonality of student jobs and assume it is inversely related to the level of youth unemployment in Estonia. By this method, the level of additionality used averaged 77.1% for all Universities in the group.

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.

Table 6-4 Estonian Universities - Student part-time working - Assumptions

	Value
Number of Students	33,200
Percentage of students who undertake part-time work (excluding international students)	56%
Percentage of students who undertake part-time work with the Estonian Universities	2.9%
Additionality of part-time work	77.1%
Average hours worked per week	18

Source: Estonian Universities, Eurostudent

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

[32] Ibid.

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 €162.6 million and 9,800 jobs in Estonia (Table 6-5).

Table 6-5 Estonian Universities - Student part-time working - Contribution

	GVA (€ m)	Employment
Estonia	162.6	9,800

Source: BiGGAR Economics Analysis

6.4 Student Volunteering

Students make a contribution to society through volunteering. The main source which has informed our assumptions on the value of student volunteering is a study by the Praxis Centre for Policy Studies in Estonia[33] which suggests that 17% of young people engage in voluntary activities and spend, on average, 322 hours per year (approximately 6 hours per week) in this way. The average monetary value of these hours is €7 per hour. The assumptions used to arrive at the estimated contribution from student volunteering are shown in Table 6-6.

Table 6-6 Estonian Universities: Student Volunteering - Assumptions

	Value
Number of Students	33,200
Percentage of students who undertake voluntary work (excluding international students)	17%
Estimated number of hours volunteered per year	322
Estimated value per hour volunteered	€7

Source: Estonian Universities, Praxis – Centre for Policy Studies in Estonia

The value of the hours volunteered to the organisations is estimated by multiplying the total number of hours volunteered by the wage that would normally be paid to a student. These inputs result in an estimate of the value of student volunteering of at least €9.2 million GVA across Estonia. 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 Estonian Universities - Student Volunteering - Contribution

	GVA (€ m)	Employment
Estonia	9.2	-

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 that captures the value of the students' time. It does not reflect the wider community benefits such as:

[33] http://www.spes.lazio.it/europe/5Estonia.pdf

- 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 €281.0 million GVA and 15,700 jobs in Estonia (Table 6-8).

Table 6-8 Estonian Universities: Total Student Contribution - Summary

Estonia	GVA (€ m)	Employment
Student Spending Contribution	109.1	5,900
Student Working Contribution	162.6	9,800
Student Volunteering	9.2	-
Total Student Contribution	281.0	15,700

Source: BiGGAR Economics Analysis

7 TOURISM CONTRIBUTION

This section considers the contribution that the Estonian Universities makes to tourism in Estonia. This contribution arises from:

- visits from friends and family to staff and students; and
- visitors to conferences and events held at the Estonian 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 to Estonia and their spending habits. This data suggests that each staff and student member receives 1.2 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 Universities (40,900) to provide an estimate of the number of visits stimulated by the group.

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 and suggests that the average expenditure on a trip to Estonia is €90. 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 Table 7-1 and Table 7-2.

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

Assumptions	Value
Total number staff & students	40,900
No. visits per staff/student	1.2
Trip spend per visitor (€)	90

Source: Eurostat 2015 and previous BiGGAR Economics Research

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

	GVA (€ m)	Employment (jobs)
Estonia	3.7	200

Source: BiGGAR Economics Analysis

This results in an estimated contribution from visits to visits to staff and students of €3.7 million and 200 jobs in Estonia.

7.2 Conference & Event Contribution

The Estonian 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 Estonian Universities were not included in the analysis as their expenditure would not be additional and has been considered in the section on staff spending. All Universities provided information on the number of delegates to conferences and events and this was used as the basis for our calculations.

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

The Estonian Universities organised conferences and events in 2016 which involved 421,000 attendees; an estimated 8.9% of were from outside Estonia. Eurostat data provides an estimate for average trip expenditure for visitors from outside the country of €680. Applying these assumptions, we can estimate the additional total turnover generated by people attending conferences organised by the Estonian 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 €4.2 million and 200 jobs in Estonia. 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 Estonia. The key assumptions used are shown in Table 7-3 and the resulting contributions are presented in Table 7-4 .

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

Assumption	Value
No. of delegates to conferences and events organised by the Estonian Universities	421,000
Estimated % of International attendees	8.9%
Trip spend per business trip(€)	680

Source: Estonian Universities and Eurostat data 2015

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

	GVA (€ m)	Employment (jobs)
Estonia	4.2	200

Source: BiGGAR Economics Analysis

7.3 Summary of Tourism Contributions

The contribution of the Estonian Universities to the economy through attracting domestic, overseas and business visitors results in an estimated €8.0 million GVA and 400 jobs per year in Estonia (Table 7-5).

Table 7-5 Estonian Universities: Tourism Contribution – Summary

Estonia	GVA (€ m)	Employment (jobs)
Visits to staff and students	3.7	200
Visits to Conferences & events	4.2	200
Total	8.0	400

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

8 BUSINESS CREATION & INNOVATION SUPPORT

This chapter considers how Estonian Universities support economic growth by driving innovation within the Estonian economy through their research and innovation support activities.

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

8.1 Knowledge Exchange 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[34], 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.

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 the 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.

In broad terms, the Universities in Estonia 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 are founded by students or members of staff using knowledge and expertise gained at the Universities or other enterprises founded directly by the Universities in order to make the benefits of some area of research more widely available. Examples of this type of support include the Mektory project (see Figure 8-2) at the Tallinn University of Technology and the IdeaLab project at the University of Tartu (see Figure 8-1).

- **Providing expert support to existing enterprises –** this can include providing consultancy support, undertaking contract research or providing staff training for existing enterprises. The ADAPTER programme is a major new step forward in offering this service (see Figure 8-3 for a description). 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 to translate research by licensing technology to businesses and to help businesses to grow by providing them with access to specialised equipment and facilities.

[34] Solow, R. (1957), *Technical Change and the Aggregate Production Function*, Review of Economics and Statistics, pp. 312-20.

- **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 such as those found in Tallinn and Tartu.

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 culture of entrepreneurship within the Estonian Universities. This was apparent from the programmes that have been implemented to support the formation and survival of start-up businesses. Figure 8-1 and Figure 8-2 give an overview of some examples of this type of support through the IdeaLab, STARTER and Mektory projects run by the Estonian Universities.

Figure 8-1: The IdeaLab and STARTER Programmes

Idea Lab at the University of Tartu is a place where students across all disciplines can test the viability of their project and business ideas. Idea Lab promotes an entrepreneurial attitude in students by organising events, founder meetups, business development programs, pitching competitions and international student start up summer camps. It also provides a physical pre-incubator space at the University of Tartu for brainstorming, training and product testing. Technical equipment is available on-site to allow students to test and develop their products.

Idea Lab runs an extracurricular semester-long pre-incubation program, STARTER, designed in collaboration with 8 universities in Estonia and financed by the European Social Fund. It is a hands-on business development training program that enables participants to develop their ideas into validated business models and prototypes. The program is free of charge and is guided by 50 supervisors, field experts and experienced start up mentors. The three-month idea development program consists of a kick off event, a number of training sessions and workshops, a networking/mentoring event, mentoring sessions and a demo day.

The STARTER programme has three sub-programs in order to cater to different fields. STARTER Lab is based at the University of Tartu, STARTER Tech at Tallinn University of Technology and STARTER Creative involves Tallinn University, Estonian Academy of Arts, Estonian Academy of Music and Theatre, Estonian Business School and Estonian Entrepreneurship University of Applied Sciences. The programs are open to all students in all educational institutions. In 2016, there were 1,908 participants at STARTER workshops and events. Around 36 teams, with 2-5 members per team, completed the program leading to 4 registered businesses.

Figure 8-2: Mektory

Mektory is a platform for actively engaging Universities, students, businesses, the public sector and foreign partners. It supports technology transfer by bringing together researchers, students and entrepreneurs to solve practical product development problems and generate new ideas. Around 30 R&D projects are undertaken each year in the Mektory. These involve company R&D staff, University supervisors and students from different faculties of the University as interdisciplinary project team members working to find solutions for companies.

Mektory also supports student entrepreneurial activities. This is achieved through the STARTER Tech initiative, start-up competitions and provision of physical incubation space in the Mektory. There are currently 8 start-up companies in the Mektory.

Mektory also offers activities for school children and teachers in order to encourage young people to consider future career paths and to develop practical skills in schoolchildren and teachers. Mektory's activities in this area include:

- tours and excursions of Mektory for students and teachers;
- technology camps for schoolchildren covering various topics, lasting for 4 days during school break, attended by 360 students each year;
- 2-3 hour workshops for 4,500 schoolchildren, with topics such as, 'LEGO robotics';
- weekend courses for schoolchildren such as, 'Programming in Python' which is held across 8 Saturdays for four hours each day, involving 600 students per year;
- teacher development programmes and training days, with 250 teachers attending each year; and
- workshops introducing new technologies in teaching attended by 200 teachers per year.

Three of the Estonian Universities were able to point to examples of spin-off businesses that have been established based on intellectual property developed within the Universities. The majority of these businesses are fairly small, typically employing fewer than 10 staff, but the have the potential to develop and generate income for the Estonian economy each year.

Table 8-1 provides some summary statistics relating to Estonian Universities start-ups and spin-offs. This shows that in 2016 there were 49 active university start-ups and spin-outs operating in Estonia and that these businesses generated a total of €23.2 million for the Estonian economy. It is however important to note that not all of the Universities were able to provide details of start-ups and spin-offs, particularly if these businesses had been founded some time ago, so this is likely to be an under estimate.

Table 8-1 - Estonian Universities: Start-ups and spin-offs - Summary Statistics

	Value
Total number of active start-ups and spin-offs	49
Total number of jobs supported	369
Total turnover generated	€23.3 million
Average employment	7.5
Average turnover	€0.5 million
Average turnover/employee	€63,000

Source: Estonian Universities and BiGGAR Economics Assumptions

8.2.1 Quantifying the Impact of Start-ups and Spin-outs

University spin-offs would not exist if it were not for the intellectual capital emerging from the Estonian Universities. Similarly, it is unlikely that staff and student start-up businesses would have achieved their current level of success without the support provided by the Universities. It is therefore appropriate to attribute the benefits that these businesses generate entirely to the Universities themselves.

These benefits were estimated based on the 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 start-up and spin-off businesses associated with the Estonian Universities generated €22.4 million GVA for the Estonian economy in 2015/16 and supported almost 1,200 jobs. This is summarised in Table 8-2.

Table 8-2 - Estonian Universities: Start-ups and Spin-outs - Impact

	GVA (€ m)	Employment
Estonia	22.4	1,200

Source: BiGGAR Economics Analysis

8.2.2 University Owned Enterprises

Four of the Estonian Universities also own a number of 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 each University.

The information provided for this study suggests that the Estonian Universities owns 10 of these businesses. These include:

- a milk biotechnology development centre which was established in 2004 to carry out research and development services for agriculture, food science and medicine organisations;
- a printing and publishing company;
- a company specialising in the development of flexible photovoltaic film;
- a forest research facility that measures concentrations of energy and matter in the atmosphere;
- a sports club;
- a dairy research farm; and
- an accommodation company.

These businesses vary greatly in size with most employing just a few people. Taken together, in 2016 these businesses employed around 100 people and generated €4.5million in turnover. Some of these businesses will have been included elsewhere in the quantifiable analysis and have therefore been removed from this section to avoid double counting.

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 the University-owned enterprises that belong to the Estonian Universities generated €3.4 million for the Estonian economy in 2016 and supported around 400 jobs. This impact is summarised in Table 8-3.

Table 8-3 - Estonian Universities: University Owned Enterprises - Impact

	GVA (€ m)	Employment
Estonia	3.4	400

Source: BiGGAR Economics Analysis

8.3 Supporting Existing Enterprises

As well as supporting the formation of new enterprises, Universities in Estonia 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 Licensing

License 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, the Estonian Universities earned €64,700 in royalty income from license agreements for technologies.

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 license, 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[35]. 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 Estonian Universities' IP enabled Estonian businesses to generate €1.3 million in 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 license 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 licensed each technology.

In this way it was estimated that the licensing activity of the Estonian Universities contributed €0.5 million GVA to the economy of Estonia in 2016 and supported around 20 jobs. This contribution and the assumptions used to estimate it are summarised in Table 8-4 and Table 8-5.

Table 8-4 - Estonian Universities: Licensing Contribution - Assumptions

	Value
University license income	€64,700
Royalties as % of additional turnover generated	5%

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

Table 8-5 - Estonian Universities: Licensing Contribution - Impact

	GVA (€m)	Employment
Estonia	0.5	20

Source: BiGGAR Economics Analysis

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

8.3.2 Services for Businesses

The industry relevant expertise of Estonian academics means that they are well placed to support the development of businesses in Estonia by undertaking contract research and consultancy projects designed to address specific business challenges and opportunities. Universities also support Estonian 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 more recent times the launch of the ADAPTER programme in late 2016 offers a further, growth-oriented link between industry and academia. All of the Universities in Estonia have signed up to the programme which offers a portal for connecting all University support services with small and medium sized businesses. Businesses can submit an enquiry through ADAPTER and be matched with a university service to provide a potential solution. A response is guaranteed within 5 days. See Figure 8-3 for a case study outlining the background to the ADAPTER programme. Although this is at an early stage with impacts some way off, it offers a further building block in the process of knowledge exchange with could lead to the development of new sectors and productivity gains in the future.

Figure 8-3: The ADAPTER Programme

The Estonian economy is characterised by few large employers and a large base of small to medium sized businesses. There is evidence to suggest that the size of these businesses is reducing over time. In the last decade, the average number of employees per business has decreased from ten to six.

Over the last two decades most R&D in Estonia been being undertaken by a small minority of large companies as such investment is beyond the funds of many small businesses. In 2014, the ratio of R&D expenditure to gross domestic product (GDP) in Estonia (1.45%) lagged behind the EU average (2.04%).

Against this backdrop and specifically to increase engagement between small and medium-sized enterprises, ADAPTER was established in late 2016. It is a business engagement initiative that involves all of the Estonian Universities as well as Estonian research institutes such as the National Institute of Chemical Physics and Biophysics and Tartu Space Observatory Centre.

ADAPTER provides a single entry point to academic expertise for all companies and organisations in Estonia and is intended to be a one-stop-shop for accessing the Estonian academic base. It has three primary functions:

- **problem solving** – companies can submit an inquiry via the ADAPTER website. This is analysed by the ADAPTER team who select the most appropriate institution/academic to answer the query. Academic experts then analyse the inquiry and present their answer to the business. All institutions have to respond within three days and the ADAPTER service promises a five day turnaround for companies from start to finish.

- **a database of all University services for businesses** – ADAPTER provides a central portal for accessing all services for businesses provided by Estonian Universities and research institutions. There are currently more than 250 services described on the website. Examples include: adhesives testing; application of georadar; biological tissue sampling from fish and mollusc; analysis and quality evaluation of engine fuels and ceramic consulting services.

- **access to support mechanisms** – ADAPTER also provides information in one place on all of the funding mechanisms available to companies engaged in research and development such as innovation vouchers.

Although ADAPTER has only been established recently, the potential of such a service is enormous and could significantly increase R&D activity across businesses in Estonia thereby generating significant economic returns in the future.

In 2016 Universities in Estonia generated a total of €31.0 million by providing these types of services to industry.

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[36]. 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[37], 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 , 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 the extent of collaboration between industry and academia in Estonia 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 - Estonian Universities: Services for Businesses - Assumptions

		Value (€ m)	Source
Total income from business services, *of which*…		31.0	See below
	Contract research	17.6	Estonian Universities
	Consultancy & advice	4.7	
	Facilities and equipment hire	2.5	
	Professional training	6.2	
Business services multiplier		340%	PWC

Source: As listed

By applying these assumptions to the total value of income received for delivering these services it was estimated that services for business delivered by Estonian Universities generated €284.3 million GVA for the Estonian economy in 2016 and supported 2,300 jobs. This impact is summarised in Table 8-7.

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

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

	GVA (€ m)	Employment
Estonia	284.3	2,300

Source: BiGGAR Economics Analysis

8.3.3 Student Placements

In 2015/16 almost 2,200 students from the Estonian Universities 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[38] 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 from 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 Estonia 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 average staff this time would be equivalent to. Students on placement are likely to be less productive than an 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

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

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 - Estonian Universities: Student Placement - Assumptions

	Value	Source
Total number of students participating in placements of >12 weeks	2,200	Estonian Universities
Total number of weeks spent on placement	36,600	
Equivalent number of employees	352	
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 Estonian Universities contributed €10.0 million to the Estonian economy and supported more than 500 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 - Estonian Universities: Student Placements – Impact

	GVA (€ m)	Employment
Estonia	10.0	500

Source: BiGGAR Economics Analysis

8.4 Science Parks and Incubation Facilities

Three Universities are closely associated with the establishment of two science parks in Estonia: Tallinn Science Park (Tallinn University of Technology) and Tartu Science Park (University of Tartu and the Estonian University of Life Sciences). These were created in collaboration with important research and economic development partners and 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.

The science parks also incorporate physical infrastructure (such as incubation centres) designed to support innovative new spin-outs and start-ups emerging from the Universities. 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 the parks is largely due to the Universities involved, which has enabled them to become more than the sum of their parts. Without the Universities, the 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 the Tallinn and Tartu Science Parks within this report.

The details provided by the Universities suggest that a number of companies that have not been considered elsewhere in this study[39] were based on these parks and that these businesses employed a total of around 1,600 people.

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

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

In assessing the economic contribution stemming from the science parks, it was necessary to consider both of these factors and come to a view about the extent to which this contribution 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 parks was then estimated using the same approach used to estimate the impact of start-ups and spin-offs (see section 8.2.1).

Using this approach it was estimated that the Estonian Universities generated €24.3 million GVA for the Estonian economy in 2016 and supported around 1,600 jobs through their associated science parks and incubation facilities. This impact is summarised in Table 8-10.

Table 8-10 - Estonian Universities: Science & Research Parks – Impact

	GVA (€ m)	Employment
Estonia	24.3	1,600

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 2015/16 the Estonian Universities generated €344.9 million for the Estonian economy as a result of their business formation and innovation support activities. It was also estimated that over 5,900 Estonian jobs were supported in this way. This impact is summarised in Table 8-11.

[39] This figure excludes start-ups and spin-offs from the Universities to avoid double counting because the impact of these businesses was considered above.

Table 8-11 - Estonian Universities: Innovation Support – Impact Summary

Estonia	GVA (€ m)	Employment
Spin-outs and start-ups	22.4	1,200
University owned enterprises	3.4	400
Licensing	0.5	20
Services to businesses	284.3	2,300
Student placements	10.0	500
Science Parks and incubation facilities	24.3	1,600
Total Innovation Support Benefit	344.9	5,900

Source: BiGGAR Economics Analysis

9 GRADUATE PREMIUM

One of the most important ways in which the Estonian Universities generate economic impact is through the long-term economic effects of their teaching activity, as realised through their graduates.

As discussed earlier in the report, Estonia's transition 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.

9.1 Graduate Premium

The education that students receive, the skills they learn and the experiences they have while at the Estonian Universities directly enhances their future productivity. This enables them to contribute more to their employer and generate a greater benefit for the Estonian economy than they would otherwise be able to do.

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.

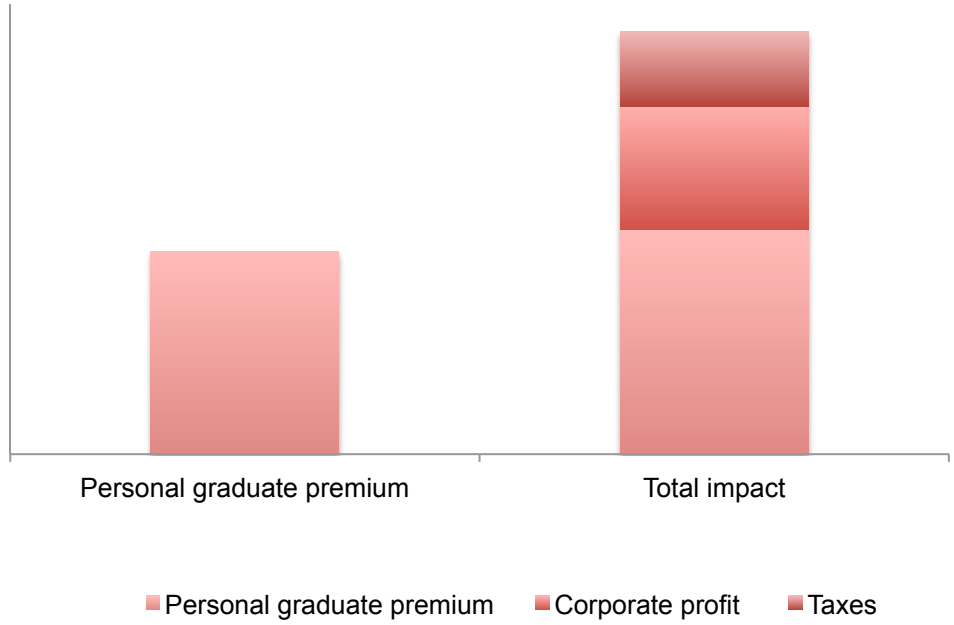
Information about the earnings premium of graduates is readily available from the OECD[40] and can be used to provide a measure of the additional contribution graduates make to the Estonian economy each year.

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 9-1) the impact presented in this section is likely to underestimate the full impact that graduates from the Estonian Universities generate for the Estonian economy.

[40] OECD Education at a Glance, Private Returns to Education

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



Source: BiGGAR Economics

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 Estonia provides information on the pay differentials for Estonian graduates between different subject areas. These figures are summarised in Table 9-1.

Table 9-1: Graduate Premium Assumptions (€)

	Undergraduate	Postgraduate
Teacher training & education science	42,436	29,084
Humanities, languages & arts	51,529	35,316
Social sciences, business & law	57,592	39,471
Science, maths & computing	63,654	43,626
Engineering, manufacturing & construction	57,592	39,471
Health & welfare	60,623	41,548
All fields (Average)	54,560	37,393

Source: BiGGAR Economics Analysis and Statistics Estonia

In 2016, almost 8,300 students graduated from the Estonian Universities. A breakdown of graduates by level of qualification is provided in Table 9-2.

Table 9-2: The Estonian Universities – Graduates

	Value
Undergraduate	4,700
Masters (PGT)	3,300
Doctoral or equivalent (PGR)	200
Total Graduates	**8,300**

Source: The Estonian Universities

The impact associated with graduates from the Estonian Universities was estimated by applying the graduate premium for each degree subject (Table 9-1) to the number of graduates in each subject area. In this way it was estimated that graduates of the Estonian Universities produce an estimated graduate premium contribution of €359.0 million in Estonia (Table 9-3). As this contribution is a productivity gain it is measured in terms of GVA and consequently does not have associated employment gains.

Table 9-3: The Estonian Universities – Graduate Premium

Estonia	GVA (€ m)
Total	359.0

Source: BiGGAR Economics Analysis

10 HEALTH BENEFITS

Only one of the Estonian Universities is engaged in medical research. In 2016 the University of Tartu received €11.9 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[41].

10.1.1 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 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 Estonia, 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 Estonian Universities is equivalent to €2.5 million in Estonia.

10.1.2 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 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%. This implies that each €1 invested in medical research at the Estonian Universities generates an increase of €0.30 GDP for the Estonian economy each year in perpetuity.

The quantifiable value of the contribution of the University's medical research to the health sector in Estonia was estimated using the economic assumptions described above. In this way, it was estimated that this research supported just under €11.8 million of GVA in Estonia.

[41] Wellcome Trust, Medical Research Council, Academy of Medical Sciences (2008), Medical Research: What's it worth?

Adding together the impacts considered above suggests that the medical research undertaken at the Estonian Universities could generate a long-term benefit for the Estonian economy of €14.3 million GVA.

Table 10-1 – Impact of Medical Research by Study Area (€m)

	Estonia
Quality of Life Impact GVA (€m)	2.5
Economic Impact GVA (€m)	11.8
Total GVA (€m)	**14.3**

Source: BiGGAR Economics Analysis

11 SUMMARY ECONOMIC CONTRIBUTION

This chapter summarises the quantifiable economic contribution of the Estonian Universities.

11.1 Total Contribution

By bringing together the various sources of economic contribution discussed in this report it can be estimated that in 2016 the Estonian Universities contributed:

- €1.4 billion GVA; and
- a total of 37,000 jobs in Estonia.

This implies that:

- for each €1 in GVA that the Estonian Universities generated through their direct operations, they created almost €7 in total benefits for the Estonian economy;
- each person directly employed by the Universities supported almost five jobs elsewhere in Estonia; and
- the total income of the Estonian Universities in 2016 was €295.1 million and so the ratio of total income to total impact was €4.59.

A breakdown of the total contribution is provided in Table 11-1.

Table 11-1 – Estonian Universities – Summary Contribution

	GVA (€ m)	Estonia Jobs
Core Operations	346.0	15,000
Direct Effect	199.3	7,700
Supplier Effect	53.0	2,600
Staff Spending Effect	69.3	3,600
Capital Investment	24.5	1,100
Student	281.0	15,700
Student Spending	109.1	5,900
Part-time Work	162.6	9,800
Student Volunteering	9.2	-
Tourism	8.0	400
Visits to Staff & Students	3.7	200
Conferences & Events	4.2	200
Business & Innovation Support	344.9	5,900
Start-ups and Spin-outs	22.4	1,200
University Owned Enterprises	3.4	400
Technology Licensing	0.5	20
Services to Business	284.3	2,300
Student Placements	10.0	500
Science Parks	24.3	1,600
Sub-Total	980.0	37,000
Graduate Premium	359.0	-
Health Contribution (Soc. Ret to Med Research)	14.3	-
TOTAL	1,353.2	37,000

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

12 EUROPEAN AND GLOBAL CONTRIBUTION

The economic contribution of the Estonian Universities extends beyond Estonia, to Europe and the rest of the world.

The contribution at these levels was estimated following the same approach and method outlined throughout the report. These contributions are summarised in Table 12-1.

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

- €1.5 billion GVA and 41,900 jobs at the European level (this includes the Estonian contribution); and
- €1.6 billion GVA and 43,900 jobs globally (this includes the Estonian and European contributions).

Table 12-1 – Contribution of Estonian Universities in Europe and Globally

	Europe		Global	
	GVA (€m)	Jobs	GVA (€m)	Jobs
Direct Effect	199.3	7,700	199.3	7,700
Supplier Effect	65.1	3,200	70.3	3,400
Staff Spending Effect	87.0	4,500	94.8	4,900
Capital Investment	35.1	1,600	38.0	1,700
Core Operations	386.5	17,000	402.4	17,800
Student Spending	122.2	6,600	128.7	7,000
Part-time Work	178.8	10,700	186.9	11,200
Student Volunteering	9.2	-	9.2	-
Student	310.3	17,400	324.9	18,200
Visits to Staff & Students	4.3	200	4.5	200
Conferences & Events	2.2	100	-	-
Tourism	6.5	300	4.5	200
Spin-outs	25.2	1,300	26.5	1,300
University Owned Enterprises	4.3	500	4.5	500
Technology Licensing	1.4	100	1.5	100
Services to Business	373.5	3,000	408.4	3,300
Student Placements	12.4	600	12.8	600
Science Parks	27.3	1,800	28.9	1,800
Business & Innovation Support	444.1	7,200	482.7	7,700
Sub-Total	1,147.4	41,900	1,214.6	43,900
Graduate Premium	383.8	-	401.0	-
Returns to Medical Research	15.3	-	15.4	-
TOTAL	1,546.5	41,900	1,631.0	43,900

13 UNIVERSITY ECOSYSTEMS

Chapter 8 on knowledge transfer and innovation support considered the various different ways in which the Universities support innovation and company formation. The approach taken has been to consider each of these areas of activity in isolation but in reality these are inter-related and mutually reinforcing services. This means that the overall contribution that this type of activity makes to the Estonian economy is likely to be much greater than the sum of its parts. For this reason, it is likely that the impact presented in the previous chapter will be an underestimate.

Escosystems are worthy of further discussion at this stage as this is where the economic development value of the Universities' work is at its most apparent as a driver of change and growth within the economy.

13.1 A Focus for Innovation

By delivering all the different types of activity described in Chapter 8, the Universities provide a strong focal point for innovation, acting as a magnet for innovative businesses and other organisations. Science parks in particular often provide an important entry point for industry to access expertise from within the Universities. Many projects that have gone on to become sources of wider prosperity and economic growth have been launched in science parks around the world.

In these parks the Universities involved generally have 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, science parks can become clusters of activity. They are often very successful in attracting investment from new companies (spin-ins), not *necessarily* to collaborate with the Universities but simply because they are perceived as the best location for companies operating in a particular sector.

Over time this can lead to the development of an innovation ecosystem which will help to drive regional (and in some cases national) economic growth. According to one definition[42] an innovation ecosystem is:

> *"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"*

The roots of two major ecosystems have already been formed through the Tallinn and the Tartu Science Parks. Figure 13-1 and Figure 13-2 present case studies

[42] 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

that outline the origins and key milestones in the development of each of these Parks.

Figure 13-1: Tallinn Science Park

The Tallinn Science Park is a science and business campus which aims to advance technology-based entrepreneurship in Estonia, bringing scientists and entrepreneurs together to provide suitable conditions and a suitable environment for the realisation of breakthrough business ideas.

As early as 1991 there were attempts to form a science park close to Tallinn University of Technology (TUT), but the plan took off only in 2003, when the Republic of Estonia, TUT and the City of Tallinn founded the Tallinn Technology Park development foundation, known today as Tallinn Science Park Tehnopol. At present (2017), there are nearly 200 companies (from startups to Skype) operating on the Tehnopol campus, which is situated close to TUT and the Estonian IT College.

The Startup Incubator facility at the Technopol has been specifically designed for new companies, primarily in the technology sector. In conjunction with a series of business development growth services, the infrastructure is in place for developing high value-added business.

A number of businesses that started out at the Tallinn Science Park have become major success stories: for example, Skype, Defendec, Toggl and FlyDog) have all gone on to become strong companies.

Figure 13-2: Tartu Science Park

Tartu Science Park describes itself as “the innovation engine of South Estonia” and its stated mission is to nurture start-up companies into global businesses.

It was the first science park in the Baltic states and was founded in 1992 by Tartu city, the county and the Universities of Tartu and the Estonian University of Life Sciences. Since then the science park has supported business innovation activities in the region by networking with universities, the public and the private sectors. Currently (2017) it is home to around 75 businesses.

Inward investors are offered services to help them access the business and economic advantages of the Estonian economy. Tartu Science Park offers access to business development units such as:

- Business Incubator – services for start-up companies including links with other entrepreneurs and experts;
- Protolab - a full range of prototyping services from CAD/CAM and technical drawings to production of prototypes: mainly in the field of precision mechanics and apparatus building.
- Tartu Demo Centre - a creative environment for mobile developers to work on or test their applications.
- Nanolab - clean room facilities for nanotechnological R&D in materials and electronics sector.

13.2 R&D and Economic Growth

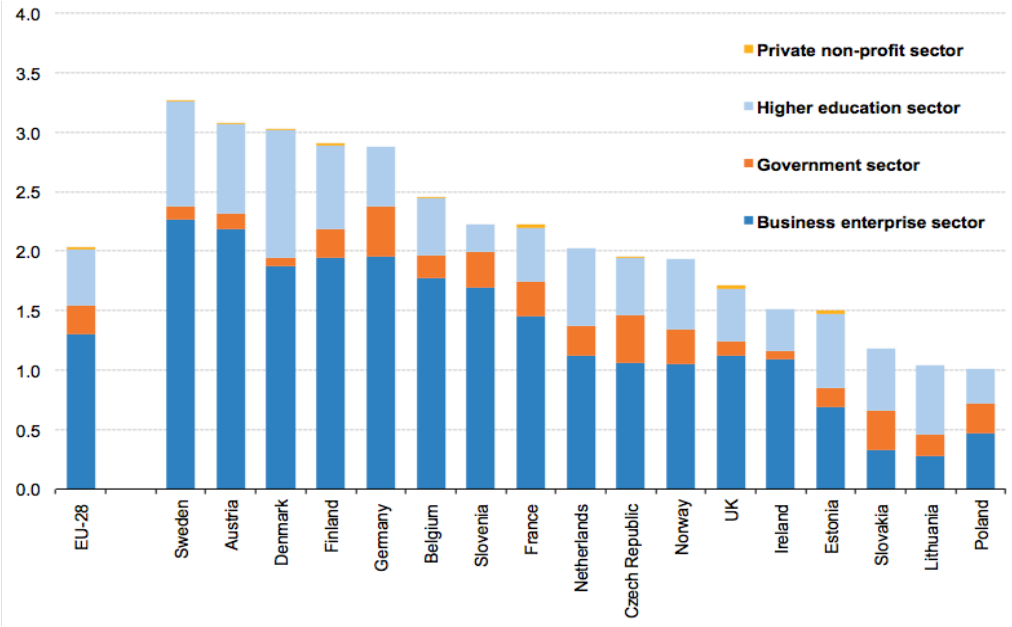
As discussed in section 8.1 there is a well-established relationship between economic growth and technological progress. Over the years there have been various attempts to model this relationship using measures such as R&D spending and patenting. Most of these studies found that R&D spending makes a significant contribution to productivity growth.

In 2015 for example, economists in Turkey[43] published a study that explored the relationship between R&D expenditure and economic growth across 15 OECD countries 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[44] 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%.

Figure 13-3 shows the proportion of GDP that selected European countries spent on R&D in 2015. On average countries in the EU spend around 2% of total GDP on R&D; in Estonia the figure is currently around 1.5% as the economy continues to emerge and compete with its EU neighbours.

Figure 13-3 – 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.

[43] Erdil Sahin B (2015) The Relationship between R&D Expenditures and Economic Growth: Panel Data Analysis 1990 - 2013

[44] Mladenovic et atl (2016) R&D Expenditure and economic growth: EU28 evidence for the period 2002 - 2012

Figure 13-3 illustrates the contribution that different sectors of the economy make to Estonia's overall level of R&D. It shows that in Estonia, the higher education sector makes a significant contribution to the overall R&D effort. Indeed in 2015, the Estonian universities accounted for around 40% of total R&D expenditure in Estonia.

This suggests that the impact presented in chapter 8 is likely to under-estimate the true value of innovation support delivered by Universities in Estonia. Their innovation and knowledge exchange services, and the focus on scientific research and development provided by the science parks provide important roots for the country's economic growth and further development.

14 WIDER BENEFITS OF HIGHER EDUCATION

There are significant wider, unquantifiable benefits emanating from the Estonian Universities to the individual and to society as a whole. These benefits have been well documented and include greater social cohesion, improved social mobility, better health and wellbeing and greater civic engagement.

14.1 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.[45] 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.[46] 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.[47] 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 total contribution of the Estonian Universities.

14.2 The Value of the Arts

The Estonian Universities also create a 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

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

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[48]:

- prevent exclusion;
- build better mental health;
- enhance social well-being and quality of life;
- reduce pain;
- improve functional mobility and motor skills; and
- 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 Estonia 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 Estonian Universities, therefore have a key role to play in making Estonia an attractive place to live, work, visit and invest and thereby in supporting economic growth.

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

15 CONCLUSIONS

The objective of this study was to assess the economic contribution of the Estonian 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 €1.4 billion GVA for the Estonian economy in 2016 and supported around 37,000 jobs. To put this in context, in 2016, the Estonian GDP at current prices was €20.9 billion[49] and there were 638,200 people in employment[50]. Therefore it is estimated that the Estonian Universities support around 6.4% of Estonian GDP and around 5.8% of Estonian employment.

The impact beyond Estonia was estimated to be even larger, contributing an estimated €1.5 billion GVA and supporting around 41,900 jobs at the European level (this includes the contribution in Estonia) and €1.6 billion GVA and supporting around 43,900 jobs world-wide. This implies that:

- each €1 generated by the Estonian Universities in GVA produced almost €7 in total benefits for the Estonian economy;
- each €1 of income received by the Estonian Universities produced almost €5 in total benefits for the Estonian economy; and
- each person directly employed the Universities supported almost five jobs elsewhere in Estonia.

15.1 Supporting Regional Development

The Estonian Universities are large organisations with extensive supply chains, significant staff complements and large student bases. As such, their expenditure and that of their staff and students makes a significant economic contribution.

The larger Universities have established a network of regional colleges throughout Estonia which has also enabled them to play an important role in supporting regional economic development beyond the urban centres of Tallinn and Tartu.

15.2 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 Estonian 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 Estonian Universities are creating a number of innovation ecosystems that provide clusters of industrial activity. They offer a space for discussion and create connections between academics, students and companies.

[49] Statistics Estonia, 28 February 2017, News Release No. 22.
[50] Statistics Estonia, ML473, Employed Persons 4th Quarter 2016.

They therefore make the areas in which they are located more attractive to potential investors and are therefore vital to attracting inward investment. These ecosystems are 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.

15.3 Wider Benefits

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

The Estonian Universities support a variety of wider benefits such as health research that generates a real, if unquantifiable, value for society.

The promotion and protection of the arts is also a major feature of the Universities' work which is important in in preserving Estonia's cultural heritage. 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. A vibrant arts and culture scene therefore supports quality of life which in turn is important for inward investment. The arts, and by the extension the Estonian Universities, therefore have a key role to play in making Estonia an attractive place to live, work, visit and invest.

The Universities also benefit society by improving social cohesion, facilitating social mobility, encouraging better health and wellbeing and encouraging greater civic engagement.

Finally, each of the Estonian 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.

15.4 The Future

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

16 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 Estonia for 2017. These are available from the Statistics Estonia 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 Estonia.

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.

17 APPENDIX B – UNIVERSITIES ESTONIA MEMBER DESCRIPTIONS

This section provides a brief summary description of each Universities Estonia member.

17.1 Tallinn University

History: Tallinn University is one of the three largest institutions of higher education in Estonia and the largest provider of education in the humanities in Tallinn. It was established in 2005 as the result of a merger of several older universities and research institutes: Academic Library of Estonia, Baltic Film and Media School, Estonian Institute of Humanities, Institute of History and Tallinn Pedagogical University.

Scale: Tallinn University has more than more than 7,300 full-time students (7.3% are international) and almost 1,000 staff. The University has six main buildings in Tallinn and two further regional colleges in Rekvere and Haapsalu. The University had an income of €37.1m in 2016.

The University has five interdisciplinary focus fields: educational innovation, digital and media culture, cultural competences, healthy and sustainable lifestyle and society and open governance.

Research: The Tallinn University research and development centres are:

- Centre for Landscape and Culture in the School of Humanities, as part of the cultural competences focus field;
- Institute of Ecology in the School of Natural Sciences and Health, as part of the healthy and sustainable lifestyle focus field;
- Institute for International Social Studies in the School of Governance, Law and Society, as part of the society and open governance focus field;
- Estonian Institute for Population Studies in the School of Governance, Law and Society, as part of the society and open governance focus field; and
- Centre for Educational Technology in the School of Digital Technologies, as part of the digital and media culture focus field.

One of the main aims of the University is large-scale internationalisation. Tallinn University currently maintains over 50 inter-university agreements with universities in Europe, U.S., Japan, China, Russia, and several other countries. It has created five Centres of Excellence in order to boost international cooperation and to facilitate interdisciplinary collaboration for excellent research and creative results.

Innovation Support: The University has an Open Academy that offers opportunities for knowledge exchange between academics and researchers and public, private and third sector enterprises. This work is supported by innovation voucher grants provided by Enterprise Estonia. In cooperation with Archimedes and Estonian Research Council the University also offers the possibility to order applied research related to smart specialisation growth areas.

17.2 Estonian University of Life Sciences

History: The Estonian University of Life Sciences is located in the city of Tartu in eastern Estonia. It is the former Estonian Agricultural University that was established in 1951 and renamed and restructured in 2005. The University was a founding member of the Tartu Science Park along with the City and University of Tartu.

Scale: The University has 2,700 full-time students and almost 900 staff. It had an income of €26.7m in 2016. Teaching and research is carried out in five institutes: veterinary medicine and animal science; technology; agricultural and environmental sciences; forestry and rural engineering and economics and social sciences. A central part of the University's ethos is to promote the Green University Initiative to foster the sustainable use of natural resources through knowledge-based education.

Rankings: The QS World University Rankings by Subject (2016), place the Estonian University of Life Sciences in the top 100 universities in the world in the field of agriculture and forestry.

Research: The University's Research and Development Strategy 2015 set out five priorities for research:

- the development of technologies for the sustainable use of renewable natural resources and environment;
- development of science and technology pertaining to the production of safe and healthy food;
- development of science and technology directed at the improvement of non-food biological products and processes;
- development of bio-economic production techniques and technologies; and
- research into the social and economic impacts of rural society.

17.3 Tallinn University of Technology

History: Established in 1918 and with University status since 1936, Tallinn University of Technology (TUT) is Estonia's flagship technical University. As well as a campus in Tallinn, TUT also has colleges in Tartu, Kuressaare and Kohtla-Järve. Despite the similar names, Tallinn University and Tallinn University of Technology are separate institutions.

Scale: TUT has a staff headcount of over 1,900 people and 9,500 full-time students of which approximately 12% are international. The University had an income of €80.3m in 2016.

Teaching and research is organised into four schools: information technologies; science; engineering and business and governance. In addition there is the Estonian Maritime Academy. In August 2017 the Estonian Information Technology College will also become part of TUT.

TUT has a strong emphasis on internationalisation and works in partnership with Universities around the world on curricula development, project cooperation and networking.

TUT has three main goals for 2020:

- To be an internationally outstanding University of engineering and technology bringing together motivated employees and ambitious students;
- To use its academic competencies and professional management to respond actively to the needs of a rapidly developing society in tackling the challenges of the digital era; and
- To cooperate with enterprises and the public sector to contribute significantly to knowledge and welfare in society.

Research: TUT's has an extensive research programme that extends across all faculties and focuses on basic and applied studies. The organisation produced 1,420 scientific publications in 2015.

Innovation Support: TUT's main vehicle for knowledge transfer, student start-ups and spin-offs is through the Mektory Innovation and Business Centre, a joint collaboration between the University, the public sector, embassies and business partners, which aims to bring together scientists, students and entrepreneurs to solve practical development problems and generate new intelligent ideas. The University is the largest investor in Mektory. Its facilities include testing and prototype laboratories, studios and conference rooms and a space centre.

In 2012, Swedbank, TUT and Tallinn Science Park Technopol founded the Prototron fund to support business ideas. It offers equity-free funding to start-ups so they can build their first working prototype to test on customers. It provides seed funding of between €5,000 and €10,000 for start-up ideas. Over the last four years this has provided €310,000 on 25 projects focused on electronics, mechatronics, greentech and ICT.

17.4 University of Tartu

History: Founded in 1632, The University of Tartu (UT) the only classical university in Estonia and is based in the city of Tartu in the east of the country. It is the national university of Estonia and is one of the oldest universities in Northern and Eastern Europe. The University of Tartu preserves the culture and language of the Estonian people. The University is a founding member of the Tartu Science Park along with the City and the Estonian University of Life Sciences. Founded in 1992, the Science Park is the oldest in the Baltic region.

Scale: It has a staff headcount of 3,400 people and a full-time student population of 12,200 of which approximately 9% are international. The University also operates in four other locations in Estonia: Narva, Parnu, Tallinn and Viljandi. It had an income of €133.6 million in 2016.

Teaching and research is organised into four main faculties: arts and humanities, social sciences, medicine and science and technology. Important contributions to the research work of the faculties are also made by the University's 4 colleges the Estonian Genome Centre and the University of Tartu Library.

Rankings: The University of Tartu belongs to the top 2% of world's best universities (THE World University Rankings 2016-17, QS World University Rankings 2016-17) and is the 5th ranked university in the Eastern region (QS EECA 2016). It is the highest ranked university in the Baltics.

Research: There are nine Centres of Excellence in Research in Estonia which are supported by the European Regional Development Fund. The University of Tartu leads three of them, in the fields of advanced materials, genomics and translational medicine and molecular cell engineering. The University also participates in the other six Centres of Excellence.

ISI Web of Science places the University of Tartu belongs in the top 1% of the world's most-cited universities and research institutions in the fields of clinical medicine, chemistry, environment/ecology, plant and animal science, geosciences, social sciences (general), biology and biochemistry and engineering.

The University of Tartu is a member of several important international cooperation networks including the GUILD (organisation of European research-intensive universities, established in 2016) and the Eastern and Central European partnership programme of the League of European Research Universities (LERU). It also participates in the prestigious Coimbra Group of research universities, the Utrecht Network and the Baltic Sea Region University Network. It has signed bilateral co-operation agreements with approximately 70 universities.

Innovation Support: UT is an innovative research and development partner for small enterprises and multinational corporations. The Satellite EstCube-1 made Estonia the 41st space nation in the world. IdeaLab of the University connects students from different faculties to develop innovative solutions to complex problems.

The University is the initiator of the ADAPTER network of Estonian Universities (along with the remaining five publically funded Universities in Estonia) which allows individuals to present an enquiry to Estonian research and development institutions, search a database of all the services on offer by each facility and to better understand what kind of support mechanisms there are to help companies engage in research and development.

17.5 Estonian Academy of Music and Theatre

History: The Estonian Academy of Music and Theatre (EAMT) was formed from an amalgamation of the Higher Music School and the State Drama School. It is the only public university in Estonia offering education in music and theatre arts disciplines. In addition to vocalists and instrumentalists, conductors, composers, musicologists, music teachers and sound engineers are also trained through its degree programmes.

In June 2016 the Estonian Government approved the investment of €54.1 million ASTRA programme for the reconstruction and renovation of seven research and teaching buildings across the country[51]. As part of this plan, the EAMT was awarded €5 million for the construction of a new and long-awaited concert hall complex. The new facility will bring an international standard facility to Tallinn and is scheduled to open in Autumn 2019 to coincide with the 100th anniversary of the Academy.

[51] As part of the same investment programme, the Estonian Academy of Arts received €15 million for new facilities; the University of Tartu also received an award of €15 million for the construction of an IT Centre and Tallinn University of Technology received €5.8 million towards two renovation projects. Source: EAMT website.

Scale: The Academy has a staff headcount of almost 400 people and a full-time student population approximately 700 people. The Academy's income in 2016 was €7.4 million.

The Development Plan for EAMT for 2015 – 2020 sets out five strategic objectives associated with the improvement of the academy. These are summarised as follows:

- to construct a concert hall complex beside the current main building to raise the quality of the facilities in line with national and international standards. This is a matter of high priority for the EAMT;
- to improve the management, development planning and performance assessment systems within EAMT;
- to deliver high-quality, internationally competitive education that meets the requirements of the field-specific labour market;
- to carry out research that supports educational and creative activities and the preservation and development of Estonian national culture[52]; and
- to promote the positive image of the institution and develop its contribution to the positive evaluation of creativity and lifelong learning in society.

Research: The major research areas at the EAMT are musicology, theatre, music education, interpretation education and cultural management. Research topics are related to music and theatre and other fields of the art and culture scene as a whole. The library is the largest music library in Estonia. Its collection contains about 130,000 scores, 35,000 books, 14,000 CD's, 2,500 DVD's and is available to all professional musicians, music teachers and interested persons

The Academy offers a variety of opportunities for further continuing professional development and training for teachers and performing musicians.

17.6 Estonian Academy of Arts

History: Established in 1914, the Estonian Academy of Arts (EAA) is the only public university in Estonia providing higher education in fine arts, design, architecture, media, visual studies, art culture, cultural heritage and conservation. It is based in Tallinn.

Scale: The Academy of Arts has almost 900 students and a staff headcount of 200 people. Its income in 2016 was €10.0m.

The main objective of the Academy is to promote creativity and research, enabling the acquirement of a contemporary higher education based on integrated study.

The EAA is striving to become a leading international centre of innovation in the field of visual culture. Currently there are more than 1,200 students enrolled in the Academy, with many participating in exchange programmes at international partner universities. In addition to active study and research activities, the Estonian Academy of Arts also offers lifelong learning opportunities through the Open Academy.

[52] Changes in the funding of research in recent years have had a negative impact on the research budget of EAMT, which decreased by 15% between 2010 and 2015.

Rankings: The QS World University Rankings by Subject for 2017 place the Academy in the top 200 art and design universities in the world.

Research: The Academy collaborates with more than a hundred universities worldwide and belongs to several international higher education networks through which student and faculty exchanges can be negotiated and apprenticeship opportunities can be expanded. EAA is a member of CUMULUS (International Association of Universities and Colleges of Art, Design and Media); EAAE (European Association for Architectural Education); ELIA (The European League of Institutes of the Arts), and through NORDPLUS is a member of many professional networks.

Since 1999 EAA has been a member of The European Commission's Lifelong Learning Programme for Higher Education, Erasmus, under which more than 100 bilateral exchange agreements have been signed. In addition to the Erasmus programme, the Estonian Academy of Arts has entered into student and faculty exchange and cooperation contracts with ten internationally recognised art universities outside of the European Union.

Innovation Support: Through it's Start! Programme, the EAA offers a business and information portal for students wishing to pursue a career or start a business in the arts. The EAA is also a member of the Mektory project (as well as TUT) which offers business start-up support, mentoring and incubator space to new businesses.