BiGGAR Economics

University of Dundee
Economic Impact Assessment

A report to the University of Dundee
June 2022

BiGGAR Economics

Contents

1. Executive Summary

The University of Dundee makes a significant contribution to Dundee and Tay Cities Region and the wider national and global economy.

In 2020/21, the activities of the University of Dundee supported:

- **£449 million** Gross Value Added (GVA) and **6,760 jobs** in Dundee City;
- **£507 million GVA** and **7,270 jobs** in the Tay Cities Region;
- **£975 million GVA** and **9,410 jobs** in Scotland;
- **£1.5 billion GVA** and **15,090** jobs in the UK; and
- **£1.6 billion GVA** and **16,070** jobs globally.

In 2020/21, the University of Dundee had 16,230 students, it employed 3,280 staff and it had an income of £276 million. Across the UK, the economic value that the University created is over five times greater than its income, and the impact within Scotland is ten times greater than its income received from the Scottish Government.

The University of Dundee generated £10 of GVA for the Scottish economy for every £1 it received from the Scottish Government.

The University of Dundee generated this impact from a wide range of activities, including;

- improved productivity of the graduates of the University, as a result of their education at the University of Dundee;
- the support it provided business through innovation and entrepreneurialism;
- the economic benefits of its research, such as improved health outcomes;
- the direct employment it supports, and throughout its supply chain;
- the students that it attracts to live, study and work in the area; and
- the support it provides to the tourism and cultural sectors in Dundee City.

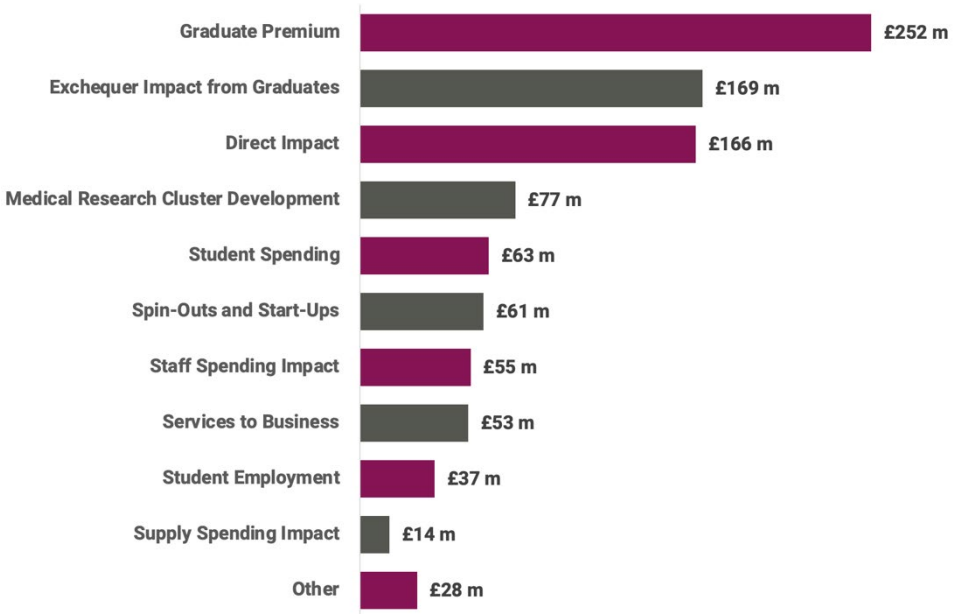
The majority of the economic impacts within Dundee City were driven by the core activities of the University and the activities of the students. The 3,280 staff that were employed at the University were in high value jobs and accounted for 7% of all the High Skill jobs in Dundee City. The gender pay gap does persist at the University, however this is not as wide as the economy of Dundee City as a whole. On average male staff earned 4% more than other males employed in Dundee City and female staff earned 14% more.

The University of Dundee supported 1 in every 12 jobs in Dundee City

The 13,000 full time students at the University of Dundee, spent an estimated £88 million in the City during 2020/21. This includes £35 million that was spent by international students. The activities of students were those most affected by the

Covid-19 pandemic because the industries most affected by the pandemic were those in which students are more likely to work or spend their money. Despite this, students still generated £100 million GVA for the Scottish economy and supported more than 3,100 jobs.

Figure 1-1 Economic Impact of the University of Dundee, Scottish GVA by source



Source: BiGGAR Economics Analysis

The **graduates of the University of Dundee** were the greatest driver of economic impact, as they put their learning at the University into practice. The 2020/21 graduation cohort will generate over £420 million for the Scottish economy as a result of their degree. Graduates of the University of Dundee were 10% more likely to work in a High Skill occupation than graduates of other Scottish universities. The performance of ethnic minority graduates of the University of Dundee is particularly strong in the labour market, as 62% entered full time employment after graduation, compared to 54% of ethnic minority graduates of other Scottish universities.

84% of the graduates of the University of Dundee work in High Skill occupations.

The **research and innovation activities** of the University of Dundee are particularly strong in the life sciences and cultural sectors, reflecting the clusters that are most prominent in Dundee City. The overall research quality of the University was recently highlighted in the REF 2021 results which found that 84% of its research was either 'world leading' or 'internationally excellent' and it was ranked the leading institution in the UK for Biological Sciences. There were 79 active spin-out or start-up companies of the University which directly employed over 600 people across the UK. Companies in the life sciences sector accounted for majority of this employment. Despite this, only 27% of the direct employment in these companies were within the Tay Cities Region, as most companies moved elsewhere in the UK after they were established.

The role that the University of Dundee has in **supporting the life sciences cluster** in the Tay Cities Region goes beyond those companies that directly emerge from the teaching and research at the University. There are obvious impacts within the City's health system, with the University acting as a key partner to NHS Tayside at strategic and operational levels, including through the teaching hospital at Ninewells and the Dundee Dental Hospital. The expertise at the University of Dundee attracted pharmaceutical and other life science companies into the area, which generated an estimated £20 million GVA in the economy of Dundee City.

Drug discovery and clinical trials are particular areas of strength of the University of Dundee, through the Drug Discovery Unit and the Tayside Clinical Trials Unit. These organisations supported the development of treatments from academic discovery through to commercial viability and improving patient outcomes. Dundee is one of the major bases for clinical trials in Scotland and has worked with industry to improve efficiency of the clinical trial process. Recently this has included a significant effort to reduce the time required to develop clinical trials, from 6 months to two months, in response to the Covid-19 pandemic.

The University of Dundee played a significant role in the cultural and tourism sectors of Dundee City. The University has been **fundamental in building the tourism offering of the city** through supporting the creation of the V&A at Dundee and the Eden Project. These shall be the two main attractions in the City and are expected to support over 1,000 jobs locally once these are both fully operational. The Duncan of Jordanstone College of Art and Design supports the creative industries within the City, which have grown by 15% since 2015, through the provision of high-quality graduates and spaces such as the Cooper Gallery and the Dundee Contemporary Arts. The activities of the tourism and cultural sectors across the UK were severely curtailed by the Covid-19 pandemic and therefore the impact of the University in this area is likely to grow as activities return to normality.

The University of Dundee enhanced the **international reputation of Dundee City** through exporting world leading research, international partnerships and attracting students, visitors and business to the city. This reputation stimulated economic benefits for Scotland. In total, the University of Dundee generated £93 million of export earnings for Scotland through tuition fee income, student spending, providing direct services to overseas organisations and from international visitors to the city.

2. Introduction

This report assesses the University of Dundee's economic, social and wider impacts on the regional, national and global economy for the 2020/21 academic year.

2.1 University Background

The University of Dundee was established in 1881 as University College Dundee with an initial intake of 370 students. It was formally granted independent university status in 1967 and has grown considerably since, becoming a key anchor institution for the region.

In 2020/21, the University had 16,230 students, 3,280 staff and a total income of £276 million. The University is located across three campuses. Most teaching and research activity takes place at the City Campus in the centre of Dundee. The School of Medicine is co-located with Ninewells Teaching Hospital on the outskirts of Dundee and some teaching and research within the School of Health Sciences is located in Kirkcaldy, in Fife.

The University of Dundee is well reputed for its quality of teaching and research:

- it was ranked 28th out of 130 institutions in the UK in the Complete University Guide 2022;
- in the top 10 universities in the UK for the following subjects[1]: forensic science (ranked 2nd in the UK), education (3rd), medicine (3rd), biomedical sciences (4th), pharmacology and pharmacy (5th), dentistry (6th), medical technology & bioengineering (6th), biological sciences (7th) and art and design (7th);
- ranked 1st in Scotland, 9th in the UK and 30th in the world in 2020, in the Times Higher Education Golden Age University Rankings[2]; and
- the top University in the UK for research in Biological Sciences according to the Research Excellence Framework (REF) 2021.

The University's current strategy outlines the main objective of the University and how this will be achieved.

> The University of Dundee's core purpose is to transform lives, locally and globally through the creation, sharing and application of knowledge. This will be achieved by working as a community committed to excellence. In doing so, the University

[1] Complete University Guide 2022
[2] The Times Higher Education Golden Age University Rankings cover universities established in the two decades between 1945 and 1967, i.e., those that have been established for more than 50 years, but less than 80 years.

will benefit the city and region by acting as a key gateway to the world.

2.2 Study Objectives

The University of Dundee is developing a new strategy, which will set out how the University will continue to be a driving force for economic, social and cultural development in the region and beyond. This economic impact study was commissioned by the University to establish a baseline of the University's current impact to measure progress over the next five years.

The key objectives of the study are:

- to quantify the economic impact of the University regionally, nationally and globally in terms of GVA and jobs;
- to assess the public return on investment; and
- consider the wider impacts of the University including cultural and broader societal benefits.

2.3 Report Structure

The remainder of the report is structured as follows:

- section 3 outlines the framework for assessment of economic impact and summarises the approach taken to the study
- section 4 outlines the operational impacts created by the University of Dundee through its staff, its supply chain expenditure on goods and services, and its capital expenditure;
- section 5 considers the impacts arising from the University's students;
- section 6 outlines the impacts of the University's graduates;
- section 7 discusses the ways in which the University supports innovation through licensing agreements, spin-outs, start-ups, services to businesses and other knowledge exchange activities;
- section 8 describes how the University supports life sciences and healthcare;
- section 9 considers the University's pivotal role in supporting tourism and culture;
- section 10 discusses the University's role as a driver of regional economic development;
- section 11 considers how the University is a driver of internationalisation and enhancing the global reputation of Dundee City; and
- section 12 summarises the total quantifiable impact created by the University of Dundee.

3. Framework, Approach and Definitions

This section discusses the pivotal role universities play in driving economic growth before outlining the approach and methodology used for the study.

3.1 Theoretical Framework

The role played by universities in economic development has long been recognised. As key sources of research and development, they play a central role in supporting industry clusters and make a significant contribution to economic growth.

A number of influential economists have published work which sets out a theoretical and empirical case for the role that high-level skills and innovation play in boosting economic competitiveness and addressing inequalities in society. In the late 1950s, Robert Solow's work demonstrated that it was not the savings rate or increases in factors of production (labour and capital) which determined the long-run growth rate, but that it depended on increases in productivity. In the early 1960s Kenneth Arrow's research on "learning by doing" showed that almost all economic growth could be accounted for by innovation. This referred to innovation from new ideas emerging from research, as well as improving productivity through "learning by doing" during the production process.

Building on this, the Nobel prize winner, Joseph Stiglitz, 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 diffusion of knowledge and innovation results in productivity gains and consequently economic growth, highlighting the crucial role which universities can play in local, national and international economic development.

Universities drive economic growth and boost competitiveness by diffusing knowledge which raises productivity

3.2 The Role of Universities in Economic Recovery

The Covid-19 pandemic has delivered the greatest shock to the global economy in modern times and, in parallel, it has brought a rare opportunity to build back a better economic future for ourselves and for future generations. In this context, universities have a powerful, long-term role in strengthening economic resilience in a way which is sustainable, equitable and transformative. This view is supported by influential global policy makers who have identified investment in education and R&D as

priorities for long-term fiscal recovery, which will also support the desired focus on a green transition that is a shared goal in most advanced economies[3].

The wealth of countries is distinct from the economic success of companies or individuals. While companies and individuals can keep rewards from extracting wealth from the economy, at a national level, the wealth of the country can only be based on wealth creation. The transformative role universities can play in this context include:

- securing and providing high quality employment;
- providing the human and intellectual capital necessary for both economic recovery and transformation;
- driving innovation for new and existing businesses and public sectors;
- reducing and avoiding youth unemployment, in particular avoiding life-long scarring effects for those unemployed as a result of the pandemic;
- building the resilience of public services, including the health and care sectors;
- supporting the net zero challenge and the green recovery, helping to provide the intellectual and human capital on which it will be based;
- providing leadership in economies as well as in wider civic society; and
- rebuilding the tax base to help ensure a net positive fiscal return which will help to pay for the cost of government assistance.

Universities have a crucial role to play in any advanced economy and they are particularly important in a time of uncertainty and change, which is the nature of current economic climate. In order to be sustainable and resilient, economic recovery and transformation needs to be based on knowledge and innovation. The education sector, and higher education in particular, will be the primary source of the human and intellectual capital required to make this a reality.

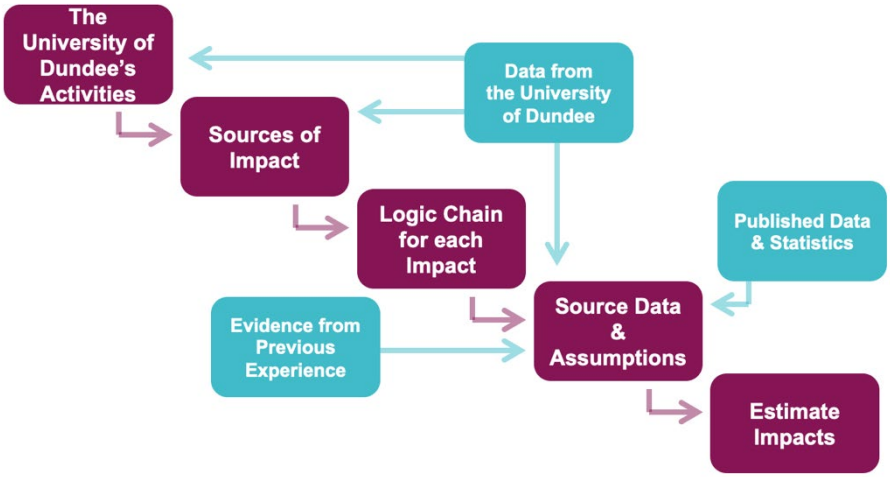
3.3 Study Approach

This study estimates the total economic contribution made by the University of Dundee in 2020/21. The approach taken has been to record all impacts which are generated by the University and, in this sense, it represents the ***additional*** impact which the University of Dundee alone creates on the economy. The key assumption is that these impacts ***could not be created*** without the University of Dundee.

The methodology followed has been tried and tested, having been used in over 100 university economic impact studies in recent years. This includes studies for individual universities in Scotland, the UK and Europe, as well as university consortia in the UK and Europe, such as the League of European Research Universities (LERU) with 23 members across 12 countries. The overall approach is illustrated in Figure 3-1.

Figure 3-1: Study Approach

[3] Hepburn, C., O'Callaghan, B., Stern, N., Stiglitz, J., and Zenghelis, D. (2020), 'Will Covid-19 fiscal recovery packages accelerate or retard progress on climate change?', Smith School Working Paper 20-02



Source: BiGGAR Economics

The starting point for analysis was to consider the various activities undertaken by the University and identify those that were likely to generate an economic contribution. Logic chains were then developed to describe how each type of activity generates economic value. The next step was to consider how the value of each activity could be measured and what data would be required to do this. For most activity, two types of information was required:

- **source information** about the scale of activity, which was supplied by the University of Dundee; and
- **other data and published statistics** which could be used as the basis for assumptions to measure economic value. Where University data was not available, an appropriate assumption was made based on BiGGAR Economics' previous experience of comparable institutions.

The key statistical sources used was the 2018 Input-Output Tables for Scotland and the Scottish Annual Business Statistics which were published by the Scottish Government in 2021. Further assumptions were informed by referring to published reports and official statistical sources which are referenced throughout the report where appropriate. The data were used to populate an economic model which estimates the value of each source of contribution from the University and these were aggregated to produce an estimate of the total contribution made.

Beyond the quantifiable impacts, the University of Dundee makes a strong contribution to wider society through its central mission of transforming lives. To understand its important social role, a series of consultations were held with University staff to highlight the University's distinctive strengths and the social impacts these create.

3.3.1 Metrics of assessment

The primary metrics of assessment used in this report are:

- Gross Value Added (GVA): this is a measure of economic value added by an organisation or industry. It is typically estimated by subtracting the non-staff operational costs from the revenues of an organisation; and
- Jobs: this is a measure of employment which considers the headcount employment in an organisation or industry.

3.3.2 Types of Impact

The economic impact assessment captures the full impact of the original activities, including knock on effects further down the supply chain and through increased consumer spending.

For each area of activity, an assumption was made about the proportion that would occur in each study area and they were then assigned a sector. On the basis of these sectors, economic ratios and multipliers were derived, which were then used to estimate economic impacts.

There are three significant types of economic impact associated the developments;

- direct impact: this is the direct impact associated with Tier 1 suppliers, including employing and paying staff, and generating profits. This is the impact calculated by dividing the expenditure on a contract by the turnover/GVA and turnover/employee ratios for the relevant sectors to estimate the direct GVA and employment impacts[4];
- indirect impact: this is the impact associated with spending in the supply chain of Tier 1 suppliers. This is captured by applying Type 1 economic multipliers[5][6] to the direct economic impacts; and
- induced impact: this is the impact associated with staff spending their wages in the wider economy and is captured by subtracting Type 1 multipliers from Type 2 multipliers, and applying this to the direct impact.

3.4 Impact Time Frame

3.4.1 Covid-19

Our economic analysis measures the impact created by the University of Dundee over an academic year, which in this case is 2020/21. This marked an exceptional time with the impact of the COVID-19 pandemic affecting all aspects of University and wider public life since March 2020. In academic terms, courses were delivered online for most of this academic year with a gradual and limited return to campus happening when restrictions allowed.

Some aspects of the University of Dundee's income and expenditure were affected more than others by the pandemic. For example, the closure of university buildings and student accommodation and the cancelation of events affected income from these sources quite significantly. Meanwhile, the drive to facilitate remote working and learning resulted in unexpected expenditure on IT systems and equipment while the requirement to make campuses compliant with social distancing rules led to additional expenditure on sanitation, signage and medical supplies. It has been noted in the report where the pandemic resulted in a significantly different pattern of expenditure than would otherwise have been the case.

3.4.2 A Snapshot in Time

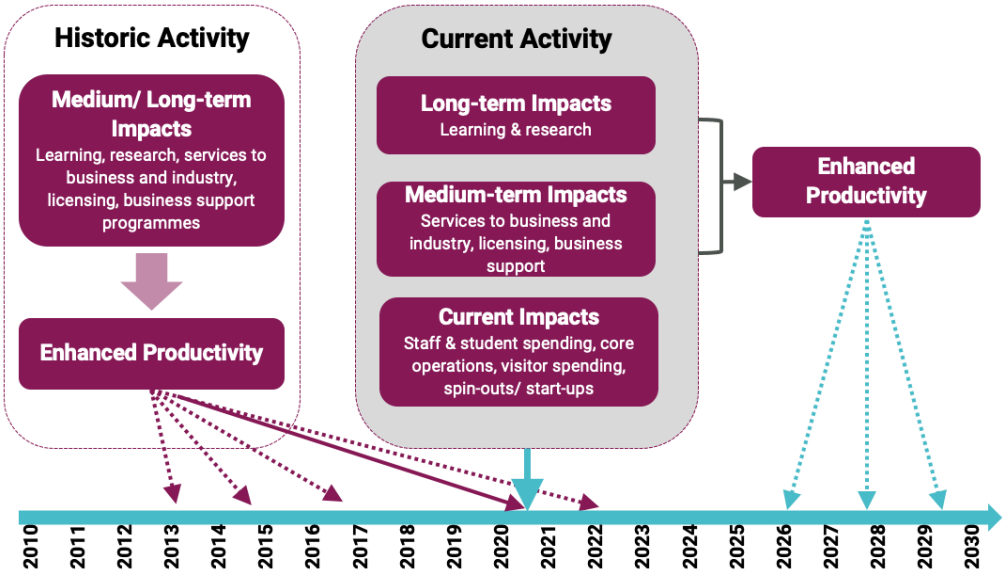
This study is intended to provide a measure of the University's impact at a snapshot in time for 2020/21. However, in designing this approach, it is recognised that some of the University's activities generate economic impact immediately, for example, staff and student spending, while for most activities the economic impacts will occur over a longer time frame, for example, research. Therefore, the impact generated in

[4] ONS (2020), Annual Business Survey 2018 Revised
[5] Scottish Government (2020), Scottish Input Output Tables
[6] ONS (2019), UK Economic Multipliers 2015

2020/21 will be the cumulative impact of historic activity plus some immediate impacts of spending in that year.

Limitations in data mean that it is generally not possible to estimate the true impact of historic activity that is realised in any particular year. To overcome this issue, the report makes the simplifying assumption that activity in 2020/21 generates impact in 2020/21. The rationale for this is that although the impact of some activity that occurs in 2020/21 will not occur until a later date, some of the impact that was realised in 2020/21 will have been generated by historic activity and no attempt is made to quantify the impact of this. Figure 3-2 summarises the different types of activity considered in the report and the time-scale over which they generate impact. The blue arrows represent impact generated by current activity and the purple arrows represent impact generated by historic activity. The dashed arrows represent future impacts and the solid arrows represent impact in the current year.

Figure 3-2: Impact Time Frame



Source: BiGGAR Economics

3.5 Reporting Definitions

The quantifiable economic impacts have been assessed using two widely accepted economic measures: **Gross Value Added (GVA):** which measures the monetary contribution that an organisation adds to the economy through its operations; and **Employment:** which is measured in terms of headcount jobs supported.

These measures provide a convenient way of capturing the entire economic contribution in a single number. However, monetary figures highlight only part of the value of an impact. This report recognises that it is not possible to quantify all of the impacts of a higher education institution because:

- the data for monetisation of many of the benefits is at an early stage of research;
- not all economic and social impacts can be converted into monetary value;
- monetary value does not capture aspects such as quality and equality; and
- monetary value is static and does not capture the dynamic activities that drive economic and social impact.

The impacts are reported at five geographic levels:

- Dundee City (local authority area)
- Tay Cities Deal Area;
- Scotland;
- the UK; and
- Globally

4. Operational Impacts

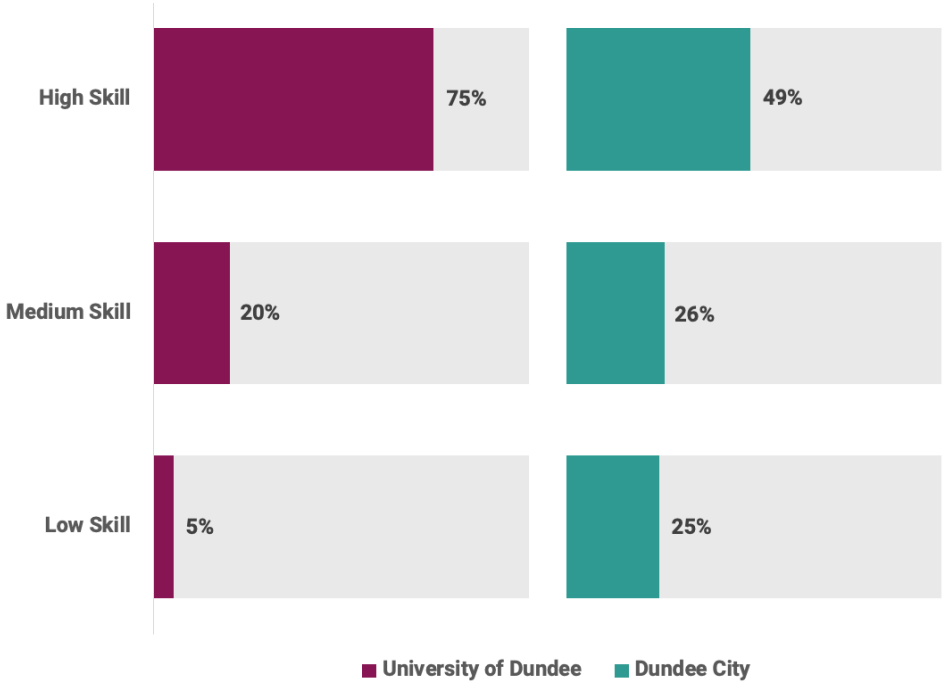
This section summarises the economic impact created through the University's operational activities, including employing staff and the buying in of goods and services.

Operational impacts result from the existence of any large organisation with a significant income, staff complement and extensive supply chain. These impacts mainly reflect the scale of the organisation. It is through its operational impacts that the University creates the most impact in the local area, in quantifiable economic terms.

The University of Dundee is one of the largest employers in Dundee City and therefore its operational impacts are felt strongest in the City.

The 3,280 staff that were employed at the University are in predominantly highly skilled and well paid. Across the University, 75% of employees were in High Skill jobs[7] and only 5% were in employment classified as Low Skill. Across Dundee City as a whole, just under half (49%) of the jobs are classed as High Skill. The University accounts for 7% of all the High Skill jobs in the City. High Skill jobs include managers, directors, professional and technical occupations, which includes all of the academic staff at the University. However, even with the academic staff excluded, the non-Academic staff were more likely than their peers across Dundee City to be employed in a High Skill position.

Figure 4-1 Occupation by Skill Level, University of Dundee and Dundee City



[7] High Skill is defined as Standard Occupation Classification levels 1 – 3, Medium Skill are levels 4 – 6 and Low Skill are levels 7 – 9.

Source: HESA, ONS Labour Force Survey

The staff employed at the University of Dundee were paid more than average for Dundee City because they worked in higher skill occupations. On average male staff of the University of Dundee earn 4% more than other males employed in Dundee City and female staff earn 14% more.

4.1 Core Impacts

The core economic impacts generated by the University of Dundee are those which occur as a result of its day-to-day activities and those of its staff. It included its direct impact, supply chain spending impact, staff spending impact and capital investment.

4.1.1 Direct Impact

The direct impact that the University of Dundee's core operations have on the economy is captured by its direct GVA and employment. Direct GVA has been estimated as the sum of the University's operational surplus, which was £4 million[8] in 2020/21 and its total staff cost. The University's direct GVA in 2020/21 was therefore £166 million GVA.

Over that year, the University of Dundee directly employed 3,280 people worldwide. In addition, the University of Dundee also employed 990 atypical staff[9]. In total, this was equivalent to 3,140 full-time equivalent (FTE) jobs. The vast majority of this employment was based at the campuses in Dundee City.

Table 4-1 Direct Impact

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)	164	166	166	166	166
Employment	3,120	3,120	3,140	3,140	3,140

Source: BiGGAR Economics Analysis

4.1.2 Supply Chain Spending Impact

The University of Dundee's expenditure on goods and services creates an economic impact by increasing turnover and employment of companies in its supply chain. In 2020/21, the University of Dundee spent £82 million on purchasing goods and services.

The University sent £12 million purchasing goods and services from Dundee City and the rest of the Tay Cities Region. The University tries to support local community procurement where possible. One example of this is Dovetail Enterprises, a furniture manufacturer which provides employment and training opportunities for disabled and disadvantaged members of society. The University worked with Dovetail to provide hybrid working stations to support employees working from home during the pandemic. Dovetail provided a desk, chair and footstool, which they delivered and installed at staff home locations. The University has also partnered with Dovetail for benches and picnic tables for outside spaces across the campus, and for raw materials for the Art, Design & Architecture Degree Show. Additionally, Dovetail has arranged site visits to their factory for the University's design and woodwork manufacturing students.

[8] This excludes the impact of US$ adjustment to staff costs
[9] This includes staff which are employed on a non-permanent basis, such as answering a phone during clearing, staging an exhibition or organising a conference. Often these are managed via an agency

It was estimated that spending on supplies by the University of Dundee generated £5 million GVA and 110 jobs in Dundee and £14 million GVA and 260 jobs in Scotland.

Table 4-2 Supplier Spending Impact

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)	5	7	14	75	86
Employment	110	140	260	1,210	1,390

Source: BiGGAR Economics Analysis

4.1.3 Staff Spending Impact

In 2020/21, the University of Dundee directly employed 3,140 staff, who made an economic impact when they spent their salaries and stipends. Staff and student spending supports the businesses they buy from, allowing these businesses to maintain their operations and support their own workforces.

In 2020/21, total staff costs at the University of Dundee amounted to £161 million. The distribution of this spent, and associated economic impact, is primarily determined by where the staff live. The majority of University staff (61%) live in Dundee City. A further 13% live in the rest of the Tay Cities Region, 23% live in the rest of Scotland and 2% live elsewhere in the UK. The remaining 1% live outside of the UK. Based on analysis of household spending patterns[10], it was possible to estimate where staff spend their salaries by study area.

In this way, it was estimated that staff spending at the University of Dundee contributed £22 million GVA and 580 jobs in Dundee City and £55 million GVA and 1,450 jobs in Scotland.

Table 4-3 Staff Spending Impact

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)	22	32	55	117	126
Employment	580	840	1,450	3,460	3,720

Source: BiGGAR Economics Analysis

4.1.4 Capital Investment Impact

The University of Dundee created economic impact through its spending on capital projects such as the construction of new buildings and investment in new equipment.

Capital spending fluctuates from year to year, so an average has been taken of the University's capital spending over ten years (2016/17 to 2025/26). On this basis, annual capital spending was estimated at £26 million.

Capital spending will include expenditure in the construction sector, on buildings, and in the manufacturing sector. Across the university sector[11], 77% of capital expenditure is on construction and the remainder was invested in equipment. It was assumed that the University of Dundee has a similar split of capital investment.

[10] ONS (2021) Family spending in the UK: April 2019 to March 2020
[11] Frontier Economics (2015) A Review of HEFCE Capital Expenditure

In this way it was estimated that, through its capital spending, the University of Dundee generated £3 million GVA and 60 jobs in Dundee City and £12 million GVA and 260 jobs in Scotland.

Table 4-4 Capital Spending Impact

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)	3	5	12	23	23
Employment	60	100	260	540	540

Source: BiGGAR Economics Analysis

4.2 Operational Impacts Summary

The University of Dundee's operational impacts generated:

- £195 million GVA and support 3,860 jobs in Dundee City;
- £208 million GVA and 4,190 jobs in the Tay Cities Region;
- £246 million GVA and 5,100 jobs in Scotland;
- £380 million GVA and 8,350 jobs across the UK and
- £400 million GVA and 8,790 jobs globally.

Table 4-5 Summary of Operational Impacts

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)					
Direct Impact	164	164	166	166	166
Supplier Spending	5	7	14	75	86
Staff Spending	22	32	55	117	126
Capital Spending	3	5	12	23	23
Total	**195**	**208**	**246**	**380**	**400**
Employment					
Direct Impact	3,120	3,120	3,140	3,140	3,140
Supplier Spending	110	140	260	1,210	1,390
Staff Spending	580	840	1,450	3,460	3,720
Capital Spending	60	100	260	540	540
Total	**3,860**	**4,190**	**5,100**	**8,350**	**8,790**

Source: BiGGAR Economics Analysis. Note: Totals may not sum due to rounding.

5. Student Impacts

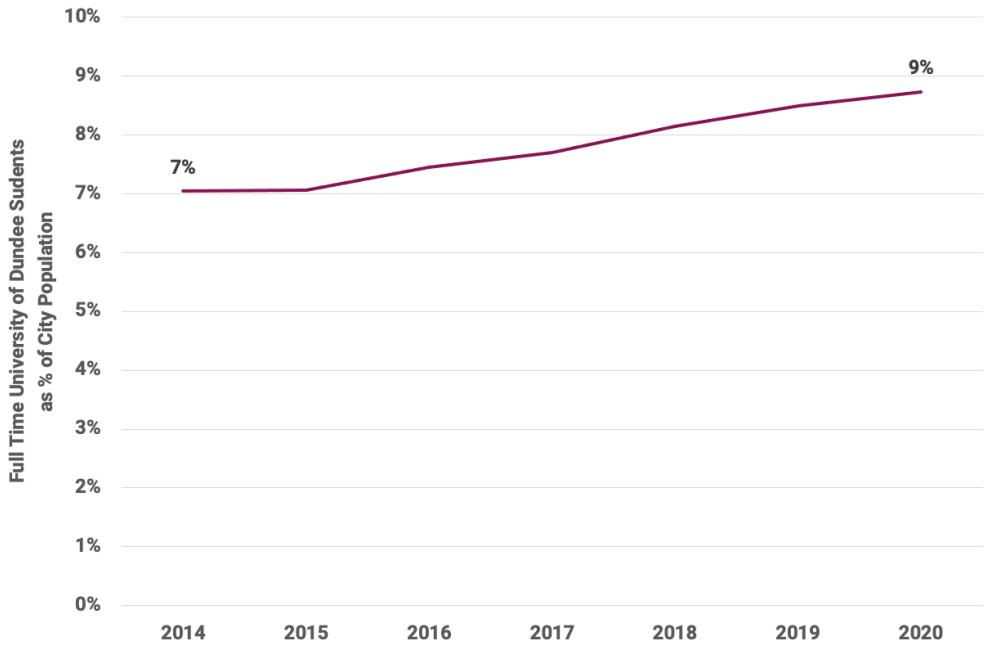
This section summarises the economic impact generated by the students at the University of Dundee, including student spending, student work and student volunteering.

5.1 Student population

Students are a fundamental part of the population of Dundee City. In 2020/21, there were 12,995 full-time students enrolled at the University of Dundee. This is equivalent to 9% of the total population of Dundee City. With the addition of the 3,900 full time students of Abertay University the full-time student population accounts for more than 10% of the total population of the City.

The student population is becoming an increasingly important demographic of the City. Since 2014/15 the number of full-time students at the University of Dundee has increased by 25%, from 10,435 to 12,995. In the same time period, the overall population of Dundee has remained static. Therefore, the full-time student population has grown from being equivalent to 7% of the population of the City in 2014/15, to 9% in 2020/21. Without the growth in student numbers, it is likely that the population of Dundee City would have decreased in this time period.

Figure 5-1 FT Students of the University as Share of Dundee City Population



Source: HESA, ONS Population Estimates

The student population is not evenly distributed across Dundee City. Analysis of council tax exemptions records shows that the majority of students live in the areas of:

- Perth Road;

- City Centre;
- Logie and Blackness; and
- Docks and Wellgate.

In Perth Road, the intermediate Zone with the highest student population, over half (53%) of all occupied households have a council tax exemption that would indicate the residents were all full-time students.

Figure 5-2 Share of households with 'Occupied Exemptions' for Council Tax

Source: National Records of Scotland (2021) Household Estimates

In addition to the demographic and cultural changes that the students of the University of Dundee have, the students at the University generate economic impacts through their day-to-day spending and through undertaking part-time work during their course of study. These impacts are quantified in this chapter.

5.2 Student Spending

Students at the University of Dundee made an economic contribution through their spending during term-time which supported turnover and employment in local businesses. The analysis has focused on full-time students as their spending patterns, labour market participation and volunteering differ from those of part-time students and are more likely to be additional.

The starting point in estimating the impact from student expenditure was to consider how much students spend each week. This was based on the Department for Education's "Student income and expenditure survey 2014/15"[12], with figures updated for inflation. Adjustments were made to account for the types of accommodation that students occupy (for example, those living at home will spend less than those renting) and to remove spending on University accommodation (which has already been included as income for the University).

There were restrictions on the ability of students to participate in face-to-face learning and wider economic activities during the 2020/21 academic year as a result of the Covid-19 pandemic. Where possible, adjustments have been made to reflect this. Using HESA data on the accommodation of students during term time[13], it was estimated that, as a result of the Covid-19 pandemic, the number of University of

[12] Department for Education (2018), Student income and expenditure survey 2014 to 2015.
[13] HESA (2022), Table 57 – Full-time and sandwich HE student enrolments by HE provider and term-time accommodation 2014/15 to 2020/21

Dundee students staying in provider-maintained properties and private sector halls fell by 11% between 2018/19 and 2020/21. Adjustments were made to account for this effect.

Kirkcaldy Campus

In addition to the students at the main campus in Dundee City, there are also students based at the Kirkcaldy campus, in Fife outwith the Tay Cities Region. These students also have an impact on the local economy through their activities.

The Kirkcaldy Campus was established when nursing was first incorporated as a discipline at the University, and the existing College of Nursing in Kirkcaldy became part of the University. There are around 25 staff and 400 nursing students based at the Kirkcaldy Campus. The Campus primarily attracts students from the surrounding local areas and is very much a campus for Kirkcaldy and Fife.

The Campus has a high proportion of mature students, students from deprived backgrounds (i.e. SIMD20 or SIMD40), and students who are the first in their families to go to University. Many of the students at the Campus would not have moved to Dundee to study because it would be impractical for them. Without the Kirkcaldy Campus therefore, many of these students would not have gone to University at all. Once these students graduate, they are more likely to stay in the area thereby supporting NHS Fife in being able to recruit locally and maintain the workforce they require.

In total, it was estimated that the full-time students of the University spent £88 million in the wider economy of Dundee City in 2020/21. This spending covered housing costs, entertainment, travel and other living costs.

This spending generated £48 million GVA and 1,280 jobs in Dundee City and £63 million GVA and 1,670 jobs in Scotland.

Table 5-1 Student Spending

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)	48	52	63	90	92
Employment	1,280	1,360	1,670	2,520	2,560

Source: BiGGAR Economics Analysis

5.3 Student Employment

Students created an economic impact through their part-time work, which allows businesses to deliver their services and benefit their individual supply chains as a result. Based on the labour force survey[14], it was assumed that 33% of full-time students worked, for an average of 14 hours per week[15] in a range of economic sectors. Students were assumed to work where they live. Not all of these jobs will be

[14] ONS (2021) Labour Force Survey, Table A06: educational status economic activity & inactivity of young people – average of employment rate of those aged 18 – 24 in full time education, Aug 2020 – Sept 2021
[15] National Union of Students (2010), Still in the Red: Student finance in 2010

additional as some may displace non-students, so an adjustment was made to account for the relatively low youth unemployment rate in each of the study areas.

The impact of student employment was converted into GVA and employment impacts by applying appropriate sectoral ratios and multipliers. As with student spending, an adjustment was made to account for the effects of Covid-19, which has a significant impact on student employment. In particular it is estimated[16] that the majority of students in part time employment are employed in either the retail or hospitality sectors. Both of these sectors experienced significant restrictions on their ability to trade and as a result the economic contribution that the staff of these sectors were able to make diminished significantly during these restricted periods.

Some students were also likely to have worked for the University of Dundee, these have been excluded from the analysis as their impacts will have been counted in the previous section.

In total, the 5,200 students that were estimated to hold a part time job outside of the University contributed an additional 56,000 hours to the Scottish labour market. Based on the industries of employment, it was estimated that the part-time of full-time students at the University of Dundee generated £28 million GVA and 1,140 jobs in Dundee City and £37 million GVA and 1,440 jobs in Scotland.

Table 5-2 Student Employment

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)	28	29	37	57	58
Employment	1,140	1,170	1,440	1,830	1,870

Source: BiGGAR Economics Analysis

5.4 Student Volunteering

Students at the University of Dundee created an economic impact through their activity as volunteers. While this enables them to acquire useful skills, it also allowed the organisations where they volunteer to deliver their services. The analysis was informed by a National Union of Students survey, which reported that, on average, 31% of students volunteer an average of 44 hours per year[17]. Adjustments were made to account for the effects of Covid-19. In total, the time volunteered by University of Dundee students in 2020/21 was estimated to be approximately 110,700 hours.

To estimate the contribution made through volunteering activity, the total hours volunteered were multiplied by £8.20, which represents the minimum wage for 21- to 24-year-olds from April 2020 to March 2021[18].

In this way, it was estimated that volunteering by University of Dundee students in 2020/21 generated £1 million GVA in Dundee City and across Scotland.

[16] Department for Business Innovation and Skills (2013) BIS Research Paper Number 142: Working While Studying
[17] NUS Connect (2014), The Student Volunteering Landscape
[18] UK Government (2022), National Minimum Wage and National Living Wage rates

Table 5-3 Student Volunteering

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)	1	1	1	1	1

Source: BiGGAR Economics Analysis

5.5 Student Impacts Summary

Adjusting for Covid-19 effects, impacts arising from the University's students were estimated to generate:

- £77 million GVA and support 2,410 jobs in Dundee City;
- £82 million GVA and 2,530 jobs in the Tay Cities Region;
- £101 million GVA and 3,110 jobs in Scotland;
- £148 million GVA and 4,350 jobs across the UK and
- £151 million GVA and 4,440 jobs globally.

Table 5-4 Summary of Student Impacts

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)					
Student Spending	48	52	63	90	92
Student Part-Time Work	28	29	37	57	58
Student Volunteering	1	1	1	1	1
Total	**77**	**82**	**101**	**148**	**151**
Employment					
Student Spending	1,280	1,360	1,670	2,520	2,560
Student Part-Time Work	1,140	1,170	1,440	1,830	1,870
Total	**2,410**	**2,530**	**3,110**	**4,350**	**4,440**

Source: BiGGAR Economics Analysis. Note: Totals may not sum due to rounding.

6. Graduate Outcomes

The education that the students received at the University of Dundee increased their skills, productivity and ability to earn after they leave the University. These graduates will also result in improved profitability for the companies that employ them and more effective service delivery for those who are employed in the public sector.

There are also improved wellbeing impacts associated with graduation from University. Indeed, analysis of national surveys[19] has shown that life satisfaction for graduates has increased at a significantly faster rate than their non-graduate counterparts in the UK. This increased life satisfaction is not only associated with greater levels of income, but also other positive life outcomes, such as improved health outcomes, and the ability to have a greater level of interest and satisfaction in their jobs.

6.1 Employment Profile

People who earn a university level degree have better outcomes in the labour market than those who do not. This include higher levels of employment and higher earnings of those in employment.

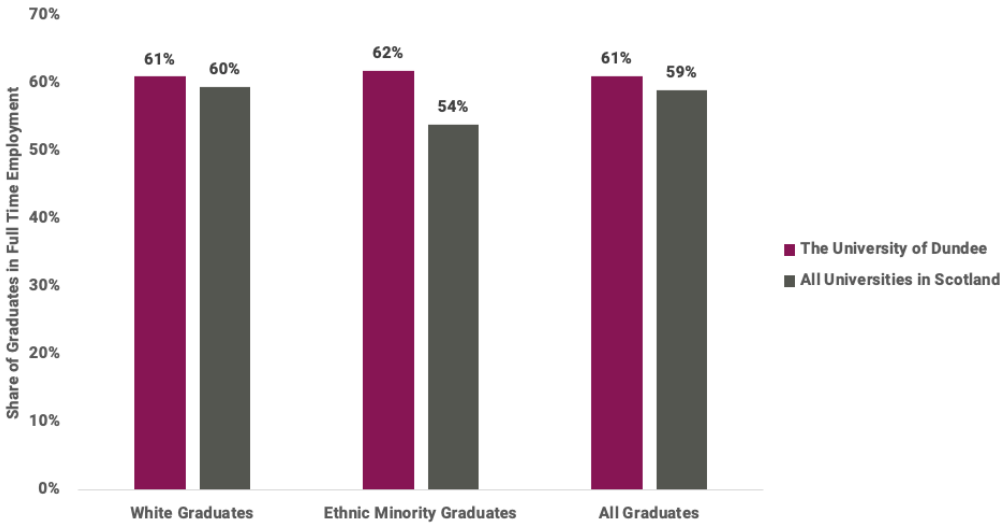
Graduates of the University of Dundee performed particularly well in the labour market, even compared to graduates of other Scottish universities. Of those who graduated from the University of Dundee in 2018/19, 61% found full time employment, compared to 59% of all graduates from Scottish universities. Students also went on to other positive destinations, such as further study.

Ethnic minority graduates of the University of Dundee have better employment outcomes than those who attend other universities in Scotland. Ethnic minorities account for 16% of the graduate cohort of the University of Dundee, compared to 10% across Scotland. The latest data, which covers the 2018/19 cohort of graduates, found that ethnic minority graduates of the University of Dundee were more likely (62%) than to enter full time employment after study, compared to their peers across other Scottish universities (54%). Indeed, they were more likely to enter full time employment in 2018/19 than their white classmates (61%)[20].

[19] Fitzroy and Nolan (2018) Education, Income and Happiness: Panel Evidence for the UK – Empirical Economics (2020)

[20] It should be noted that in the 2017/18 cohort of University of Dundee white graduates were more likely (64%) to enter full time employment than ethnic minority graduates (55%).

Figure 6-1 Graduates in Full Time Employment by Ethnicity



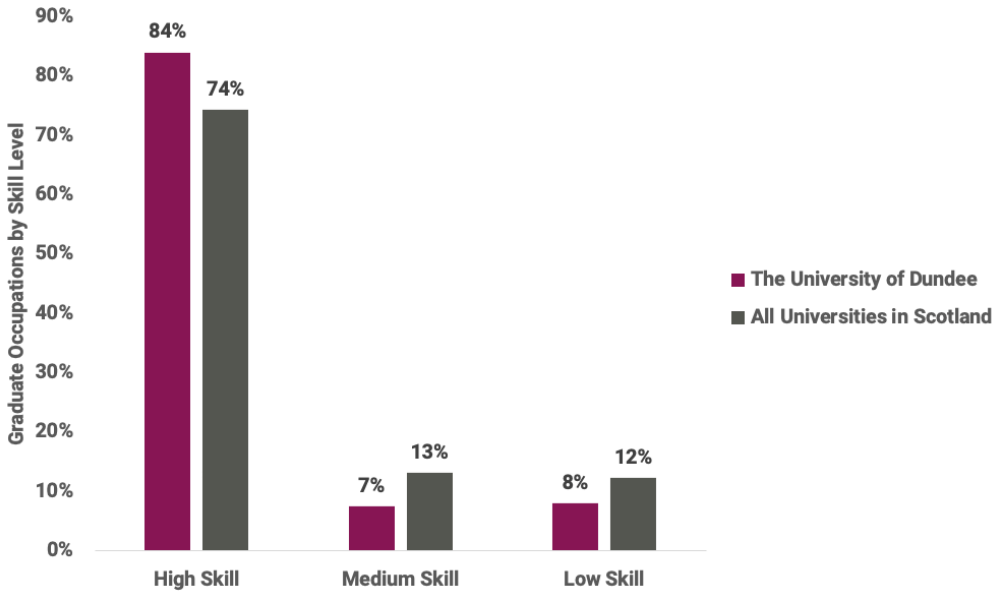
Source: HESA (2021) Graduate Outcomes - 2018/19 Cohort

The same survey found that female graduates of the University were more likely to enter full time employment (62%) than either male graduates of the University of Dundee (60%) or the average for female graduates across Scotland (59%).

6.1.1 Occupation Level

The graduates of the University of Dundee are highly likely to enter high skilled employment after graduation. The share of Dundee graduates who were in High Skill occupations is 84%. This is the third highest of all Scottish universities. Consequently, Dundee students are less likely to be in either low or medium skill occupations after graduation.

Figure 6-2 Occupation Level of Graduates

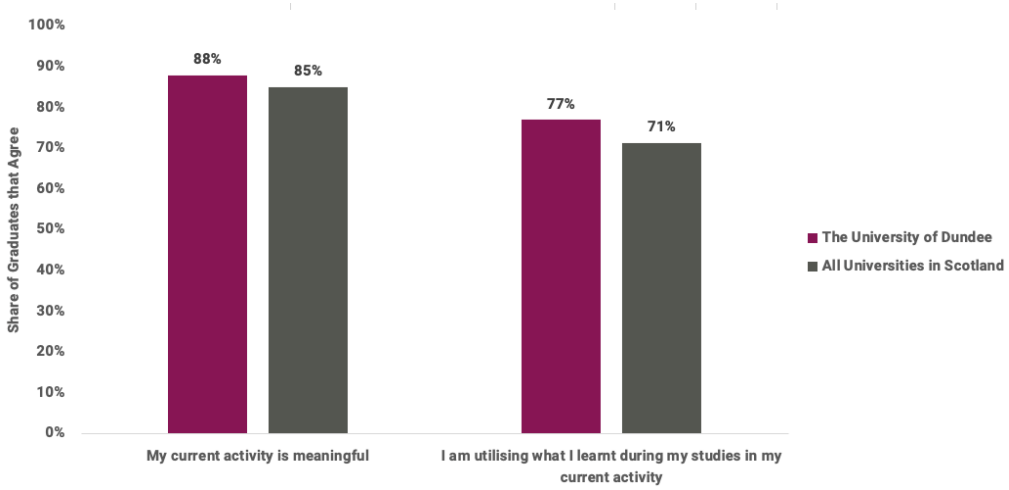


Source: HESA (2021) Graduate Outcomes - 2018/19 Cohort

6.1.2 Wellbeing Indicators

The vast majority of the graduates of the University in Dundee are able to find meaning in their work. The proportion of Dundee graduates in full-time professional employment who agreed with the statement “my current activity is meaningful” (88%) is the (joint)[21] highest of any Scottish university. It was the only institute in Scotland for which the majority of graduates ‘Strongly Agreed’ with this question. In addition, 77% of graduates of the University of Dundee felt that they were actively applying what they had learned at University in their currently employment. This is significantly higher than the Scottish average of 71%.

Figure 6-3 Perceptions of employment and wellbeing of graduates



Source: HESA (2021) Graduate Outcomes - 2018/19 Cohort

The ability to find meaning and purpose in employment is an important contributor to individual well-being. Studies[22] have found that in addition to improved professional outcomes, such as lower absenteeism, lower employee turnover and higher job satisfaction, a higher sense of meaning and purpose at work also leads to improved outcomes outside the work place such as self-reported levels of happiness. Therefore, the ability of the University of Dundee to prepare its students for meaningful employment is a significant contributor to their life long well-being.

6.1.3 Sectors of Employment

The high proportion of graduates of the University of Dundee who find their work both meaningful and relevant to their studies is likely to be linked to the types of jobs that they do and the sectors that they are employed in.

The sectors of graduate employment are shown in Figure 6-4 for the University of Dundee and all Scottish Universities. One third of graduates of the University of Dundee work in the health and social care sector. This is also the largest source of employment for graduates across the Scottish economy, but graduates of the University of Dundee are much more likely to work in this sector.

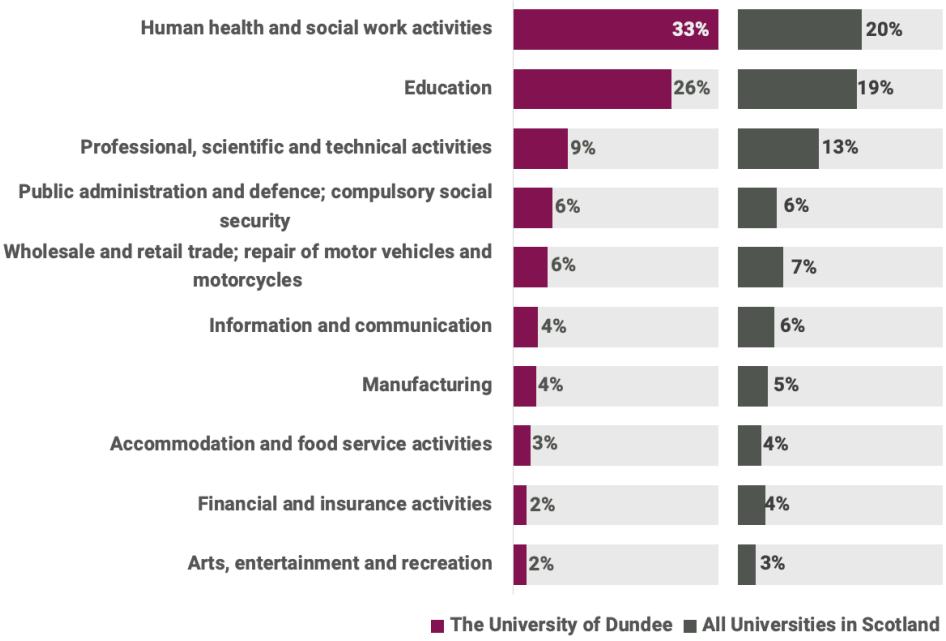
The education sector is the second highest source of employment for both graduates of the University of Dundee and the entire Scottish graduate pool.

These two sectors account for the majority of employment of graduates of the University of Dundee. Subsequently, they are less likely to work in other fields such

[21] The other Scottish Universities which had 88% of graduates responding positively to this question include the Royal Conservatoire of Scotland, Queen Margaret University, Glasgow Caledonian
[22] Steger, Michael. (2016). Creating Meaning and Purpose at Work. 10.1002/9781118977620.ch5.

as professional services, manufacturing or financial and insurance services. The proportion of graduates who are employed in the Arts, entertainment and recreation sectors is also lower than the average for the Scottish economy.

Figure 6-4 Sectors of Graduate Employment



Source: HESA (2021) Graduate Outcomes - 2018/19 Cohort

6.2 Assessing Lifetime Productivity Impacts

By completing their studies at university, graduates acquire skills that make them more productive than they would otherwise have been. The personal graduate premium includes the additional earnings that the graduate can achieve from having their degree, plus the fiscal contribution they make to the Exchequer, less the costs they incurred in studying, which is largely accounted for by student loans.

Graduates are also more likely to be employed than those without a university education. In 2017[23], the employment rate of graduates in the UK labour market was 82%, compared to 78% for individuals with A Level or equivalent qualifications. Therefore, the decision to go to university not only means that the graduates are more productive when they are employed, but they are also more likely to be in employment than individuals who chose not to go to university. Although not quantified, the increase in labour market participation is also an economic benefit to the economy.

Beyond this, businesses that employ graduates become more profitable and can generate a greater economic impact than they would otherwise have done. The GVA and productivity gains that they realise include the additional profits that employers can generate by employing graduates and the additional employment costs they are willing to pay to generate these additional profits.

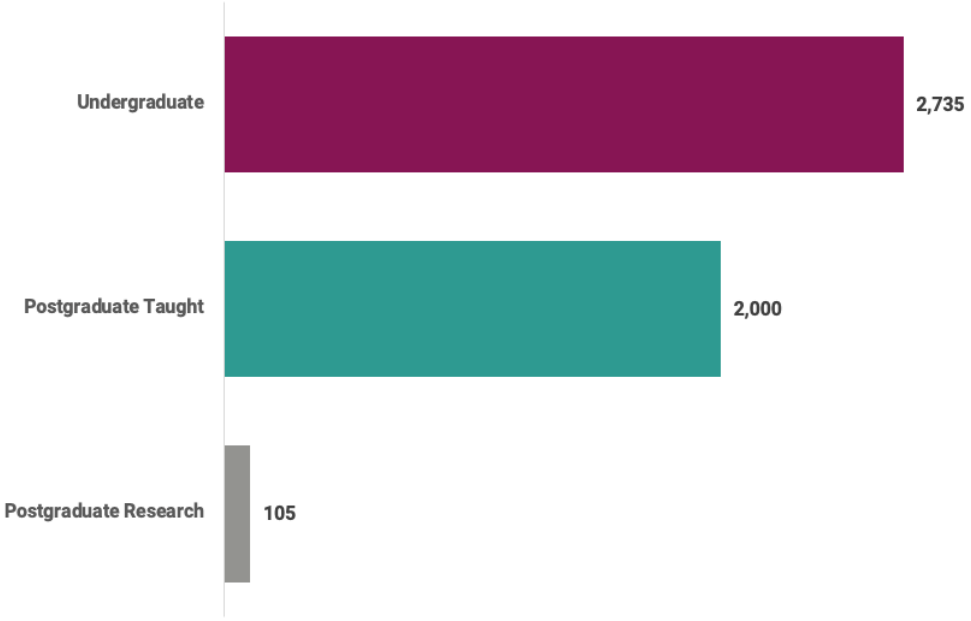
Therefore, the total economic contribution includes the graduate premium plus the additional corporate profits and taxes that they generate. In this way, the total

[23] ONS (2018) Graduates in the UK Labour Market 2017. *These are the latest available data at UK level comparing graduates' outcomes and outcomes for individuals with A Level qualifications.

graduate premium gives 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 is an under-estimate of the total economic impact associated with increased graduate productivity as it does not include the corporate profit associated with each graduate.

The starting point in estimating the graduate premium associated with the University of Dundee was to consider the number of awards delivered. In 2020/21, the University of Dundee awarded 4,845 degrees. The majority (56%) of these were Undergraduate degrees, followed by Postgraduate Taught (41%) and Postgraduate Research (2%).

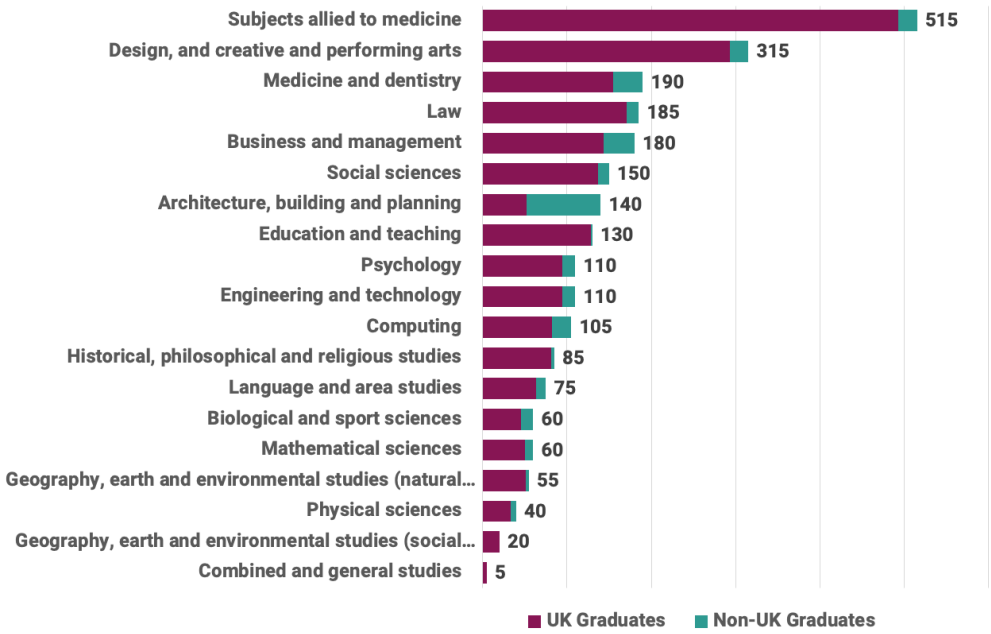
Figure 6-5 Number of Awards by Type



Source: HESA

To estimate both the personal and fiscal graduate premium from undergraduate degrees it was necessary to consider the number of awards by subject. As shown in Figure 6-6, Subjects allied to medicine was the subject area with the largest number of graduates, followed by Design, and creative and performing arts, Medicine and dentistry.

Figure 6-6 Number of First Undergraduate Awards by Subject



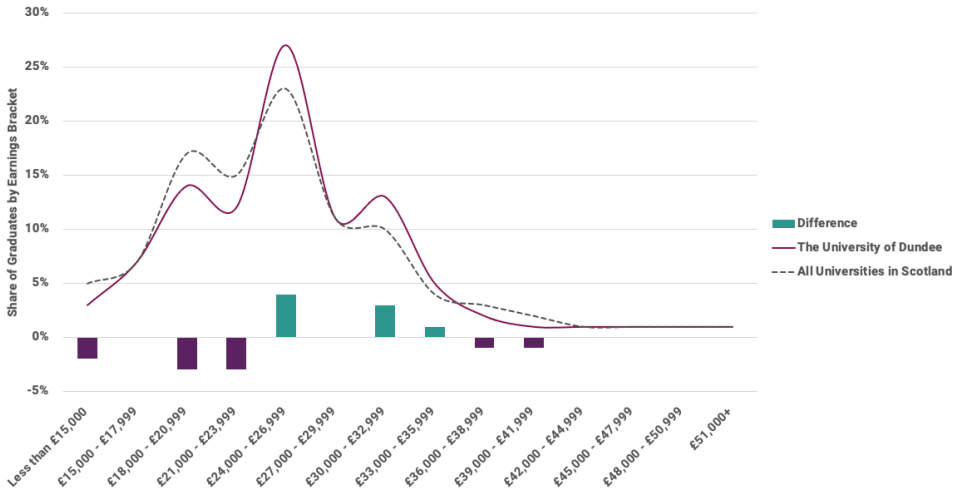
Source: HESA

The estimate of personal graduate premium relies on data for discounted lifetime earnings from different degrees. These were sourced from a recent study by the Institute for Fiscal Studies (IFS) on the impact of undergraduate degrees on lifetime earnings[24]. The IFS study estimates discounted lifetime earnings across different types of universities and accounts for the background of students, including their sex, ethnicity, and participation of local areas (POLAR) status.

The University of Dundee, as a pre-1992 University, is associated with graduate earnings by subject which are broadly in line with the sector average. Data from HESA shows that the earnings of graduates of the University of Dundee are broadly in line with the average for Scotland as a whole[25]. In particular, three years after graduation Dundee graduates are less likely than their peers to be high earners (above £36,000) or low earners (below £24,000). This is shown in Figure 6-7 which finds that more than a quarter of graduates are earning between £24,000 and £27,000

[24] IFS (2021), The Impact of undergraduate degrees on lifetime earnings.
[25] HESA (2021) UK Domiciled Graduates who obtained first degree qualifications and entered full-time employment in the UK by provider and salary band, accessed via https://www.hesa.ac.uk/data-and-analysis/graduates/table-26

Figure 6-7 Graduate Earnings Profile

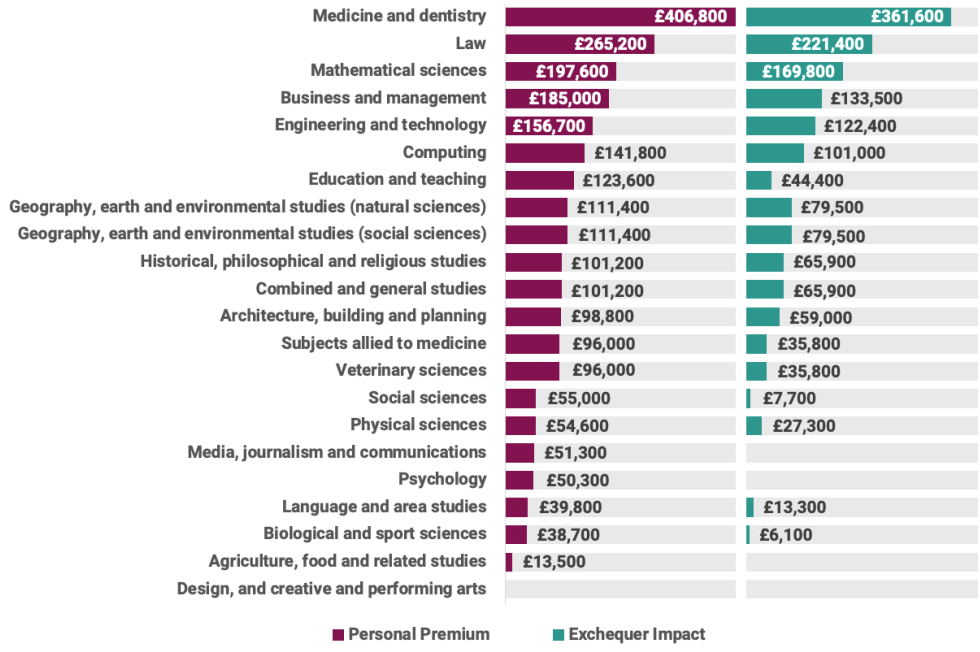


Source: HESA

The average premium per graduate, both the personal returns and the benefits to the Exchequer as a result of obtaining an undergraduate degree are highlighted in Figure 6-8. This shows that Medicine and Dentistry is linked with the highest earnings premium and highest benefit to the Exchequer for each undergraduate degree awarded.

Some subjects have lower, or no, earnings premium associated with the award of an undergraduate degree. This includes Design, and creative and performing arts, which is one of the areas of strength of the University of Dundee and is the second largest contributor to the graduate cohort. This is because typically graduates of this subject earn less than those with similar characteristics who did not chose to study at University. This does not mean that the graduates of these subjects do not contribute to the economy through their work, rather it means that they are not well paid for doing so.

Figure 6-8 Graduate Premium and Fiscal Impact by Subject per UG Award



Source: BiGGAR Economics analysis of IFS Data

The total undergraduate productivity impacts, including the personal graduate premium and the Exchequer impacts of this increased productivity, were estimated by multiplying the number of graduates by their respective premiums. In total this found that those who received an undergraduate degree from the University of Dundee in 2020/21 would earn at least £600 million over their lifetimes as a result of their education, of which £200 million would be paid in taxes to the Exchequer.

The economic impact from postgraduate awards was based on evidence from the ONS[26]. This found the lifetime earnings associated with those holding postgraduate qualifications are 10% larger than for those with an undergraduate degree. To estimate the extra premium from a postgraduate degree, the undergraduate premium was then applied to the distribution of postgraduates by subject and then weighted by 10%. In this way, it was estimated that the extra benefits (i.e., excluding those for also having an undergraduate degree) from being awarded a postgraduate degree at the University of Dundee are £17,800. This figure was then multiplied by the number of postgraduate awards to estimate the premium associated with postgraduate degrees. A similar approach was taken for fiscal impacts.

The geographic distribution of the graduate productivity impacts is dependent on where the graduate lives and works. Data provided by the University of Dundee found that;

- 18% of graduates lived in Dundee City;
- 66% of graduates lived in Scotland,
- 86% of graduates lived in the UK; and
- 14% lived outside the UK.

It was assumed that 10% of graduates who lived in Scotland, but not Dundee City, lived elsewhere in the Tay Cities Region. Therefore, the majority of the graduate productivity impacts are retained in Scotland.

In this way, the total graduate productivity impacts were estimated to be:

- £112 million GVA from graduates living in Dundee City;
- £143 million GVA from graduates living in the Tay Cities region;
- £421 million GVA from graduates living in Scotland;
- £552 million GVA from graduates living in the UK; and
- £603. million GVA from all graduates

Table 6-1 Productivity Impacts of Graduates of the University of Dundee

	Dundee City	Tay Cities Region	Scotland	UK	Global
Graduate Premium	67	85	252	330	382
Exchequer Impact	45	57	169	221	221
Total	112	143	421	552	603

Source: BiGGAR Economics Analysis

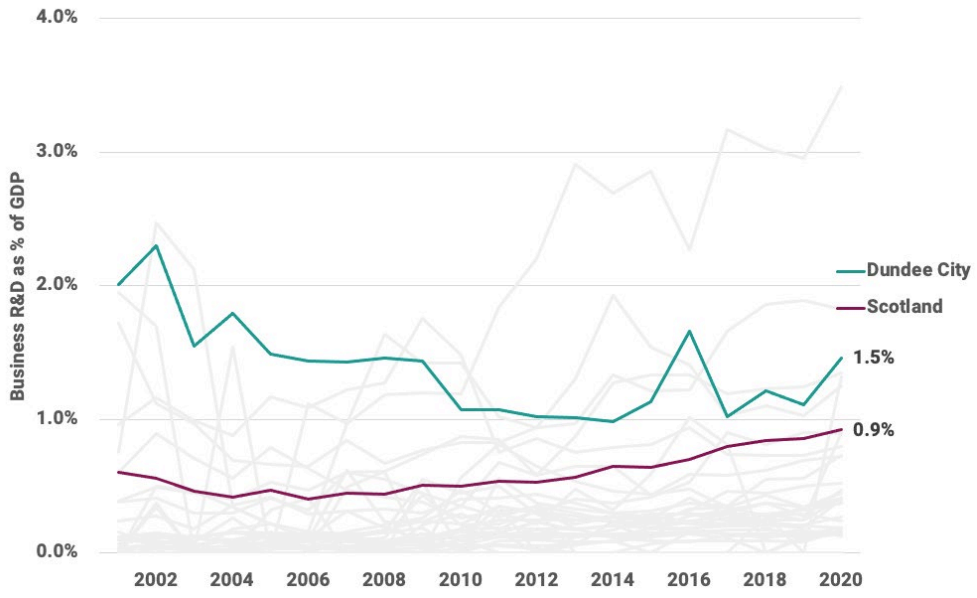
[26] ONS (2019), Human capital estimates in the UK: 2004 to 2018, available at: https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/humancapitalestimates/2004to2018

7. Innovation

The research undertaken at the University supports technological innovation through the commercialisation of research outputs and knowledge exchange with businesses.

Dundee City is an innovative place. For the past 20 years, businesses in Dundee City have consistently invested more in research and development than the Scottish average. In 2020, businesses invested the equivalent of 1.5% of the City's GDP on research and development activities. This is the third highest of all the Scottish local authorities after West Lothian (3.5%) and the City of Edinburgh (1.9%). Across Scotland the level of business investment in R&D was equivalent to 0.9% of the national GDP.

Figure 7-1 Business investment in R&D as % of GDP, Scottish Local Authorities



Source: Scottish Government (2021) Business Enterprise Research and Development Scotland 2020

Businesses invest in R&D to create new or improved products or services. This in turn can allow them to grow, become more productive and improve their economic output.

The knowledge and research within a University can directly support business innovation through its knowledge transfer and innovation activities. This includes;

- creating companies directly out of innovative ideas generated at the University, such as through spin out or start-up companies;
- licencing new technologies and approaches to existing companies;
- providing productivity and research services, either through contract research, consultancy, continuing professional development or facilities hire, to companies that are innovating; or

- placing students, including Knowledge Transfer Partnership associates, within companies to enable them to directly benefit from the teaching of a University.

The University of Dundee is comparatively strong in some areas of knowledge transfer and innovation, and less so in others. According to the latest returns of the Higher Education Business and Community Interaction Survey, out of the 18 Scottish Universities the University of Dundee ranks:

- 1st for income from sale of shares in spin-outs;
- 3rd for income from other intellectual property assets;
- 4th for income from contract research;
- 4th for income from consultancy;
- 4th for total employment supported by active spin outs and start-ups;
- 6th for income from facilities and equipment hire;
- 6th for the cumulative patent portfolio;
- 8th for the total number of active spin outs and start-ups; and
- 8th for the number of new spin outs and start-ups.

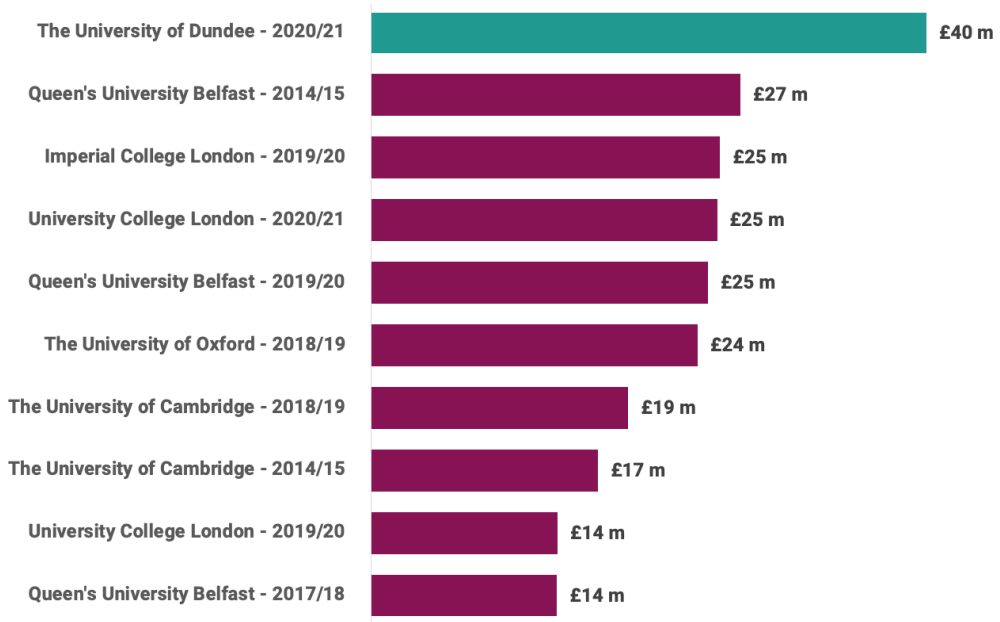
The University of Dundee will also support business innovation indirectly, as organisations learn from the research that academics publish openly. Evidence of this could be found in overall productivity improvements in the sectors that are most directly related to the research in question. This chapter quantifies the economic impacts associated with the direct knowledge transfer and commercialisation activities, namely;

- Intellectual Property and Commercialisation
  - Licencing;
  - Spin out and start-up companies;
- Services for business
  - contract research;
  - consultancy;
  - facilities and equipment related services;
  - continuing professional development (CPD)
- Knowledge Transfer Partnerships; and
- Student placements.

7.1 Intellectual Property and Commercialisation

In 2020/21, the University of Dundee had intellectual property income of over £41 million. This was the largest amount received by a Scottish university and across the UK it was second only to the University of Oxford. This was an exceptional year for the University of Dundee as it received £40 million of income from the sale of shares in Exscientia. This is the largest value exit of a spin out company by any UK university since at least 2014/15.

Figure 7-2 Largest Annual Sale of Shares by UK University 2014 – 2021



Source: HESA (2022) Business and Community Interaction Survey

7.1.1 Licencing

One of the ways in which research activity is translated into economic activity is through licensing agreements with industry. Licence agreements give companies the legal right to use a particular technology or other type of intellectual property (IP) to generate additional sales, reduce costs or otherwise improve their profitability. In return, companies pay royalties to the University. In 2002, Goldscheider[27] analysed the returns from licensing agreements by industry sector and found that the royalties rate varied between 2.8% and 8.0%.

Data provided by the University of Dundee indicates that licencing income accruing to the University was £470,000 in 2020/21. The vast majority (72%) of the University's licences were within the School of Life Sciences, reflecting the University's strengths in drug development as discussed further in Section 8. In order to estimate the turnover linked to the licences, the revenue derived from royalties was divided by 4.9%, which represents the median royalty rate paid across the sectors in the Goldscheider study. Analysis of the location of licence holders indicates that 43% of licence holders were based in the UK, with almost a quarter located in Dundee City.

The companies that held these licences were estimated to have increased their turnover by £9.6 million globally as a result of the technologies developed by the University of Dundee.

Based on the sectors of the companies that held these licences, it was estimated that licences from the University of Dundee supported £2 million GVA and 20 jobs in Dundee City and £6 million GVA and 80 jobs in the UK.

[27] Goldscheider et al. (2002), Use of the 25 Per Cent Rule in Valuing IP.

Table 7-1 Licensing Impact

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)	2	2	3	6	13
Employment	20	20	40	80	140

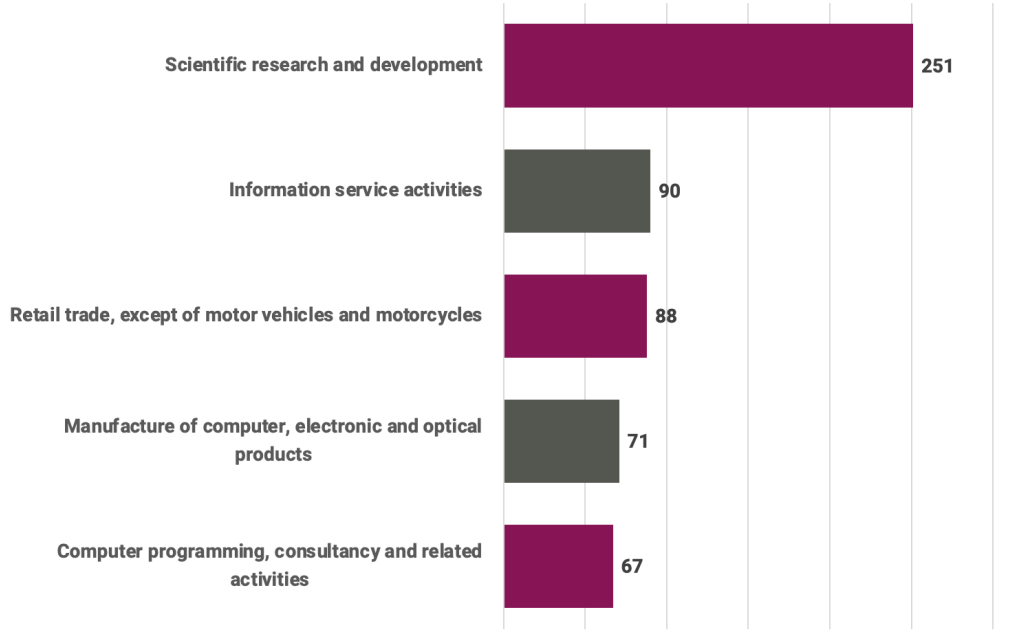
Source: BiGGAR Economics Analysis

7.1.2 Spin-Outs & Start-Ups

Research undertaken by the University can be commercialised directly, through the creation of a spin-out company to bring a specific new product, service or technology to market. In addition, students at the University can set up their own companies related or unrelated to their field of study.

In 2020/21 the University of Dundee had 21 active spin-out companies which collectively employ 380 people across the UK and have a combined estimated turnover of £26 million. In addition, the University had 58 start-ups, employing 283 staff and a total turnover £51.2 million. The University's largest start-up is Beer52, a craft beer subscription company, with 82 employees. As Figure 7-3 illustrates, the vast majority of employment (251 employees) in the University's spin-outs and start-ups is in the scientific research and development sector.

Figure 7-3 Employment in Spin-Outs and Start-Ups by Sector



Source: BiGGAR Economics Analysis

Where turnover data was available, this was used to estimate direct GVA by applying sector appropriate turnover to GVA ratios. If only employment data was available, the number of employees was multiplied by the sector appropriate average GVA per employee ratio to estimate direct GVA. Where a company had employees but no reported turnover, it was assumed that it was in the early stages of product development and may not yet be generating revenue.

Impacts were attributed by study area based on the location of the companies. In this way it was estimated that the University of Dundee's spin-out companies supported

£13 million GVA and 210 jobs in Dundee City and £61 million GVA and 770 jobs in the UK.

Table 7-2 Spin-Outs & Start-ups Impact

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)	13	14	61	118	127
Employment	210	230	770	1,560	1,710

Source: BiGGAR Economics Analysis

7.2 Services for Business

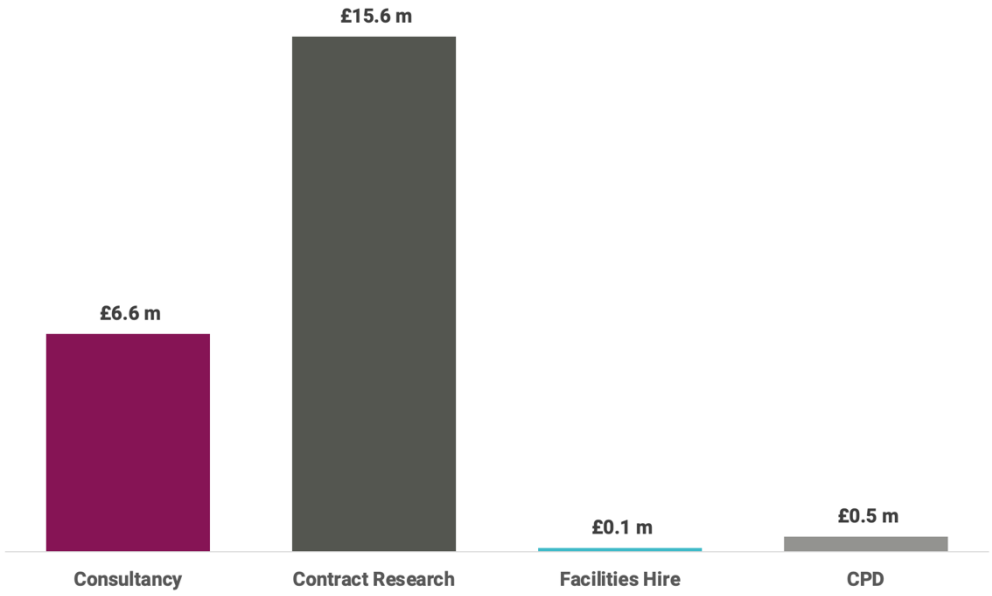
The University of Dundee generated economic value by providing services to business. Through collaboration with the University, businesses benefit from the latest research findings and best practice coming from academia and this can led to increased productivity and higher profits. A more productive workforce is likely to benefit from higher wages which will support the economy when spent.

This section considers the following services that the University of Dundee provides to businesses:

- contract research;
- consultancy;
- facilities and equipment related services; and
- continuing professional development (CPD).

In 2020/21, the University of Dundee received £23 million in income from these services. As shown in Figure 7-4, the majority of this income from is contract research agreements with businesses. The majority of this income came from international companies and organisation and so the jobs created and GVA supported was assumed to be realised outside of the UK. Consultancy contracts were the second largest source of income and the majority of these were placed by Scottish organisations. Therefore, it is the largest driver of impact within Scotland.

Figure 7-4 Services to Business, Income to the University of Dundee by source



Source: University of Dundee

Research and development projects paid for by industry can have an impact on the economy in several ways. They can increase the productivity of staff employed by the company, enable the company to offer a new product or service that supports growth, or allow them to improve an existing product or service.

The services that the University of Dundee will offer commercial clients are bespoke to the needs of the clients and will vary depending on what the client is looking to gain. For some early-stage companies, academics within the University of Dundee have input specialist knowledge at the start to guide how a company develops from an idea to a commercial success. An example of this is the work that has been done with the start-up IT company Waracle[28], where guidance was sought on how employment conditions could be structured to maximise recruitment and staff retention in a highly competitive labour market. This guidance has helped Waracle grow from a company of 10 employees in 2017 to one of 200 by 2020.

The value to an individual business of collaboration with the University will vary considerably between projects. It is based on the type of work done, the stage in the development process that the project relates to and the capacity of the company to absorb the knowledge and developments that result from the collaboration. However, in order to quantify this impact, it is necessary to estimate what this value would be to a company based on typical returns from these collaborations.

The economic impact associated with spending on engagement with a university partner was assumed to be 340%. This was based on the evidence from a study by Department of Business, Enterprise & Regulatory Reform[29], which found that interventions in Science, R&D and innovation infrastructure had achieved cumulative GVA equivalent to 340% of the cost of the projects in the short to medium term and up to 870% in the long-term. In addition, the research contracts will directly support

[28] University of Dundee (2022) Impact Case Study (REF 3)Addressing the Uniqueness Paradox by Changing HR Strategy and Practice in a Global and Local Company
[29] PriceWaterhouseCoopers, Impact of RDA spending – National report – Volume 1 – Main Report, March 2009, DBERR.

employment within the University itself. These employment impacts have not been included here to avoid double counting the impacts in Section 4.

It was therefore estimated that the £23 million invested by companies in collaborating with the University of Dundee in 2020/21 supported £22 million GVA in Dundee City and 80 jobs and £53 million GVA and 190 jobs in Scotland.

Table 7-3 Services for Business Impact

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)	22	30	53	125	177
Employment	80	110	190	550	820

Source: BiGGAR Economics Analysis

7.3 Knowledge Transfer Partnerships

The University of Dundee is an academic participant in the Knowledge Transfer Partnership (KTP) programme. The KTP programme recruits graduates to work on joint industry academic projects, in which companies use the research expertise of universities to overcome certain challenges that they are facing. These placements last for approximately three years.

The economic impact of KTPs stems from the increased productivity the industrial partner achieves from overcoming the issue they were looking to address. For example, since 2011 the engineering firm Rautomead Ltd has completed two KTPs with the University of Dundee. The objectives of these KTPs have been to:

- To process new complex high-performance alloys by improving the capability and performance of continuous casting machinery; and
- To develop and implement state-of-the-art, bespoke modelling and simulation tools into the design process for continuous casting machines. To address the demand for low weight copper alloy wiring for the rapidly evolving automotive, aerospace and high-speed rail market.

Rautomead Ltd used the KTPs to conduct research and product development to overcome specific issues that it was facing. In doing so it has reported that it has been able to improve efficiencies by reducing production lead times by 25%. The improved efficiencies, as a result of the KTP, has enabled it to earn an additional £1 - £2 million per year.

Data on improved economic outcomes is only available for some companies that participated in the KTP programme. To estimate the impact of the entire KTP programme at the University of Dundee it is necessary to use project evaluation data that covers the entire UK wide programme. A study by Regeneris Consulting[10] found that in the six years after their completion, each KTP contributed £713,000 GVA to the economy for companies based in Scotland and supported three jobs throughout the economy. While a KTP is ongoing its economic impact is assumed to be a lot smaller as the benefits of any research will not be realised in the early stages of development.

Analysis of the KTP Online database indicates the University of Dundee has completed 9 KTPs in the last six years and has one ongoing project at the moment. By applying the findings of the Regeneris review to the number of KTPs in each

study area, it can be shown that the KTP programme at the University of Dundee supported £1 million GVA and 30 jobs in Scotland.

Table 7-4 Knowledge Transfer Partnerships Impact

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)	<1	<1	1	1	1
Employment	10	20	30	30	30

Source: BiGGAR Economics Analysis

7.4 Student Placements

Placements provide students with an opportunity to develop skills in the workplace and allow businesses to benefit from the knowledge that students have acquired during their studies.

In 2020/21, there were 628 students of the University who undertook placements. The contribution students on placement make to the organisations they are placed in is lower than the average output expected by a worker in the sector and would require more time spent training. To reflect this, it was assumed that the GVA of students undertaking a placement is 33% of the GVA generated by a sector's average worker. Economic ratios and multipliers were then applied to estimate the economic impact of student placements.

In this way it was estimated that the placements undertaken by University of Dundee students in 2020/21 contributed £3 million GVA to the Scottish economy and supported 10 jobs.

Table 7-5 Student Placements Impact

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)	1	2	3	4	4
Employment	<10	<10	10	20	20

Source: BiGGAR Economics Analysis

7.5 Graduate Apprenticeships

The University of Dundee is one of the providers of a new programme of Graduate Apprenticeships launched by Skills Development Scotland (SDS). They provide a new way for people who are currently in employment to study for a degree, or who want to work in a relevant role gaining the right experience while studying.

In 2020/21, 90 students at the University of Dundee were undertaking graduate apprenticeships. The impact of graduate apprenticeships was estimated based on the contribution made by apprentices to the businesses where they work while studying. The economic impacts of apprentices were weighted by 57% which is the

ratio between the average salary of an apprentice in the UK[30] and the median gross pay in Scotland[31].

In this way it was estimated that graduate apprenticeships provided by the University of Dundee supported £3 million GVA and 70 jobs in Dundee City and £6 million GVA and 120 jobs in the UK.

Table 7-6 Graduate Apprenticeships Impact

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)	3	3	5	6	6
Employment	70	80	110	120	120

Source: BiGGAR Economics Analysis

7.6 Innovation Impacts Summary

Drawing together all these sources of impact, innovation related activity at the University of Dundee was estimated to generate:

- £42 million GVA and support 390 jobs in Dundee City;
- £51 million GVA and 450 jobs in Tay Cities Region;
- £126 million GVA and 1,160 jobs in Scotland;
- £260 million GVA and 2,360 jobs across the UK; and
- £328 million GVA and 2,850 jobs globally.

[30] All About School Leavers (2021), How much will I earn on a Degree Apprenticeship?, available at: https://www.allaboutschoolleavers.co.uk/school-leaver-options/degree-apprenticeships/how-much-will-i-earn-on-a-degree-apprenticeship
[31] ONS (2021), Annual Survey of Hours and Earnings (ASHE) 2021.

Table 7-7 Summary of Innovation Impacts

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)					
Licensing	2	2	3	6	13
Spin-outs & Start-ups	13	14	61	118	127
Services to Businesses	22	30	53	125	177
KTPs	<1	1	1	1	1
Student Placements	1	2	3	4	4
Graduate Apprenticeships	3	3	5	6	6
Total	**42**	**51**	**126**	**260**	**328**
Employment					
Licensing	20	20	40	80	140
Spin-outs & Start-ups	210	230	770	1,560	1,710
Services to Businesses	80	110	190	550	820
KTPs	10	20	30	30	30
Student Placements	<10	<10	10	20	20
Graduate Apprenticeships	70	80	110	120	120
Total	**390**	**450**	**1,160**	**2,360**	**2,850**

Source: BiGGAR Economics Analysis. Note: Totals may not sum due to rounding.

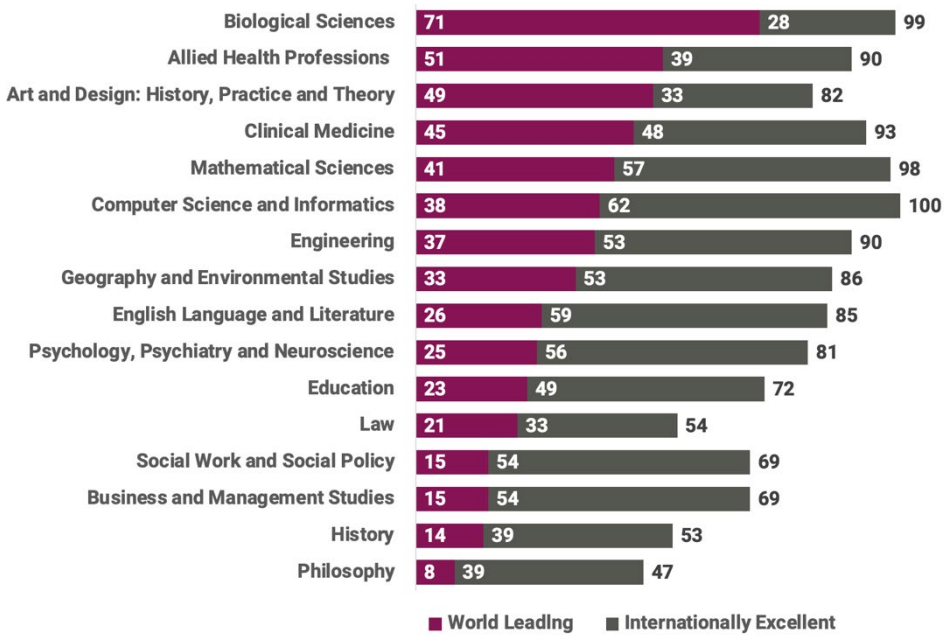
8. Life Sciences & Healthcare

A global reputation in life sciences, medicine and dentistry coupled with strong translation capabilities yield important economic and societal benefits.

The University of Dundee has internationally recognised teaching, research and clinical excellence in life sciences and healthcare. The University's researchers lead future clinical and commercial developments in life sciences and healthcare, with translation of research leading to important innovation impacts. Long-term strategic investment in assets such as the Drug Discovery Unit and a well-established track record of working with industry has had far reaching impacts.

Subjects related to life sciences and healthcare are those in which the University of Dundee scored highest in the REF 2021 exercise. Biological Sciences is the subject area in which the University of Dundee had the highest proportion of research classed as World Leading (71%). This was the highest of any university in the UK. Allied Health Professions (including Dentistry, Nursing and Pharmacy) and Clinical Medicine were also high achieving subject areas in the REF 2021.

Figure 8-1 Percent of REF 2021 returns classified as either World Leading or Internationally Excellent, University of Dundee



Source: REF 2021

The University's teaching activity provides a consistent supply of trained professionals which enhances healthcare provision locally, regionally and nationally. The University is also a key partner with NHS Tayside at strategic and operational levels including through the teaching hospital at Ninewells and the Dundee Dental Hospital. Together, these strengths underpin the region's globally recognised bio sciences cluster.

8.1 A Global Reputation

The University of Dundee has a long-standing global reputation as a leader in teaching and research in life sciences and healthcare. 'The State of Innovation' report by Clarivate Analytics in 2017 ranked the University as the most influential scientific research institution in the world for pharmaceuticals for the period 2006-16.

8.1.1 School of Life Sciences

With around 700 staff, it is the largest School at the University and attracts on average around £40 million of competitively won research income per year. Research in the School of Life Sciences is world leading, achieving the highest aggregate score of all UK universities in the REF 2021 for Biological Sciences.

Teaching in the School of Life Sciences is also highly regarded, with the University of Dundee ranked 44th in the world for Pharmacy & Pharmacology and 93rd for Biological Sciences in the 2022 QS World University Rankings by subject.

8.1.2 School of Medicine and School of Dentistry

The School of Medicine is the second largest school at the University in terms of staff numbers. In the REF 2021, 93% of submissions from Clinical Medicine were classed as either World Leading or Internationally Excellent. The School also has an outstanding reputation for teaching and was ranked 3rd for Medicine in the UK in the Complete University Guide 2022.

The School of Dentistry was ranked 6th in the UK for dentistry according to the Complete University Guide 2022 and consistently ranks in the top 10 dental schools in the UK across several league tables.

8.2 Commercialisation through Company Creation

The University of Dundee has been exceptionally successful in creating high-growth spin-out companies in the life sciences and medical technology sectors. The impact of these companies have been quantified in the previous section. Examples include Amphista Therapeutics, which is developing therapeutics that harness the body's natural processes to degrade and remove disease-causing proteins selectively and efficiently. This new approach offers several advantages such as broad therapeutic applicability, better drug response at lower doses as well as reduced side effects and disease resistance.

Exscientia

University of Dundee spin-out company which is at the forefront of Artificial Intelligence (AI) driven drug discovery and design.

Exscientia is a spin-out company of the University of Dundee that is based on the research of Professor Andrew Hopkins. It was formed in 2012 and focuses on using AI to precision engineer new medicines. The company's mission is to encode and automate every stage of drug design and development in order to make safer, more sophisticated drugs available to all, more quickly and efficiently.

Drug development is a lengthy and costly process; developing a new drug is estimated to cost £2.1 billion and takes 10-15 years. Using AI drug discovery

platforms allows Exscientia to shorten the pre-clinical drug discovery stage and in turn, substantially accelerate the path to clinical testing and subsequent delivery of new treatments to patients worldwide. To date, the company has been able to advance seven precision designed drugs from project initiation to development candidate in an average time of 12 months. This early drug discovery phase would normally take between three to six years[32]. By reducing the time and costs of preclinical drug discovery the company could revolutionise the way drug discovery works.

Exscientia has grown into a market leader in AI-driven drug design. Exscientia were the first to automate drug design and the first company to have AI designed molecules entering clinical trials. Headquartered in Oxford, the company has 200 employees, across 6 offices globally (including one in Dundee). In 2020/21, the company had an annual turnover of £13 million and its recent Initial Public Offering raised around $510 million and was valued at $2.9 billion. The company also has 18 partnerships with major global pharmaceutical companies, including a $100 million partnership with Sanofi where research will be focused on up to 15 novel small molecule candidates across oncology and immunology. The company has won numerous prizes including the Queen's Award for Enterprise in Innovation, recognizing its pioneering work in the field of AI-driven drug discovery. In 2021, Exscientia was named the number one fastest growing pharma/biotech company in the UK in the Alantra Pharma Fast 50.

[32] http://phrma-docs.phrma.org/sites/default/files/pdf/rd_brochure_022307.pdf

In 2021 Amphista employed 17 people and had an estimated turnover of over £2.5 million. Its economic impact is considered in Section 7.1.2. The company recently secured £38 million investment, one of the largest investments of this kind to be made in Scotland and a testament to the quality of science emerging from the University.

Current Health is a start-up company created by medical student Chris McCann while studying at the University. He developed a wearable armband that uses artificial intelligence to monitor a patient's health. The company was last year acquired by a US-based technology retailer for £200 million, in a deal thought to be one of the largest of its kind.

8.3 Industry Collaboration

The University of Dundee has strong links with commercial organisations. In particular, the School of Life Sciences has a well-established track record of working with industry, with approximately a tenth of its research income coming from industry-funded sources. Three important examples highlight the university's collaborative strengths:

- the Division of Signal Transduction Therapy (DSTT) is considered to be one of the world's largest and longest running collaborations between the pharmaceutical industry and any academic research institute and has been operational for over 20 years;
- the University's Drug Discovery Unit collaborates with industry partners to translate world-class biological research into novel drug targets and candidate drugs for diseases of unmet medical need (i.e., diseases for which treatments either do not exist or are ineffective); and
- the new Centre for Targeted Protein Degradation (CeTPD), which opened in 2022 and supports collaboration with leading pharmaceutical companies to tackle cancer and other conditions by targeting disease-causing proteins for degradation.

Division of Signal Transduction Therapy (DSTT)

A model of university-industry collaboration.

The DSTT is a unique collaboration involving the Medical Research Council Protein Phosphorylation and Ubiquitylation Unit (MRC PPU), other leading researchers in Dundee's School of Life Sciences, and a number of the world's leading pharmaceutical companies. The aim is to develop improved treatments in multiple therapeutic areas, including cancer, arthritis, lupus, hypertension and Parkinson's disease by accelerating the early-stage development of future drugs that target specific cell signalling systems.

The main benefit to the pharmaceutical companies is close interaction with the scientific groups and other partner companies, and the advice, opinions and foresight of leading academics. The Division does not conduct contract research on behalf of member companies, instead the companies have access to the ongoing fundamental research projects designed by Dundee scientists and have the opportunity to co-design projects within the academic laboratories. In addition, the companies visit Dundee twice a year for a three-day meeting that includes a scientific symposium where the latest research data is presented and a series of one-to-one meetings with research groups as requested by the companies.

Established in 1998 this long-standing collaboration has attracted almost £60 million of investment and is widely regarded as a model for how academia should interact with industry, for which it was awarded the Queen's Anniversary Prize for Higher Education in 2006. The collaboration has led to the development and clinical approval of over 40 drugs that target kinases, mainly for the treatment of cancers with sales of many billions of pounds a year.

Drug Discovery Unit (DDU)

A drug discovery research lab which works with industry to de-risk novel drug targets for neglected tropical diseases.

The University's Drug Discovery Unit is a unique venture; a drug discovery research lab in a university which bridges the gap between academic scientific research and commercial drug discovery and development. The unit employs 130 scientists, currently has four drugs in clinical development and has nine licensed assets to pharmaceutical companies. The Unit has multi-million-pound partnerships with pharmaceutical companies such as GlaxoSmithKline, Takeda Pharmaceuticals and Pfizer, bringing millions in international funding to Dundee which would not have come to Dundee without it.

One of the DDU's core areas of activity is anti-infectives drug discovery. In low- and middle-income countries, more than 450 million people are at risk of diseases such as malaria, leishmaniasis, Chagas' disease and cryptosporidiosis. Existing treatments can be expensive, difficult to administer, unsafe and/or increasingly ineffective as the parasites that underly these conditions develop resistance. The development of drugs for low- and middle-income countries is unattractive for pharmaceutical companies given the high investment costs and low likelihood of recovering these costs from developing nations. The work of the DDU is to find new ways for drugs to work, reducing the risk for pharmaceutical companies and making it more likely they will invest. The DDU therefore makes drug development cheaper and more efficient for companies, and solutions more viable for non-governmental organisation working in developing countries.

Sleeping sickness is endemic in 36 sub-Saharan countries, placing 57 million people at risk. This is a potentially devastating disease mostly affecting rural populations. DDU has developed a rapid diagnostic test, which can be used anywhere and provides results in 15 minutes. The previous test required a blood sample and needed refrigeration, labs and trained personnel to administer and achieve a result. The new test developed by the DDU overcomes these issues and is suitable for large scale use in rural locations. The test is affordable, costing $0.50 each and provides the same level of accuracy as the previous test. Rapid diagnostic tests are critical for quickly identifying infected individuals for treatment thereby saving lives of those immediately infected, reducing transmission and supporting disease elimination. The DDU's original research has been adopted through partnership with The Foundation for Innovative New Diagnostics, which announced that 450,000 rapid diagnostic tests will be donated by global healthcare company Abbott to scale up testing for sleeping sickness[33].

A further example of successful collaboration is the development of two new preclinical candidate drugs with the potential to treat visceral leishmaniasis. Both drugs are currently in clinical trials. The DDU, GSK Global Health Research and Development and Wellcome have been working together since 2011, to discover new preclinical candidate drugs for visceral leishmaniasis and Chagas disease. Visceral leishmaniasis is caused by a parasite, which is spread through the bite of infected sandflies. People infected with the disease suffer fever, weight loss and anaemia, and the disease is typically fatal unless treated. The World Health Organisation (WHO) estimates that over 600 million people are at risk of visceral

[33] https://www.dundee.ac.uk/stories/dundee-research-help-eliminate-sleeping-sickness

leishmaniasis. It is estimated that there are 50,000–90,000 new cases per year, giving rise to 20,000 to 40,000 deaths annually. The current available drugs have limitations and are not ideal for use in resource-poor settings, resulting in a clear need for new and improved treatments which the DDU is fulfilling.

A final example is of the DDU working with pharmaceutical and partner NGO Medicines for Malaria. The World Health Organisation estimated[34] there were 220 million cases of malaria in 2020 resulting in over 627,000 deaths. Over three quarters of those who died were under 5. There are current treatments for malaria but they can be expensive and resistance to these treatments is spreading. This has increased the need for new treatments to be made available to tackle malaria. Research is looking at the potential to re-purpose drugs to see if they can be re-used in different formats and stages. Researchers in the Drug Discovery Unit at the University of Dundee have invented the compound DDD107498 that can treat malaria with a single dose, taken orally, and has been proven as effective in clinical trials. It is effective against parasites at every stage of their life cycle and meets the goal of providing treatment costing 1 US dollar. This is now in its first human trials.

The process through which the molecule DDD107498 has been discovered and developed is also significant in itself. The DDU was able to quickly characterise the drug and its safety profile. This has reduced the risk to pharmaceutical companies that have looked to progress this drug to market, and ultimately impact. The development of new drugs, particularly those in low- and middle-income countries, requires significant up-front costs and the outcomes are often unknown. It therefore represents a risky investment to pharmaceutical companies. Any process which de-risks this investment will led to more treatments being developed and therefore less people dying from preventable diseases.

Centre for Targeted Protein Degradation (CeTPD)

A new translational research centre that will support the development of new treatments based on fundamental research at the University of Dundee

University of Dundee academic, Professor Alessio Ciulli, is one of the pioneers of a new drug type that changes the way medicines interact with diseases inside individual cells. It is called proteolysis-targeting chimeras (PROTACs) and it targets disease causing proteins for degradation. This process has allowed previously thought to be untreatable conditions to be medicated and has stimulated over $3.5 billion of investment in the global targeted protein degradation sector.

The new Centre for Targeted Protein Degradation (CeTPD) will consolidate and bolster this research at the University of Dundee and the wider development of the pharmaceutical sector. It is through this process that the research will have an impact on the lives of patients throughout the world. The University of Dundee has already successfully collaborated with pharmaceutical companies in this sector, including Boehringer Ingelheim. This collaboration was expanded in 2020/21 and will grow to

[34] World Health Organisation (2021) World Malaria Report 2021

support 30 jobs within the University by the end of 2022. Other Other company collaborations include Almirall, Eisai and Ono.

The CeTPD is based beside the new Tay Cities Regional Innovation Hub, which will support the creation of spin out companies from the research in targeted protein degradation. This offers accommodation for growing companies and support with their commercial development. The CeTPD will work closely with the Hub so the full commercial potential of this research is realised.

The economic impact that will be associated with the CeTPD in the future will be greater than the number of staff it employs or are employed within the spin out companies. The largest impact will be in the lives saved and diseases cured as a result of this technology. Two areas that the technology is currently being developed to treat are castration resistant prostate cancer, which occurs in 250,000 people each year in the USA alone, and metastatic breast cancer, which results in 500,000 deaths globally each year. The potential improvements in outcomes for these patients will be cumulative, life changing and attributable to the cutting-edge research at the University of Dundee.

8.4 Population and Public Health

The University of Dundee is embedded within the structures that support the health of the population of Tayside. There are hugely important societal benefits for the healthcare of communities served by NHS Tayside and beyond:

- Ninewells Hospital is one of the largest teaching hospitals in Europe, with 750 beds[35], and includes the medical school and the nursing school of the University of Dundee. In fact, it was the second purpose built medical school in UK and has developed a strong reputation for excellence in academic research,;
- Dundee Dental Hospital is home to the NHS Tayside Specialist Dental Services working with the University of Dundee and some Emergency Dental Care Services. This is a shared facility with staff employed by both the NHS and the university, with a pre-COVID activity of around 50,000 attendances per year;
- University medical and dental staff contribute across several NHS and local authority health structures, including the Integration Joint Board, national committees, public health initiatives. The reach of this work is not limited to public health, but to wider population health outcomes around health inequalities and environments; and
- strengths in research and clinical practice, along with high levels of trust between the university and community, mean Dundee is one of the major clinical trials areas in Scotland, with the largest cancer trials hosted here. Financed by industry, there is cutting edge treatment for patients involved in these trials without cost to the NHS.

The University of Dundee is of fundamental importance to the core services offered by these hospitals, with impacts on the population of Dundee, Tayside and Fife that extend far beyond the GVA and jobs measures provided within this economic impact assessment.

Tayside Medical Science Centre (TASC) was established in 2010 to combine the established research strengths of the University of Dundee and NHS Tayside. It is one of Europe's leading clinical trial sites, offering its many industry partners a trusted, high quality, and innovative clinical research environment that offers end-to-end support across the trial lifecycle. In the last five years alone, TASC has taken

[35] https://www.nhsperforms.scot/hospital-data?hospitalid=27

part in over 170 commercial research studies that generated £7.0 million further investment into the research infrastructure at Dundee. As well as this, patients who are enrolled in clinical trials have access to treatment and the drugs they require at no cost, as all costs are covered by the industry partners running the trials. There is considerable benefit from this given that the cost of treatment and drugs can run to several hundreds of thousands of pounds per patient.

Trials currently underway are set to transform the lives of people around the world. For example:

- Bronchiectasis is a chronic respiratory disease characterised by bronchial dilation. Research at the university of Dundee has transformed the management of this debilitating condition and supported the development of a patient registry involving over 15,000 patients from over 30 countries. The development of a new drug therapy for the treatment of this previously neglected disease is currently in Phase 3 clinical trials led by Professor James Chalmers.
- Liver disease is a leading cause of death. Each year around 23 million Liver Function Tests (LFTs) are carried out by GPs in the UK to detect liver disease, with frequent failure to follow up on the results. Professor John Dillon and team at the University of Dundee created highly cost-effective automated pathways for the investigation of abnormal liver function tests. This has led to improved patient outcomes and quality of care through the earlier diagnosis and treatment of liver disease, helping to prevent progression to cirrhosis and liver failure. The "intelligent Liver Function Test" has been adopted as standard NHS care in Tayside and is being rolled out in other regions across the UK. Since 2018 over 7,000 patients have benefitted from this approach, which has informed Scottish national health policy and contributed to the effective elimination of hepatitis C in Tayside;
- Colorectal cancer is the second most common cause of cancer death, killing around 1,600 people in Scotland every year. Research led by Professor Bob Steele at the University, has resulted in changes to the UK's colorectal cancer screening programme, saving around 2,000 deaths per year and providing a model for similar programmes in other countries. The research found that the faecal immunochemical test (FIT) was an effective way to screen for colorectal cancer, and the test was adopted for this purpose in Scotland in 2020;
- The Dental School has led on six UK multicentre trials, the highest number of any dental school and collaborated with all schools over a period of ten years - involving around 400 dental practices and 5000 patients. The Dental Health Services Research Unit at Dundee has led three large-scale randomised controlled trials addressing areas of global and national priority in clinical dentistry. These have provided evidence enabling safe dental care and increased patient access during the COVID-19 pandemic. Impacts include sustained yearly reductions in dental antibiotic prescribing influencing global action on antimicrobial resistance. This has a wider impact on policy, with the Scottish Government's 2018 Oral Health Improvement Plan, noting that the evidence trials run at Dundee have generated "has informed government thinking which underpins the design of our preventive approach"[36].

University of Dundee medical and dental researchers and clinicians have made significant contributions to health outcomes in other ways. For example, Smile4life is a national oral health improvement programme implemented across all NHS Health Boards, since 2013, when it was established by the university. Smile4life involves NHS practitioners going to NGOs, hostels and homelessness accommodations to deliver toothpaste and toothbrushes, and to tailor oral health promotion sessions to staff and service users. From 2013 to 2020, national training events been held by NHS Education for Scotland and University of Dundee have resulted in more than

[36] https://www.gov.scot/publications/oral-health-improvement-plan/

360 health and social care participants benefitting from training. Co-design is at the heart of this programme and current work involves the development of a package to promote oral health/health for people experiencing homelessness with people with lived experience, practitioners, NGOs and NES.

8.5 Forensic Science

Through the Leverhulme Research Centre for Forensic Science, the University of Dundee is raising the standards of forensic science, nationally and globally.

8.5.1 Transforming Forensic Science Research

The Leverhulme Research Centre for Forensic Science (LRCFS) at the University of Dundee was established in 2016 through a 10-year £10 million grant from the Leverhulme Trust. It is the largest grant of this nature to have been awarded for forensic science in the UK. The objective behind establishing the LRCFS was to engage directly with forensic scientists, law enforcement, legal practitioners, policy makers and members of the public to ensure the science that underpins forensic evidence going into courts is robust and reliable.

> The mission of the LRCFS is to 'bring the whole justice community together to explore and identify where the challenges with scientific evidence lie from the perspective of all stakeholders and to address these challenges, where possible, to enable fairer justice outcomes.'

To achieve this, the LRCFS has 5 structural research pillars which underpin the Centre's research, interactions with stakeholders and engagement with the public. The first of these is around how to detect physical, chemical and biological materials that may be relevant to investigations. Secondly, if materials are detected how can they be characterised in order to identify them and so that scientifically robust, valid and reliable data is created. Once there is detection and recognition, is it possible to say whether two materials have come from the same source? This involves comparison of scientific findings and providing objective comparative opinions through the power of AI and data (which has not been implemented in forensic science before). It is then necessary to understand what this means in different case circumstances, i.e. how materials move around, which is also referred to as transfer and resistance. Finally, and equally important, is how the scientific findings can be communicated within a case context to ensure they are transparent and understood by a wide range of audiences.

Although there a number of universities in the UK offering courses in forensic science, research in forensic science is much more limited, with the University of Dundee, through the LRCFS, the only place with research of this magnitude taking place. With 45 staff (including 25 staff and 20 PhD students), the LRCFS is the largest interdisciplinary forensic science research team in the UK working to address these key research issues, which are also extremely important for operational practice.

8.5.2 Creating Impact at all Levels

Perhaps the most striking aspect of the LRCFS' approach is how it has engaged widely with forensic scientists, judges, lawyers, law enforcement and the general public, creating significant impact in all parts of the process from the laboratory to courtroom.

For example, the LRCFS has worked with the Royal Society, Royal Society of Edinburgh and senior members of the judiciary to create a series of judicial primers. These are documents written by scientists and peer reviewed by practitioners. Each primer presents an easily understood and accurate position on the scientific topic in question, as well as considering the limitations of the science and challenges associated with its application, to inform admissibility of that evidence in court. Since 2016, six of these primers have been produced and distributed to judges across the UK. In addition, staff and students undertake forensic science casework and have been involved in a number of high-profile cases.

The LRCFS also works closely with law enforcement. In particular, the rise in the production of novel psychoactive substances is one of the most significant challenges facing forensic drug chemists, law enforcement agencies, prison services and policy makers. The LRCFS' research has led to the creation of ground truth datasets underpinning analysis of novel drug samples for forensic laboratories. Working closely with the Scottish Prison Service, this has helped identify and prevent drugs from entering Scottish prisons. The LRCFS has also provided intelligence on novel drug compounds to the national and international forensic drug community, which supported the decision to ban the synthetic drugs known as synthetic cannabinoid receptor agonists (SCRAs) globally.

Public engagement is a major feature of the Centre's work, with members of the public contributing to major citizen science projects and shaping the way in which forensic science research is planned, conducted and communicated. In recognition of this, the LRCFS was awarded a Gold Engage Watermark for Public Engagement by the National Co-ordinating Centre for Public Engagement (NCCPE).

The purpose of the public engagement work undertaken by the LRCFS is to raise the scientific literacy of the public, particularly in relation to forensic science, as it is members of the public who form the juries in courtrooms. It is therefore extremely important that the work of the LRCFS includes engaging with the public as widely as possible. Some examples of its success in this area include a very successful six-part podcast series exploring how forensic science has developed over the last century and the limitations that still exist, with 12,000 downloads to date. In addition, the LRCFS has worked with a TV crime drama series to ensure the science depicted is reliable and accurate so that the general public can understand the uses and limitations associated with forensic science in criminal investigations[37]. The first season of this series had 6.7 million viewers with a second season to follow. In terms of the LRCFS' mission to engage as widely as possible with the work it does, that is an incredible achievement.

As well as its regional and national importance as a leader in forensic science research, the LRCFS is recognised globally. It is one of three strategic partners with the International Forensic Strategic Alliance (IFSA), alongside the United Nations (UN) and Interpol. IFSA brings together these strategic partners and six regional networks of forensic science providers. The LRCFS has worked with IFSA in developing minimum standards of practice for all forensic providers globally to implement. The LRCFS has also helped formulate an international research and innovation position statement[38] which defines 10 priority areas where research in

[37] https://www.dundee.ac.uk/stories/crime-show-stars-investigate-universitys-forensic-centre
[38] International Forensic Strategic Alliance, Research and Innovation Position Statement 2021

forensic science needs to be focused. The position statement has been highly effective in promoting funding for research. The European Network of Forensic Science Institutes (ENFSI) presented it to the European Commission and were awarded €27 million funding for forensic science research. The LRCFS is therefore helping to raise the bar in scientific service provision for justice systems globally, by helping define global standards of practice and supporting a unified approach to research and innovation in areas of operational relevance.

Without the LRCFS therefore, there would be very little research in forensic science taking place in the UK and consequently a lack of global influence in this area. There would not be any connectivity between operational practice in the laboratory and forensic science admissibility in the courtroom. Without the LRCFS there would be no engagement with the judiciary, law enforcement and other practitioners and there would be very little wider public engagement. The work of the LRCFS is therefore hugely important for raising the standards of current forensic science nationally and globally as well as in communicating forensic science correctly and appropriately.

8.5.3 Future Opportunities

The LRCFS has established itself as a nationally and globally recognised centre for forensic science. This also has benefits and implications regionally for Dundee and Tayside, helping to support specialism in forensic science in the region. The LRCFS has leveraged £15 million of funding as part of the Tay Cities Deal to develop JustTech, an institute for innovation for forensic science, helping to create a new innovation cluster for the Tay Cities Region.

JustTech will carry on the legacy and approach that LRCFS is pioneering and create spaces for interaction and creativity. This will include prototyping spaces and a digital courtroom to explore how new technologies can be used to shape the courtrooms of the future, enabling new tools to be designed. It will also have the UK's first Data Arena, a fully immersive, virtual reality data environment interaction with data by multiple people at the same time sharing the experience, creativity and insights.

LRCFS is already creating intellectual property that can be licensed or spun-out from the University via JustTech for application within the forensic science arena or in the wider industrial landscape. The LRCFS' global standing also means that the region is ideally placed to attract collaborators with innovative IP to translate and accelerate at JustTech. JustTech will therefore act as an innovation portal, advancing new technological solutions in the criminal justice system, and leveraging those innovations back into wider industrial application in the commercial landscape. In this way, JustTech has the potential to support the development of a cluster of activity centred around forensic science technology development, with new spin-out companies being created in the region and additional jobs being created.

8.6 Economics Returns to Medical Research

Research by the Wellcome Trust on the value of medical research in the UK considers two types of return: health gains (net of the health care costs of delivering them) and economic gains[39]. This section considers the value of both.

8.6.1 Quality of Life Impact

The value of health gains was assessed by the Wellcome Trust research 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

[39] Medical Research: What's it worth? Estimating the economic benefits from medical research in the UK, For the Medical Research Council, the Wellcome Trust and the Academy of Medical Sciences, November 2008

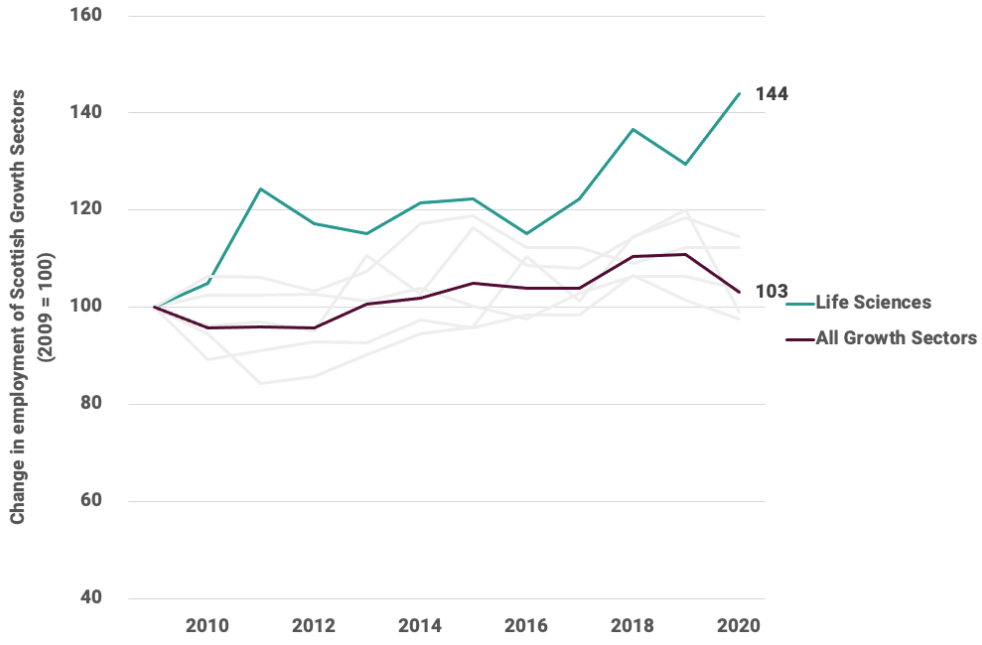
reasonable quality a person might gain as a result of treatment. The Wellcome Trust research considered two areas of medical research expenditure, for cardiovascular disease and mental health. The value of the health benefit was presented as a return on initial expenditure on the research (IRR). In order to apply these IRRs to the wide range of medical research undertaken at the University of Dundee, the average of the two best estimates was used. In this way, it was assumed that every £1 invested in medical research would result in health gains with a value of £0.08 each year in the UK for perpetuity.

Following the approach used by the Wellcome Trust, the Net Present Value (NPV) of medical research was estimated by applying the Treasury approved 3.5% discount rate. In this way, it was estimated that the £21 million income for health and medical research received by the University of Dundee would have a total impact of around £24 million over the next twenty years across the UK. The impact in each of the other study areas is assumed to be proportional to their respective populations.

8.6.2 Economic Impact

The life sciences sector in Scotland, and in Dundee City in particular, is a highly productive and innovative sector. It was identified in Scotland's Economic Strategy in 2015 as one of the growth sectors in which Scotland had a particular comparative advantage and there should receive particular attention from development agencies. The Life Sciences sector is the smallest of the Growth Sectors and in 2020 it employed 20,000 people across Scotland. However, it is the fastest growing of all the sectors that were identified as having a comparative advantage in 2015. Since 2009 employment in the life sciences sector in Scotland has grown by 44%, compared to just 3% on average across all the other Growth Sectors. This success, and growth, is driven by a strong academic and clinical foundation, such as is found at the University of Dundee.

Figure 8-2 Change in Scottish employment of Life Science & other Growth Sectors



Source: Scottish Government (2021) Growth Sector Statistics Database

The Wellcome Trust also considered the effect of medical research expenditure on GDP. It considered the impact this would have in stimulating investment in the

private R&D sector and social returns to private investment stimulated by publicly funded medical research. This found that a £1 investment by a public body in medical research and development stimulated an increase in private R&D investment of between £2.20 and £5.10.

As with the estimates for the Quality of Life IRR, the research finds that there is a range of estimates for the IRR for GDP impacts. The lowest estimate for IRR is 20% and the highest is 67%. The best estimate given is 30%. Therefore, it was assumed that every £1 invested in medical research results in £0.30 in GDP each year in the UK in perpetuity.

As with the previous calculation, the Net Present Value (NPV) of medical research on GDP was estimated, applying the Treasury discount rate of 3.5%. Over a 20-year period, it was estimated that medical research would result in £91.2 million across the UK. It was assumed that the economic impact would arise for the most part in Dundee City and Tay Cities Region, in line with the location of the University's commercialisation activity.

8.6.3 Total Returns to Health and Medical Research Impact

Adding the social and economic impact of medical research undertaken by the University of Dundee provides an estimate of the total returns to medical research. Thus, the University was estimated to contribute £20 million to Dundee City and £115 million across the UK through its medical research.

Table 8-1 Returns to Health & Medical Research Impact

	Dundee City	Tay Cities Region	Scotland	UK	Global
Health Impacts	<1	<1	2	24	24
Cluster Development	20	20	77	91	91
Total GVA (£m)	**20**	**21**	**79**	**115**	**115**

Source: BiGGAR Economics Analysis

9. Culture and Tourism

The University plays a pivotal role in the cultural life of the city, Art and Design research and practice also drives translational impact. The University supports tourism by attracting visitors to Dundee.

9.1 Supporting Cultural Assets

The University of Dundee also plays a fundamental role in the cultural life of Dundee. The relationship between Universities and the cultural sector is well-established, with their roles as arts organisations and operating museums and libraries being important in supporting communities, bringing people together, creating thought provoking work and inspiring reflection. The Duncan of Jordanstone College of Art and Design plays a pivotal part in this. It is a place of arts and cultural innovation and entrepreneurship, deeply connected to arts and culture organisations in the city, the region and around the world. As well as educating new generations of designers and artists, its researchers play a leading role in projects in the arts, humanities, social sciences, physical and life sciences, technology and engineering.

The College of Art and Design has also played a key role in securing significant cultural venues and events for Dundee. This has been achieved through its pivotal role in partnerships that have brought significant arts investments to the city.

The Cooper Gallery was the first contemporary art gallery in Dundee and is internationally recognised as a distinctive platform in Scotland for its curatorial research, international approach and focus on contemporary art and culture. It is the only university gallery that is a member of Plus Tate, a network of leading visual art organisations across the UK that exchange ideas, knowledge, skills and resources and collaborate on joint programmes, facilitated by Tate.

The College of Art and Design was also at the heart of founding Dundee Contemporary Arts (DCA), an internationally renowned centre for contemporary art with large-scale gallery spaces, cinema screens, a print studio, and a programme of events, workshops, classes and activities aimed at all ages and abilities. DCA is a cultural hub located in the heart of the city and in 2019/20 attracted 32,800 visitors40. Like the Cooper Gallery, DCA is also part of the Plus Tate network making Dundee the only Scottish city to host two Plus Tate recognised galleries.

More recently, the University was a founding partner of the project that brought the V&A to Dundee, which is helping to transform the city.

[40] Dundee Contemporary Arts (2020), Annual Report 2020

V&A Dundee

The University of Dundee was the driving force behind the initiative to locate the V&A in Dundee.

First opened in 2018 and designed by internationally acclaimed architect Kengo Kuma, the V&A Dundee is the centrepiece of a £1 billion redevelopment of Dundee's waterfront. It is the first V&A museum in the world outside London and the first ever dedicated design museum in Scotland. The original idea was sparked at the University, which led to the first pitch to the V&A to consider Dundee as a location, and consisted of the following elements:

- the V&A has a huge amount of material that is never exhibited because of space constraints in South Kensington;
- the V&A's longstanding focus on robust academic research to underpin their exhibitions aligned with the strong research reputation in the applied arts at Duncan of Jordanstone College of Art & Design (the only Scottish art school that has such a strong research base in the applied arts);
- there was no museum dedicated to the applied or digital arts in Scotland, digital being an area that the V&A had started to really explore;
- the V&A could anchor any expansion plans around an urban regeneration project that would demonstrate the ability of a major arts capital project to transform a post-industrial city; and
- a V&A in Dundee would stand out in a way it would not had it gone to another city which already had a wider cultural provision.

The University then hosted a series of events, looking to gather further support and build a solid case to establish V&A in Dundee with partners.

The V&A Dundee has already brought significant benefits for Dundee. It has helped raised the city's profile globally and attract visitors to Dundee. With 620,000 visitors in 2019 the V&A Dundee was the most visited attraction in Dundee and Angus and in the 10 most popular free tourist attractions in Scotland[41]. An economic impact assessment of the V&A Dundee found that it supported £21 million GVA and 696 jobs in Dundee in its first year of operation[42], through the visitors it helped to attract. In terms of regeneration, the V&A development has attracted investment from hotels and other companies choosing to locate in Dundee at the waterfront helping to redevelop the area. All of these benefits can be attributed to the University of Dundee as they would not have happened without the University's drive and work in partnership with key stakeholders to have the V&A locate in Dundee. Simply put, without the involvement of the University the V&A in Dundee would not exist.

An important partnership project that is currently being developed, is the Eden Project Dundee. This will see the city's former gasworks overlooking the River Tay transformed into a new ecological attraction of international interest for the city, providing a large verdant space and playing an important role in the ongoing regeneration of the city's waterfront. The project is based on the hugely successful Eden Project in Cornwall which attracted just over a million visitors in 2019.

The University of Dundee is a key partner along with Dundee City Council, DC Thomson and The Northwood Charitable Trust. The project is expected to create 200 direct jobs, support an additional 300 jobs in the supply chain and connected

[41] VisitScotland (2020), Key Facts on Tourism in Scotland in 2019.
[42] Ekosgen (2020), V&A Dundee Economic Assessment, Year 1 Impacts for V&A Dundee

businesses, attract 500,000 visitors annually and contribute £27 million each year to the regional economy.

9.2 Translation of research and practice

As well as its important role in supporting cultural assets, art and design research and practice at the University of Dundee has provided strong opportunities for translation into society, creating economic, environmental, and social impacts.

For example:

- research into co-creation approaches to address environmental issues in urban and rural settings has mobilised international communities. Two large scale research projects led by Professor Mel Woods at Duncan of Jordanstone addressed high priority environmental challenges in Europe. The work established the value of a novel environmental monitoring framework that led to the empowerment and education of over 25,000 participants worldwide in action-orientated citizen science and data collection, and engagement of 7.8 million citizens. There was positive environmental impact on air and noise pollution; urban infrastructure and municipal services; sustainable food growing; management of soil health and water resource. This contributed to validation of satellite products for monitoring extreme climate events, such as flood, wildfire, drought and food sustainability;
- advances in 3D Visualisation techniques have improved methods for capturing data from underwater sites of historical or environmental significance. The visualisations enhance the understanding of complex data by audiences in different contexts. The impacts include informing Government policy on recording the condition of protected war-grave shipwrecks, e.g. HMS Royal Oak, HMS Vanguard, providing virtual access for the public to maritime heritage sites and supporting international salvage operations;
- design meets disability and related research projects are changing the way that designers, disabled people, business and society engage with issues of inclusion and with each other. This work has impacted on design-led businesses, by changing the conceptual framing of disability, inspiring Canadian company Alleles to enable self-expression for thousands of individual prosthetics wearers and influencing the mind set of nearly 400 CEOs representing 12 million employees. There is a cultural impact, changing the framing of disability and design, reflecting and affecting participants' disability identity and introducing these nuances to over 100,000 disabled and non-disabled visitors to V&A Dundee during the summer of 2019. The work has reframed the role of design, raised the profile of disability-related practice and education, and reached 500,000 designers, users and/or future designers through Microsoft's inclusive design and education initiative.

9.3 Contribution to the Tourism Economy

The University of Dundee supports the tourism economy by attracting visitors and their associated expenditure to Dundee. These tourism impacts are generated by:

- friends and relatives who visit students and staff;
- visitors to conferences and events held at the University; and
- attendees to graduations.

These visitors spend money in the area during their visit and this spending increases turnover in local tourism, retail and hospitality businesses, which in turn supports local employment.

It is important to consider how much of this activity is additional to each study area (i.e. how much activity would have happened anyway, in the absence of the University). For each visitor type, appropriate assumptions were made in relation to this. It was estimated that 28,000 visitors came to Dundee because of the University in 2020/21. It was then possible to apply average visitor spending assumptions for each type of visitor. In this way, it was estimated that the University of Dundee attracted £2 million additional visitor spending in Dundee.

The additionality of the tourism activity is greater at the Dundee City area than any of the larger study areas because it was assumed that the visitors would have made trips to other attractions in Scotland or the UK if they had not visited Dundee City.

In this way it was estimated that by attracting visitors to Dundee, the University of Dundee contributed £1 million GVA and 70 jobs to Dundee City. However, the role of the University in contributing to tourism and culture goes far beyond this, as discussed in Section 10.

Table 9-1 Tourism Impact

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)	1	2	1	1	-
Employment	70	70	40	30	-

Source: BiGGAR Economics Analysis

10. Regional Development

The university is a civic anchor for Dundee and an important driver of regional economic development.

10.1 A Civic Anchor

As large employers, anchor institutions have an impact on and within their local areas because of the number of people they employ, land and infrastructure assets, spending power, the nature of their services and the ways in which they interact with their communities. The notion of universities as anchor institutions is an accepted tenet of economic policy.

The annual economic impact of the University of Dundee's operation (employment, suppliers, and capital investment) totals £208 million GVA and 4,190 jobs in the Tay Cities Region and £195 million GVA and 3,860 jobs in Dundee City. Additional impacts are created through tourism, research and innovation and internationalisation. The overall annual contribution of the university to the regional economy is £506 million GVA and 7,240 jobs in Tay Cities Region and £447 million GVA and 6,730 jobs in Dundee City. There is no denying the University of Dundee is an economic powerhouse at the heart of the city.

However, the part played by the University of Dundee in supporting the city and region goes beyond what can be expressed in terms of GVA and jobs alone. The University uses its assets to create a wide array of economic and social value. There are deep connections into local communities, businesses, schools, colleges, the NHS, City Council and other public bodies.

There are obvious impacts within the city's health system, with the University acting as a key partner to NHS Tayside at strategic and operational levels, including through the teaching hospital at Ninewells and the Dundee Dental Hospital, discussed in Section 7 above. More than this, the University supports the essence of the health and social care system in the region. There are 400 nursing and other health science students based at the Kirkcaldy Campus, a high proportion of whom come from local areas and are retained in the local workforce on graduation. The School of Health Sciences therefore plays an important role in underpinning the foundational economy, providing skilled nursing and health care professionals into the health and social care workforce across the city and region.

The University of Dundee also plays a fundamental role in the cultural life of Dundee, discussed in Section 9 above. The city's cultural and creative industries produce an annual turnover of £190m and provide employment for 3,000 people. When you consider that the population of Dundee is just 150,000, you can see the importance of the cultural sector to the city's economic wellbeing.

10.2 A Driver of Regional Economic Development

In its business facing role, the University of Dundee collaborates with businesses, organisations and economic development agencies to address priority needs in economic development, including raising productivity through innovation support, forming new businesses, and addressing skills needs. The University has a considered approach to this, recognising a need for leadership from the University, through a Regional Development Strategy Board acting as an internal forum, chaired

by the Principal and with membership from across the University. The University of Dundee's strengths have underpinned the economic development of the region.

Its role in building the life sciences and med tech cluster in Dundee has been discussed earlier in this report (Section 8). There has been a long-term strategic investment in translational capabilities such as the Drug Discovery Unit and the Laboratory of Quantitative Proteomics and the Institute for Medical Science and Technology. There is a strong track record in successfully commercialising life sciences spin outs directly into therapeutics, with Amphista and Ex Scientia being particular highlights. Companies have invested heavily and create significant value, although there is a challenge in retaining value in the city when such companies choose to locate headquarters functions elsewhere. This is being actively addressed by the University and its partners through major infrastructure investments, discussed below.

The life sciences cluster in Dundee City includes academics, clinicians, researchers and specialised professional services. The success of this cluster relies on the existence of world class academic researchers, clinicians, and companies within the city and with a supportive city council. And the role of the University of Dundee in this is paramount.

As well as generating culture and creativity that provides huge wider benefits for the city and its people, discussed above, the Jordanstone College of Art and Design supports industrial developments, playing a strong role in the innovation impacts of the University. For example, it is a key partner of InGAME, part of the Creative Clusters Programme facilitated by the Arts and Humanities Research Council (AHRC). AHRC has provided InGAME with £5.25m of funding to increase the scale and value of the Dundee videogames cluster.

Partnership is at the heart of the University's contribution to regional economic development. It has strong relationships with the other universities and research institutes, companies, investors and local authorities across the Tay Cities region. The birth of the Tay Cities Deal has brought a common purpose to these partners, and a series of important opportunities have been conceived with the potential to transform the economy of the region in the future:

- the continuing development of the biomedical cluster, creating infrastructure to keep keeping new and growing companies in the region by developing a bio-medical innovation ecosystem;
- JustTech, an investment in crucial infrastructure to develop a new innovation cluster to support the life science pipeline as well as creating the world's first institute for innovation for forensic science. This will build on the £10 million investment to establish the Leverhulme Research centre for Forensic Science;
- the Eden Project Dundee will see the city's former gasworks on the banks of the Tay transformed into a new ecological attraction of international interest for the city, providing a large verdant space and playing an important role in the ongoing regeneration of the city's waterfront. The University of Dundee is a key partner along with DC Thomson and The Northwood Charitable Trust.

10.3 A Baseline for Future Impacts

The university of Dundee has been working with partners to build on regional economic strengths, most recently in development of the Tay Cities Deal investments introduced above. Over the coming decades, these projects are set to drive an increase in the economic impact of the University. There will be economic growth in absolute terms as well as a capturing economic benefit that currently spills into other

areas, such as when new and growing companies locate outside the region because of lack of infrastructure or other factor conditions required for growth.

Each Cities Deal project will have its own evaluation strategy that will track progress towards outcomes over time. However, overall, the investments would be expected to build on the following baseline.

Table 10-1: Regional Development Baseline

Item	Measure	% retained in Tay City Region
Innovation total	GVA and Jobs £370m 2,240 jobs	17%
Spin out and Start Up Companies	GVA and Jobs £177m and 820 jobs	11%
Licencing	GVA and Jobs £13m and 140 jobs	14%
Medical Research funding	£21m income	n/a
External R&I funding	£23m Income to university	n/a

11. Internationalisation

Internationalisation and the sharing of knowledge globally is at the heart of the vision for the University of Dundee, with the University expanding its international reputation and influence across multiple countries.

"The University's core purpose is to transform lives locally and globally through the creation, sharing and application of knowledge." [43]

11.1 International Students

As a result of the University's work in internationalisation, the number of international students studying at the University of Dundee has more than trebled in recent years. Between 2015/16 and 2021/22, the number of international students at Dundee increased from 1,005 to 3,390.

It is projected that in the coming years, the number of international students studying at Dundee will increase to 5,000, including both students studying full time in Dundee and those studying between Dundee and partner institutions. The opportunity to study between Dundee and other institutions in enabled by the University's partnerships with international universities, together providing access to articulation and joint awards.

The University of Dundee has also improved access to degrees at the University through the International College Dundee. The Foundation College, which supports students to improve their knowledge of academic English and university level study skills, enrolled 49 new undergraduates and 90 postgraduates in 2020/21.With the support of experienced teachers, international students enrolled in the International College Dundee are given the best opportunity to succeed once they begin their degree, supporting improvements in attainment and the number of students who complete their degree.

11.2 Global Partnerships

The University of Dundee has established itself as a University which strives to work with high quality partners based across the world, developing sustainable and scalable partnerships which support the priorities of the University and deliver the aim to "transform lives locally and globally through the creation, sharing, and application of knowledge". Currently, the University has over 300 active agreements with international partners from over 40 countries.

The University of Dundee has entered into partnerships with five flagship partners globally, including:

[43] University of Dundee (2017), University Strategy: Strategy to 2022

- **Central South University:** establishing the Dundee International Institute of Central South University (DIICSU) in China, which will offer Honours Degree courses in Mathematics, Civil Engineering, Mechanical Engineering, Mechanical Engineering with Transportation and Computing Sciences;
- **Chinese University of Petroleum Beijing:** providing a masters course in Energy Finance with students completing the first year of their degree in China and their second in Dundee;
- **Wuhan University:** offering BA (Hons) degree in Architectural Studies, with students studying in Wuhan for four years and completing their fifth year of study in Dundee;
- **National University of Singapore:** offering a BSc (Hons) degree in Biological and Biomedical Sciences, with students studying for 30 months in Dundee before completing their degree in Singapore or the other way round; and
- **Northeastern University:** providing a BEng (Hons) in Biomedical Engineering, with students studying for three years in China, and their final year in Dundee.

The University of Dundee has also established multiple articulation partnerships with international universities. The University's articulation partnerships with multiple Universities based in China, France, Malaysia, Norway, Colombia, Pakistan and Italy, improves the opportunities available to international students wanting to study in Dundee, and enables the economic contribution made by international students while they are studying, as well as the benefits brought about by educated international students who choose to stay in Dundee, Scotland and the UK following the completion of their degree.

11.3 Export Income

As the number of international students attending the University has Dundee has increased significantly in recent years, this increases the impact they have on the income of the University and the benefits they bring to the local economy.

International students attending the University of Dundee pay tuition fees, increasing the income of the University which allows it to expand and increase its impact. As a result of the increased numbers of international students, University income from international student fees has risen from £18 million in 2015/16 to £40 million in 2020/21.

As with all students who study at the University of Dundee, international students make a contribution to the economy through their spending while they are studying. Of the total spending by University of Dundee students in Scotland, international students accounted for 39%, spending £35 million within Scotland in 2020/21.

The University also generates income through its knowledge transfer activities, providing businesses with services enable innovation. The income generated by this activity supports the University in its own development and supports the University of Dundee to spend more in the local economy. Through knowledge transfer activities, the University of Dundee generated £16 million in income in 2020/21.

The University also makes income through its work with partner organisations in China and Singapore. In 2020/21, these partnerships generated £2 million in income for the University of Dundee.

International students also generate tourism impacts in the local economy, through visits from friends and family. In 2020/21, visiting friends and relations of University of Dundee internationals students spent £1 million in Scotland.

Table 11-1 Export Income Summary

	Export Earnings (£million)
Tuition Fees	40
International Students Spending	35
KT Services	16
Partner Organisations	2
Tourism	1
Total Export Income	**93**

Source: BiGGAR Economics Analysis

12. Summary of Quantifiable Impacts

This section provides a summary of the study's main quantitative findings and considers how these might have changed in recent years.

12.1 Total Quantitative Economic Impact

In 2020/21, the activities of the University of Dundee supported:

- **£449 million** Gross Value Added (GVA) and **6,760 jobs** in Dundee City;
- **£507 million** GVA and **7,270 jobs** in the Tay Cities Region;
- **£975 million** GVA and **9,410 jobs** in Scotland;
- £1.5 billion GVA and 15,090 jobs in the UK; and
- £1.6 billion GVA and 16,070 jobs globally.

A breakdown of GVA and employment by source of impact and study area is provided in the table below.

Table 12-1 Total Economic Impact of the University of Dundee

	Dundee City	Tay Cities Region	Scotland	UK	Global
GVA (£m)					
Direct Impact	164	164	166	166	166
Supply Spending Impact	5	7	14	75	86
Staff Spending Impact	22	32	55	117	126
Capital Impact	3	5	12	23	23
Student Spending	48	52	63	90	92
Student Employment	28	29	37	57	58
Medical Research Health Impacts	<1	<1	2	24	24
Medical Research Cluster Development	20	20	77	91	91
Student Volunteering	1	1	1	1	1
Graduate Premium	67	85	252	330	382
Exchequer Impact from Graduates	45	57	169	221	221
Spin Outs and Start Ups	13	14	61	118	127
Services to Business	22	30	53	125	177
Licencing	2	2	3	6	13
Student Placements	1	2	3	4	4
Knowledge Transfer Partnerships	<1	1	1	1	1
Graduate Apprenticeships	3	3	5	6	6
Visiting Friends and Relatives	1	1	1	<1	-
Conferences and Events	1	1	<1	<1	-
Total Impact	**447**	**506**	**975**	**1,456**	**1,598**

Source: BiGGAR Economics Analysis. Note, totals may not sum due to rounding.

Table 12-2 Total Economic Impact of the University of Dundee

	Dundee City	Tay Cities Region	Scotland	UK	Global
Employment					
Direct Impact	3,120	3,120	3,140	3,140	3,140
Supply Spending Impact	110	140	260	1,210	1,390
Staff Spending Impact	580	840	1,450	3,460	3,720
Capital Impact	60	100	260	540	540
Student Spending	1,280	1,360	1,670	2,520	2,560
Student Employment	1,140	1,170	1,440	1,830	1,870
Spin Outs and Start Ups	210	230	770	1,560	1,710
Services to Business	80	110	190	550	820
Licencing	20	20	40	80	140
Student Placements	<10	<10	10	20	20
Knowledge Transfer Partnerships	10	20	30	30	30
Graduate Apprenticeships	70	80	110	120	120
Visiting Friends and Relatives	30	30	20	20	-
Conferences and Events	40	40	20	10	-
Total Impact	**6,730**	**7,240**	**9,410**	**15,090**	**16,070**

Source: BiGGAR Economics Analysis. Note, totals may not sum due to rounding.

The global impact is largest; however, the economic activity is most concentrated within Dundee City. Within Dundee City there are 82,000 jobs in total, of which 6,730 are supported by the University. Therefore, the University supports one job in every 12 across the Dundee City.

12.2 Impact Multipliers

Multipliers are a useful summary indicator to express within a single figure the returns from investment in an organisation. In 2020/21, the University of Dundee had an income of £276 million, generated £166 million direct GVA and directly employed 3,140 people. Therefore;

- for each £1 of income the University generated as a result of its direct operations, it supported £8.80 GVA in total benefits across the UK economy, including £5.90 in Scotland;
- for each person it directly employed, the University supported 4.8 jobs across the UK, including 3.0 in Scotland;
- for each £1 of income received, the University of Dundee generated £5.30 in economic impact across the UK, including £3.50 in Scotland; and
- for each £1 of income received from the Scottish Government, the University of Dundee generated £10.20 in economic impact across Scotland.

Table 12-3 University of Dundee Impact Ratios 2020/21

	Scotland	UK
Direct GVA: Total GVA	5.9	8.8
Direct Jobs: Total Jobs	3.0	4.8
Income: Impact	3.5	5.3
Scottish Government Income : Impact	10.2	-

Source: BiGGAR Economics Analysis

12.3 Difference from impact in 2014/15

The economic impact study that was completed by the Fraser of Allander Institute in 2016 found that the University contributed £740 million to the Scottish economy and supported over 8,000 FTE jobs.

The two studies are not directly comparable because the list of quantifiable economic impacts which are considered in this report is greater than that considered in 2016. The primary differences are;

- **Approach** – This study has considered the primary metric to be Gross Value Added (GVA) and the 2016 study focused on turnover (output) as the key metric of economic activity; and
- **Scope** – In addition to the activities considered in the 2016, this report has also considered the economic impacts generated by improved graduate labour market performance, services to business, tourism, student placements and part time employment.

To compare how the economic impact of the University has changed in this time period, it is best to consider how the key drivers of impact have changed over time. The key drivers of the impact of the University are;

- the number of students;
- the number of graduates;
- the income of the University; and
- the number of staff.

A summary of how these have changed since 2014/15 is shown in Table 12-4 This shows that the main drivers of impact have increased by between 9% and 25% in the previous 6 years. It is therefore reasonable to assume that the underlying economic impact, excluding the disruption from the Covid-19 pandemic, of the University of Dundee has grown by a similar proportion over this time period.

Table 12-4 Change in Key Drivers of Economic Impact at the University of Dundee

Metric	2014/15	2020/21	Change
Full time Students	10,435	12,995	25%
Degrees Awarded (UG)	2,560	2,730	7%
Income to the University*	254	276	9%
Staff numbers	3,280	3,280	0%

Source: HESA, note staff numbers differ from reported figures in this study due to changes in definitions * Taken from Annual Accounts

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