

**BiGGAR Economics**

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Economic Impact of the University of Edinburgh's  
Commercialisation Activity

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A report to  
Edinburgh Research and Innovation

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# 1 EXECUTIVE SUMMARY

This report presents the results of an economic impact analysis of the commercialisation activity supported by Edinburgh Research and Innovation (ERI).

The University of Edinburgh has a significant impact on the Scottish economy. An economic impact study undertaken for the University by BiGGAR Economics in 2008 found that the total annual impact of the University in the Scottish economy was £826 million Gross Value Added (GVA) and 19,580 jobs supported, in addition to a productivity gain of £406 million in the working lifetime of each year's graduates.

Much of this impact is associated with research activity undertaken at the University and the commercialisation of this. A study undertaken in 2010, specifically considered the impact of the University's research activity and found that it contributed around £414.2 million GVA to the Scottish economy each year and supported 8,182 jobs.

The sources of impact considered in this report included commercialisation impacts associated with start-up and spin-out companies and technology licencing. The report estimated that the annual impact of start-ups and spin-outs amounts to around £82.7 million GVA and support 1,772 jobs while technology licencing was found to generate around £12 million GVA for the Scottish economy and support 141 jobs. This amounted to a combined impact of £94.7 million GVA and 1,913 jobs.

Since this report was published, commercialisation activity has increased significantly. The amount of licence income received in 2010/11 increased by 9% to £3.0 million, 35 new spin-outs and start-up companies were created in 2010/11 and the number of active university spin-out companies increased by 13%. In late 2011, ERI appointed BiGGAR Economics to consider the impact of this activity and this report presents the results of this analysis.

## 1.1 Commercialisation Activity

In 2010/11, ERI generated £3.0 million of royalties and other licence income of which £0.7 million (25%) was as the result of new agreements reached since August 2010. The University holds licence agreements with 71 different companies and organisations in 12 different countries around the world. The most important market by value is the USA (65%) and the second most important (28% by value) is Scotland.

Licencing activity spans a range of sectors but the most important is biotechnology and pharmaceuticals, which accounts for 93% of the total income received. The next most important sector is semi-conductors, which accounts for just over 5% of the income received.

In 2010/11, ERI supported the creation of 35 new spin-out and start-up companies, bringing the total number of active businesses created to 213. The vast majority (89%) of active businesses created by ERI are located in Scotland and almost all of the remainder are located in England. The rate of new business creation at the University of Edinburgh has increased significantly since the 1960s, with a notable acceleration occurring since the middle of the first decade of the 21<sup>st</sup> Century.

## 1.2 Commercialisation Impact

The impact of licencing activity can be estimated based on the total amount of licence and royalty income received and the additional turnover this represents in Scottish based companies. In this way it can be estimated that the licencing activity of ERI contributes around £12.0 million GVA to the Scottish economy and supports 234 jobs.

The impact of new company formation can be estimated based on total employment in spin-out and start-up companies and the additional turnover this generates. In this way it can be estimated that new company formation supported by ERI contributes around £128.8 million GVA to the Scottish economy and supports almost 2,200 jobs.

The combined impact of licencing activity and new company formation therefore amounts to approximately £140.8 million GVA per year in Scotland and supports more than 2,400 jobs in the Scottish economy.

ERI also helps to generate wealth and support employment outside in Scotland. This report estimates that in 2010/11, this international impact amounted to £60.8 million GVA and supported almost 1,200 jobs.

Taken together, the domestic and international impact of ERI in 2010/11 amounted to £201.6 million GVA and almost 3,600 jobs.

## 2 EDINBURGH RESEARCH AND INNOVATION

As the University of Edinburgh's technology transfer office, Edinburgh Research and Innovation (ERI) is responsible for realising commercial potential of the research undertaken by the University. It does this in a variety of ways including:

- identifying sponsors and commercial partners for research projects;
- licensing new technologies developed by University researchers;
- creating and securing investment for spin-out and start-up companies;
- providing industry with access to academic expertise (consultancy) and facilities; and
- encouraging companies to locate in the University of Edinburgh science and technology parks where they will benefit from being co-located along side similar companies and academic expertise.

### 2.1 Licencing Activity

In 2010/11, ERI generated £3.0 million of royalties and other licence income for the University of Edinburgh of which £0.7 million (25%) was as the result of agreements agreed since August 2010. The University of Edinburgh holds licence agreements with 12 different countries of which the most important by value is the USA (65%) and the second most important (28% by value) is Scotland. A break down of the income received from each country is presented in Table 2-1.

Table 2-1 – Licence income received by country

Country	Income received	% of total
Scotland	£833,730	28%
Non-Scotland total	£2,119,006	72%
USA	£1,931,501	65%
England	£146,104	5%
India	£13,000	0.4%
Canada	£10,233	0.3%
Switzerland	£7,932	0.3%
Ireland	£4,200	0.1%
Belgium	£3,961	0.1%
Germany	<£1,000	<0.1%
Korea	<£1,000	<0.1%
Italy	<£1,000	<0.1%
Netherlands	<£1,000	<0.1%

Source: ERI licence and royalty income 2010/11

ERI licencing activity spans a wide range of sectors however by far the most important is biotechnology and pharmaceuticals, which accounts for 93% of the total income received. The next most important sector is semi-conductors, which

accounts for more than 5% of the income received. A break-down of the income received by sector is provided in Table 2-2.

Table 2-2 – Licence income received by sector

Sector	Income received	% of total
Biotech and pharma	£2,745,905	93.0%
Semi-conductors	£156,725	5.3%
Internet	£26,073	0.9%
Electronics	£16,916	0.6%
Health care	£2,500	0.1%
Media and entertainment	£2,375	0.1%
Software	£1,735	0.1%
Consumer goods	£507	<0.1%

Source: ERI licence and royalty income 2010/11

## 2.2 Spin-Outs and Start-Ups

Since the 1960s, 262 spin-out and start-up companies have emerged from the University of Edinburgh of which approximately 213 remain active today. The vast majority (89%) of active businesses are located in Scotland and almost all of the remainder are located in England. These figures are presented in Table 2-3.

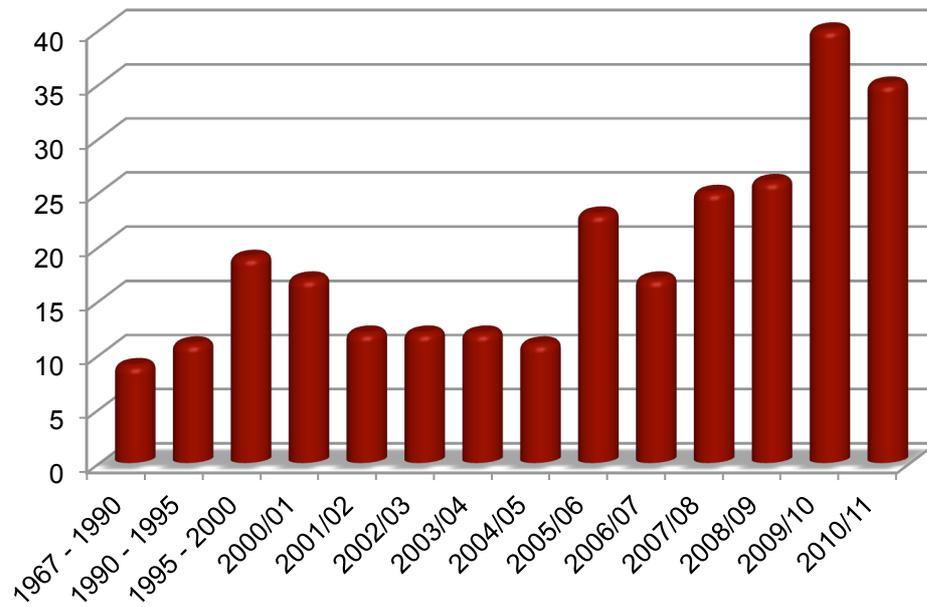
Table 2-3 - Total new business creation since 1967

Sector	Value	% of total
Total start-ups and spin-outs	262	n/a
Total active start-ups and spin-outs	213	81%
Active start-ups and spin-outs in Scotland	190	89%
Active start-ups and spin-outs outside Scotland	23	11%

Source: ERI spin-out and start-up activity (percentages may not sum due to rounding)

The rate of new business creation at the University of Edinburgh has increased significantly since the 1960s, with a notable acceleration occurring since the middle of the first decade of the 21<sup>st</sup> Century. As many business have been created in the five years since 2006/7 as were created in the four and a half decades prior to this point. The number of new businesses created each year is illustrated in Figure 2-1.

Figure 2-1 - New businesses created since 1967



Source: ERI spin-out and start-up activity

### 3 RESEARCH SPILL OVER EFFECTS

Despite the advances that have been made in intellectual property legislation over the last couple of decades, knowledge is essentially what economists would term of a public good that is it is both:

- non-excludable – the creators of a non-excludable good can not prevent others from using the good once it exists, i.e. once created, it is difficult or impossible to prevent others from also learning and applying new ideas; and
- non-rival – i.e. knowledge is not ‘used up’ in production, the fact that one person uses an idea does not prevent others from using it.

These characteristics mean that the discovery of new ideas through R&D often gives rise to benefits above and beyond those accruing to the firm or organisation making the investment. The existence of such public benefits – or research spill-over effects - is central to the rationale for government investment in publicly funded research. A recent discussion paper<sup>1</sup> for example found “*strong evidence of market sector spill-overs from public R&D spend on research councils*”.

The literature on research spill-over effects generally distinguishes between ‘private’ or return on investment and ‘social’ return. Private returns are the economic benefits generated by a specific R&D programme and accruing to the organisation undertaking the research, through royalties and/or sales of a new product or process. In the context of this report, private returns are therefore defined as the direct returns to the University of Edinburgh from undertaking research (as measured by royalties and licencing income). In this report, private returns are included in section 3.2.

Social return is a wider concept that includes private returns as well as any benefits spilling over to third parties. This would include innovation, performance improvements or growth either within individual businesses or whole sectors. Social returns would for example include new spin-out and start-up businesses created as a result of research activity (see section 3.1) and any increase in turnover accruing to a firm as a result of using a new technology licensed from a university (see section 3.2).

#### 3.1 Spin-Outs & Start-Ups

One of the main ways in which research activity is translated into economic activity is when new spin-out or start-up businesses are created in order to exploit research outputs commercially.

Over the years the University of Edinburgh has developed an impressive list of spin-outs and start-ups spanning a very wide range of sectors from micro-electronics to creative arts and bio-technology to tourism. To date, three of these businesses have become public listed companies:

- Wolfson Microelectronics PLC (2003);
- Vision Group PLC (1995) (now part of ST Microelectronics);
- MicroEmissive Displays PLC (2004) (no longer trading).

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<sup>1</sup> Haskel & Wallis, *Public support for innovation, intangible investment and productivity growth in the UK market sector*, Imperial College London, Business School, Discussion Paper, February 2010.

As none of these businesses would have been created were it not for the research activity at the University of Edinburgh, all of the GVA they generate and jobs they support can be attributed to the University.

Analysis of information provided by ERI suggests that of the 262 businesses created by the University of Edinburgh, 213 remain active today and 190 of these are located in Scotland. Of these 190 businesses, there were 30 for which no information was available other than the company name. Two thirds of these businesses have been formed in the last few years so it is assumed that they are still at the pre-commercial stage and therefore do not yet employ any staff or generate any turnover. It was assumed that the remaining businesses have stopped trading.

The first step in calculating the economic impact of the remaining 160 active businesses was to establish how many people each one employs. Employment information for some of the businesses was obtained from a survey of university start-ups and spin-outs undertaken during 2011 and it was possible to obtain information for some others from the businesses websites.

As employment in start-up and spin-out businesses tends to grow over time, in order to estimate employment for the remaining businesses, it was first necessary to consider when the business was established. Previous research undertaken on behalf of ERI suggests that, on average, businesses created after 2005 employ 2.7 full time equivalent (fte) staff. Analysis of the results of the spin-out and start-up survey undertaken in 2011 suggests that businesses created prior to 2005 typically employ around 28 fte staff. By applying these assumptions to the remaining businesses, it was possible to estimate that total employment across all active University of Edinburgh start-up and spin-out companies in Scotland amounts to almost 2,200 ftes. A break-down of this employment is provided in Table 3-1.

Table 3-1 – Employment in impact generating businesses in Scotland by sector

Sector	Number of businesses (% of total)		FTE employees (% of Total)	
Tourism and hospitality	5	3%	13	1%
Textiles	2	1%	5	0%
Software	15	9%	91	4%
Retail	1	1%	3	0%
R&D	3	2%	310	14%
Life sciences	27	17%	410	19%
ICT and digital	63	39%	533	24%
Engineering & manufacturing	13	8%	218	10%
Electronics	3	2%	355	16%
Charities and third sector	2	1%	5	0%
Business & professional services	26	16%	239	11%
<b>Total</b>	<b>160</b>	<b>100%</b>	<b>2,181</b>	<b>100%</b>

Source: BiGGAR Economics analysis of information provided by ERI

The economic impact of this employment can be estimated by multiplying total employment in each business by an estimate of the average GVA by employees

in the sector in which that business operates. Estimates for GVA in each sector are taken from data published by the Scottish Government and presented in Table 3-2.

Table 3-2 – Commercialisation assumptions

Sector	GVA/ employee
Tourism and hospitality	40,031
Textiles	23,387
Software	58,154
Retail	32,596
R&D	42,960
Life sciences	50,680
ICT and digital	58,154
Engineering & manufacturing	76,801
Electronics	90,154
Charities and third sector	6,540
Business & professional services	37,194

*Annual Business Survey (2009) compiled by the Scottish Government*

In this way it can be estimated that businesses created as a result of University of Edinburgh research generate £128.8 million GVA in the Scottish economy. This impact is summarised in Table 3-3.

Table 3-3 - Spin-out and start-up impact and assumptions

Assumption	Value	Source
Start-ups & spin-outs trading and generating impact in Scotland 2011/12	160	BiGGAR Economics analysis based on information provided by ERI.
Average employment in businesses created since 2005	3	
Average employment in businesses created before 2005	28	
Impact	Scotland	Source
GVA impact	£128,779,117	BiGGAR Economics Economic Impact Model
Employment impact	2,181	

## 3.2 Licensing

Research activity is also translated into economic activity through licensing agreements between the University and industry. Licence agreements give companies the legal right to use a particular patented technology or other type of intellectual property right (IPR) to generate additional sales, reduce costs or otherwise improve their profitability. In return, companies pay the University royalties or licence fees.

The amount the University receives depends on the details of the licensing agreement, which can vary considerably from company to company. In order to agree a licensing deal, negotiators must first form a view of how much the IP is

worth to the prospective licensee. There are a wide variety of variables that may inform this judgement including potential risks to the company, the technology's stage of development, any capital investment that might be required and market conditions.

According to a training manual issued by the World Intellectual Property Organisation<sup>2</sup>, a common starting point for many licensing professionals is to start valuation calculations with the "well known and widely quoted" 25% rule. The 25% rule is a general rule of thumb according to which the licensor should receive around one quarter to one third of the profits accruing to the licensee and has been used by IP negotiators for at least 40 years.

The rule is based on an empirical study undertaken in the 1950s, which found that royalty rates were around 25% of the licensee's profits or 5% of sales from products embodying the patented technology. In 2002<sup>3</sup> Goldscheider (et al) undertook further empirical analysis to test the continued validity of the 25% rule. The analysis was based on more than 1,500 licensing agreements from 15 different sectors between the late 1980s and the year 2000.

The study found that although royalty rates ranged between 2.8% in the food sector to 8% in the media and entertainment sector, on the whole they differed very little from those used in the 1950s. This provides support for the continuing use of the 25% rule as a tool for calculating the value of IP. The sectors considered in the Goldscheider analysis, along with the respective royalty rates and number of licences considered are summarised in Table 3-4.

Table 3-4 – Royalty rates by sector

Sector	Number of Licences	Median Royalty Rate
Automotive	35	4.0%
Chemicals	72	3.6%
Computers	68	4.0%
Consumer Goods	90	5.0%
Electronics	132	4.0%
Energy and Environment	86	5.0%
Food	32	2.8%
Healthcare Products	280	4.8%
Internet	47	7.5%
Machine Tools	84	4.5%
Media and Entertainment	19	8.0%
Pharmaceutical and Biotechnology	328	5.1%
Semiconductors	78	3.2%
Software	119	6.8%
Telecom	63	4.7%

Source: Goldscheider et al (2002)

<sup>2</sup> Exchanging Value, Negotiating Technology Licensing Agreements: a training manual, World Intellectual Property Organisation, 2005.

<sup>3</sup> Goldscheider, Use of the 25% rule in valuing IP, les Nouvelles, 2002.

### 3.2.1 Licencing Impact

The economic impact of the University of Edinburgh's licence agreements can be estimated by applying these royalty rates to the value of royalties and licence income received. In 2010/11, the total value of licence income and royalties amounted to £3.0 million (see section 2.1). In order to estimate the impact of this in Scotland, it is first of all necessary to calculate how much income the University receives from licence agreements with Scottish based companies in each sector. The next step is to calculate the total additional turnover that the licence agreements support in each sector. This is done by dividing the total income received from companies in each sector by the appropriate royalty rate from Table 3-4.

The GVA impact of this can be calculated by dividing the additional turnover supported in each sector by a turnover to GVA ratio for each sector taken from the Scottish Government economic statistics. The employment impact of this can then be calculated by dividing the GVA impact for each sector by an estimate of the GVA by employees in each sector, which is also obtained from the Scottish Government's economic statistics. The effects of subsequent spending rounds are then accounted for by applying appropriate multipliers from the Scottish input-output tables. These assumptions are presented below.

Table 3-5 – Commercialisation assumptions

Sector	Turnover/ GVA ratio	GVA/ employee	Type II GVA multiplier	Type II Employment multiplier
Consumer goods (manufacturing)	2.78	66,521	1.85	1.99
Electronics	3.59	90,154	1.65	1.65
Software, ICT and digital	1.95	58,154	1.61	1.64
Biotechnology and pharmaceuticals	2.19	50,680	1.62	1.62
Semi-conductors	3.59	90,154	1.65	1.65
Software	1.95	58,154	1.61	1.64

*Annual Business Survey (2009) compiled by the Scottish Government and Scottish Government input-output tables 2007*

In this way it can be estimated that the licensing activity of ERI contributes around £12.0 million GVA to the Scottish economy and supports 234 jobs. This and the assumptions used in the calculation are presented in Table 3-6.

Table 3-6 – Turnover supported by sector

Sector	Income from Scottish companies	Turnover supported in Scottish companies
Consumer goods	507	10,136
Electronics	7,619	190,482
Internet	24,133	321,773
Biotechnology and pharmaceuticals	794,910	15,586,473
Semi-conductors	5,125	160,154
Software	1,436	21,113
Total	833,730	16,290,131
GVA impact (£)		12,014,165
Employment impact (fte jobs)		234

Source: BiGGAR Economics economic impact model

## 4 INTERNATIONAL IMPACT

This section describes the international impact of the spin-outs, start-ups and licencing activity undertaken by ERI.

### 4.1 Approach

The method used to calculate the impact of international spin-outs, start-ups and licencing activity is exactly the same as described in section 3. This means that the multipliers used to calculate indirect impacts in the previous section relate to the Scottish economy rather than the economy in which the companies are based. As the Scottish economy is relatively small, this means that the total impact calculated will tend to be somewhat under-estimated. Given the availability and comparability of multipliers for other parts of the world however, this is the most robust approach available.

### 4.2 Spin-Outs & Start-Ups

There are currently 23 University of Edinburgh start-up and spin-out companies that are based outside Scotland. Most of these (19) are based in England or Wales, two are based elsewhere in Europe, one is based in Canada and one is a multi-national company that operates across the world.

These companies contribute around £21.4 million GVA to the UK economy each year, around £4.2 million GVA to the North American economy and around £4.2 million GVA to the wider European economy. The direct employment and GVA impacts of these companies are presented in Table 4-1

Table 4-2 – International spin-out and start-up impact

Location of impact	Number of companies*	Employment	GVA
Rest of the UK	20	399	21,394,456
Rest of Europe	3	83	4,228,889
North America	2	78	4,160,511
<b>Total</b>	<b>23</b>	<b>560</b>	<b>29,783,856</b>

\* Eurogentec Ltd is included in all three locations as it operates around the world.

### 4.3 Licensing

In 2010/11, the University of Edinburgh received £2.1 million from licence agreements with companies based outside Scotland, two and a half times as much as it received from Scottish companies. In order to calculate the economic impact of this, it is first necessary to calculate how much additional turnover these licence agreements enables the companies involved to generate. This is done using the same method described in section 3.2 and the results are presented in Table 4-3 – Turnover supported by sector

Table 4-3 – Turnover supported by sector

Sector	Turnover supported in companies from the rest of the UK	Turnover supported in companies from the rest of Europe	Turnover supported in companies from North America	Turnover supported in companies from the rest of the world
Biotech & pharma	2,344,377	309,657	34,900,026	254,902
Electronics	8,250	21,009	-	-
Energy & environment	-	-	204,666	-
Health care	499,401	-	-	-
Internet	25,867	-	-	-
Media & entertainment	-	8,750	-	10,430
Semi-conductors	-	-	4,737,500	-
Software	4,412	-	-	-
<b>Total</b>	<b>2,882,307</b>	<b>339,416</b>	<b>39,842,192</b>	<b>265,331</b>

Source: BiGGAR Economics economic impact model

The approach for estimating the impact of licencing activity outside Scotland is exactly the same as described in section 3.2. By applying this methodology, it can be estimated that licencing agreements with the University of Edinburgh generate £2.3 million GVA in the rest of the UK each year, £0.2 million GVA in the rest of Europe, £28.2 million GVA in North America and £0.2 million GVA in the rest of the world. This activity also supported 71 jobs in the rest of the UK, 5 in the rest of Europe, 535 in North America and 4 in the rest of the world. This impact is summarised in

Table 4-4 – International licencing impact

Location of impact	Employment	GVA
Rest of the UK	71	2,341,692
Rest of Europe	5	247,315
North America	535	28,234,413
Rest of World	4	198,547
<b>Total</b>	<b>615</b>	<b>31,021,967</b>

## 5 SUMMARY

This report considers the impact of licence agreements with 71 different companies and organisations and the impact of 213 different start-up and spin-out companies created by the University of Edinburgh. In 2010/11 the combined impact of this activity around the world amounted to £201.6 million GVA and supported almost 3,600 jobs. This is summarised in Table 5-1.

Table 5-1 - Summary impact of start-ups, spin-outs and licencing activity.

Location	GVA (£)	Jobs (fte)
Scotland	140,793,283	2,415
Rest of the UK	23,736,148	471
Rest of Europe	4,476,204	88
North America	32,394,924	613
Rest of World	198,547	4
<b>Total</b>	<b>201,599,105</b>	<b>3,591</b>