University of Strathclyde Glasgow

Fraser of Allander Institute

The economic contribution of colleges in Scotland

October 2023

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Table of contents

The Fraser of Allander Institute

1 Introduction

2 An overview of the colleges sector in Scotland

4 System wide impacts of college learners

11 Developing a skilled workforce for Scotland

19 Widening access to education in Scotland

26 Productivity, Innovation and Entrepreneurship

41 Conclusions

Disclaimer

The analysis in this report has been conducted by the Fraser of Allander Institute (FAI) at the University of Strathclyde. The FAI is a leading academic research centre focused on the Scottish economy.

The report was commissioned by Colleges Scotland and the College Development Network.

The analysis and writing-up of the results was undertaken independently by the FAI. The FAI is committed to providing the highest quality analytical advice and analysis. We are therefore happy to respond to requests for technical advice and analysis. Any technical errors or omissions are those of the FAI.

Colleges Scotland

cdn College Development Network

Executive Summary

- Scotland's colleges are anchor institutions within the regions where they operate, helping to support employment and generating significant economic activity in the sectors that are most important to Scotland's current and future prosperity.
- This research involves an extensive review of the contribution of college graduates to the Scottish economy and the economic impact of the money that colleges spend.
- For the 2021/22 graduation cohort, we estimate that:
  - The Scottish economy, in terms of GDP, will be cumulatively better off by £8 billion in present value terms over the long term, when compared to an economy without these skilled graduates.
  - This is equivalent to a £73,000 boost in productivity per graduate to the Scottish economy.
  - The uplift in productivity is estimated to support over 31,000 FTE jobs across the Scottish economy.
  - The Scottish Government's £740m investment, via the The Scottish Funding Council in colleges in in 2021/22, led to a £8bn boost to the GDP of the Scottish economy and a £2.8bn boost to government revenues. The investment in this college cohort therefore represented 9% of the return in terms of the boost in GDP, and 26% in terms of the boost to government revenues.
- We estimate that the 2016/17 – 2021/22 graduation cohort:
  - Make the Scottish economy cumulatively better off by around £52bn over their 40-year working life, when compared to a scenario without these skilled graduates.
  - Help to boost labour productivity by 2% in the long run across the Scottish economy.
  - These graduates also help to support an additional 203,000 FTE jobs in the Scottish economy over their 40-year participation in the labour force.
  - The Scottish Government's £4.1bn investment, via The Scottish Funding Council between 2016/17 and 2021/22, led to a £52bn boost to the GDP of the Scottish economy and a £18.2bn boost to government revenues. The investment in multiple years of college graduates therefore represented 8% of the return in terms of boost in GDP, and 22.5% in terms of the boost to government revenues.
  - As well as their supply of highly skilled graduates, the money colleges spend also supports significant economic activity and employment across the Scottish economy, which is additional to the 10,700 FTE employment already supported by the college sector.
- Our modelling suggests:
  - College spend helps to support an additional 4,400 jobs across the Scottish economy, of which 2,700 are directly supported by college supply chain spending, and the remaining 1,700 are supported across the wider economy.
  - Their spend also generates substantial additional economic activity, with £225m supported in GVA[1], and colleges having the second highest GVA output multiplier (the measure of GVA supported for every £1m of final spend) when compared to the other 97 sectors of the economy.

1 Gross Value Added is a measure of the value of goods and services within a sector.

THE ECONOMIC CONTRIBUTION OF COLLEGES

The labour productivity uplift from multiple years of college graduates makes the economy cumulatively better off by **£52bn** in the **long run**

Colleges had the **2nd** highest **GVA-output** multiplier and the **14th** highest **employment-output** multiplier

Multiple years of college graduates boost investment and exports by **1.8%** during their working life

In **addition** to the **10,700 FTE jobs** supported within the college sector, their spend helps to support

£225m GVA

& an additional

4,400 FTE jobs

College graduates support **203,000 FTE jobs** over their **40-year** period of participation in the Scottish labour force

The 2021/22 college graduation cohort makes the Scottish economy cumulatively better off by **£8 billion**, equal to around **£73,000** per college graduate

95% of care-experienced individuals went onto a **positive destination** after completing their college course

1,700 FTE jobs & £109m GVA

supported across the **wider sectors** of the Scottish economy by **college spend**

College graduates made up **46%** of the **5,600 first degree entrants** to Scottish universities in 2021/22 by individuals living in the 20% most deprived areas of Scotland

1. Introduction

Scotland's colleges make a significant contribution to the Scottish economy.

Each college not only acts as a vehicle to train and educate highly skilled individuals for the workforce, but also act as anchor institutions within the areas they are located, helping to support and boost economic growth within those regions.

Beyond growth, colleges also provide significant opportunities to everyone in society, helping to widen access to individuals facing significant barriers to their education and helping to close the attainment gap across Scotland.

Given this, colleges are therefore fundamental in helping the Scottish Government achieve its policy aims, particularly those outlined as part of the National Strategy for Economic Transformation published in March 2022.

In this report we model the contribution of college graduates to the Scottish economy and find that those graduating between 2016/17 and 2020/21:

- Make the Scottish economy cumulatively better off by around £52bn over their 40-year working life, when compared to a scenario in which these skilled graduates had not entered the labour market.
- Help to boost labour productivity by 2% in the long run across the Scottish economy.
- Support an additional 203,000 FTE jobs in the Scottish economy over their 40-year participation in the labour force.
- The Scottish Government's £4.1bn investment, via The Scottish Funding Council between 2016/17 and 2021/22, led to a £52bn boost to the GDP of the Scottish economy and a £18.2bn boost to government revenues. The investment in multiple years of college graduates therefore represented 8% of the return in terms of boost in GDP, and 22.5% in terms of the boost to government revenues.

As well as their educational offerings and the contribution of the hundreds of thousands of college graduates entering the labour force, college spend also supports vast economic growth and employment in the Scottish economy.

Colleges spent over £200 million in 2019-20[1], helping to support an additional 4,400 FTE jobs and £225 million in Gross Value Added (GVA) across the whole Scottish economy

The structure of this report is as follows. In Section 1 we provide a brief overview of the colleges sector in Scotland.

In Section 2, we present our modelling results of the system-wide impacts of college learners, both for a single graduation cohort and multiple year cohort.

For the remaining sections of the report, we align the contribution of colleges to the pillars of the Scottish Government's National Strategy for Economic Transformation, highlighting the role colleges have to play in supporting The Scottish Government's policy ambitions.

Section 4 therefore provides insight to the role of colleges in developing a skilled workforce and Section 5 highlights the significant contribution of colleges to widen access to education.

Finally, Section 6 explores the ability of colleges to foster innovation and boost entrepreneurship in Scotland.

1 This only accounts for capital and operating expenditure, hence does not including staffing costs, which accounts for the majority of college spend as shown in Table 3.

2. An overview of the college sector in Scotland

Colleges provide a diverse range of courses and qualifications to individuals across the whole education spectrum, from school learners to postgraduate degrees.

Colleges are also uniquely placed to provide both further and higher education to all regions of Scotland, helping to boost educational attainment across the country.

In 2021/22, there were 321,850 enrolments in recognised college qualifications across Scotland, which has grown significantly since 2016/17.

Table 1: Number of enrolments in Scotland's colleges by National Vocational Qualification (NVQ), 2016/17 – 2021/22

SCQF Level	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
1	5660	10,020	8,455	6,515	4,660	7,850
2	25,360	23,950	21,395	18,750	20,525	22,125
3	24,310	23,425	31,705	22,495	15,200	25,355
4	51,685	55,525	63,250	55,450	38,610	56,750
5	57,110	61,525	75,640	77,310	74,465	86,125
6	57,625	62,580	69,885	65,845	66,020	70,485
7	30,425	30,545	30,075	29,240	31,610	29,705
8	22,520	22,505	22,710	21,430	23,080	20,300
9	2,135	2,135	2,035	2,070	2,105	2,285
10	425	450	630	680	745	785
11	45	60	40	65	100	85
Total	**277,300**	**292,720**	**325,820**	**299,850**	**277,120**	**321,850**

**excludes those funded outside of Scotland, rUK and EU*

Source: *Scottish Funding Council*

As well as these courses provided, colleges also generate and spend significant amounts of money across Scotland.

In 2020/21, colleges spent around £841 million, generating income of over £792 million[2].

Table 2: College income for 2019/20 and 2020/21 (£ million)

Type of Income	2019-20	2020-21
SFC/RSB grants	595	622
Tuition fees and education contracts	114	114
Donations, endowment and investment income	0.15	0.24
Research grants and contracts	2	3
Investment Income	0.13	0.52
Other income	64	54
Total income	775	792

Source: *Scottish Funding Council*

2 Colleges also made profit on several sources such as revaluation of assets and actuarial gain on pension schemes therefore overall income was over £1 billion once these are accounted for.

Table 3: College expenditure for 2019/20 – 2020/21 (£ million)

Type of Spending	2019-20	2020-21
Staff Costs	566	586
Other exceptional costs	2	7
Other operating expenditure	171	165
Depreciation	60	58
Interest Payable	26	27
Total spending	826	841

Source: *Scottish Funding Council*

Colleges also help to support substantial employment in a variety of different forms.

There were 10,700 Full-Time Equivalent (FTE)[3] staff in Scottish colleges in 2021/22, of which 4,540 were teaching staff, and the remaining 4,500 were non-teaching staff.

Whilst employment in colleges has fallen slightly since 2016/17, the nature of employment has changed.

In recent years, there has been a major shift to more permanent full-time and part-time employment, with a large shift away from temporary members of staff.

Table 4 provides an employment comparison between 2016/17 and 2021/22, highlighting the nature of jobs in Scotland's colleges.

Table 4: FTE staff by occupation and mode of employment, 2016/17 – 2021/22

			2016/17	% of staff	2021/22	% of staff	% change between years
Teaching	Permanent	Full-time	3,570	33%	3,500	33%	-2%
		Part-time	1,280	12%	1,710	16%	34%
		Total	***4,850***	***44%***	***5,200***	***49%***	***7%***
	Temporary	Full-time	75	1%	80	1%	4%
		Part-time	470	4%	220	2%	-53%
		Total	***540***	***5%***	***300***	***3%***	***-45%***
Teaching total			5,400	49%	5,510	51%	2%
Non-teaching	Permanent	Full-time	3,720	34%	3,540	33%	-5%
		Part-time	1,275	12%	1,375	13%	8%
		Total	***4,990***	***46%***	***4,910***	***46%***	***-2%***
	Temporary	Full-time	320	3%	274	3%	-15%
		Part-time	230	2%	7	0%	-97%
		Total	***550***	***5%***	***281***	***3%***	***-49%***
Non-teaching total			5,550	51%	5,190	49%	-6%
Staff total			**10,940**		**10,700**		

**Numbers may not sum due to rounding*

Source: *Scottish Funding Council*

3 See Scottish Funding Council

3. System-wide impacts of college learners

In this section we summarise our modelling results of the economic contribution of both a single and multiple years of graduation cohorts.

Using our AMOS model for the Scottish economy, we simulate the long-term contribution of both a single-year graduation cohort (2021/22) and multiple years of graduation cohorts (2016/17 - 2021/22).

Throughout this report we refer to the 'long-run' which refers to the assumed **40-year** period post-graduation in which graduates participate in the labour force.

After 40 years, we remove the estimated uplift in productivity and model for a further 45 years, meaning in total we can examine the contribution of graduates over an 85-year period.

Our estimates of the uplift in GDP are also presented in net present value (NPV) terms, meaning we have expressed the future values in current prices.

Table 5 shows the number of successful completions of graduates by year of qualification[4] that we model, and includes only an individual's highest qualification within that given year i.e., where an individual achieves an HNC and HND in a given year, then we include only the HND.

We also include in column 2 estimates of the wage premia associated with each level of National Vocational Qualification (NVQ). These premia are taken from McIntosh and Morris (2016) which uses pooled Labour Force Survey data for 1997-2015 and provides estimates of the wage premium for each NVQ level achieved when compared to individuals with no qualifications.

We provide a more detailed description of our methodology in Technical Annex A, which is appended to this report.

Table 5: Number of recognised completions of qualifications by college graduates by NVQ level, 2016/17 – 2021/22

	Wage Premia	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
NVQ1	2.7%	31,815	28,335	29,065	23,710	18,140	21,055
NVQ2	7.2%	28,295	27,345	30,515	29,090	24,945	25,900
NVQ3	31%	55,120	58,040	59,185	57,515	56,185	52,060
NVQ4	48%	10,960	11,895	11,425	10,730	11,335	10,295
NVQ5	41%	10	10	20	25	65	55
TOTAL	-	126,200	125,625	130,210	121,070	110,670	109,365

Source: *Scottish Funding Council, Mitchell and Morris (2016)*

Disclaimer: The results in the following section are not directly comparable to those in our previous report given that the college completion estimates used excluded qualifications that related to school-level qualifications. In this report, given that these qualifications are still recognised, we have included them. Hence, whilst the effect might appear significantly larger in comparison to our previous report, this is because we are considering a much larger cohort of students.

4 We are grateful to the Scottish Funding Council for their support and delivery of these qualification figures.

Economic impact of single graduation cohort

Our modelling suggests that a single year graduation cohort:

- Makes the Scottish economy cumulatively better off by £8bn over their 40-year working life, when compared to a economy without these skilled graduates.
- Help to support an additional 31,000 FTE jobs in the Scottish economy over their 40-year participation in the labour force.
- The Scottish Government's £740m investment, via the The Scottish Funding Council in colleges in 2021/22, led to a £8bn boost to the GDP of the Scottish economy and a £2.8bn boost to government revenues. The investment in this college cohort therefore represented 9% of the return in terms of the boost in GDP, and 26% in terms of the boost to government revenues.

Table 6 provides detailed long-run effects of changes to labour productivity reflecting the impacts of a single graduation cohort of college students for the year 2021/22.

The increase in the productivity of the Scottish labour force generated by the 2021/22 college graduation cohort is 0.31%. This increase is fed into our model of the Scottish economy and is held from year 1 to year 40, when this uplift is removed, to reflect the likely 40-year participation in the workforce of the average college graduate.

Our results suggest that over their 40-year working life, college graduates help to boost employment (hence reduce unemployment), increase real wages and help to increase investment and exports, both globally and to the rest of the UK.

The uplift in productivity from the addition of the 2021/22 college graduation cohort makes the Scottish economy cumulatively better off by around £8bn when compared to an economy without these skilled graduates.

This corresponds to a £73,000 per college graduate uplift across their 40-year working life, calculated by dividing the overall uplift in GDP by the total number of graduates (£8bn/109,365).

Furthermore, the total employment boost to the economy over the long run is equal to an additional 31,000 FTE jobs across the whole Scottish economy, when compared to an economy without the contribution of these graduates.

Table 6: Single cohort analysis for 2021/22: long-run (40-year) effects of a change in labour productivity (in percentage changes from base year values unless otherwise stated).

	Long-run
GDP	0.31
Consumer price index (CPI)	-0.17
Unemployment Rate (pp difference)	-0.08
Total employment	0.04
Nominal gross wage	-0.09
Real gross wage	0.08
Households Consumption	0.04
Investment	0.28
Capital Stock	0.28
Exports rUK	0.29
Export ROW	0.29
Total GDP (£bn)	8
Number of graduates	109,365
GDP per Graduate (£)	73,000

Source: *FAI Calculations*

Chart 1 highlights the long-run percentage changes in GDP and employment against their base line levels.

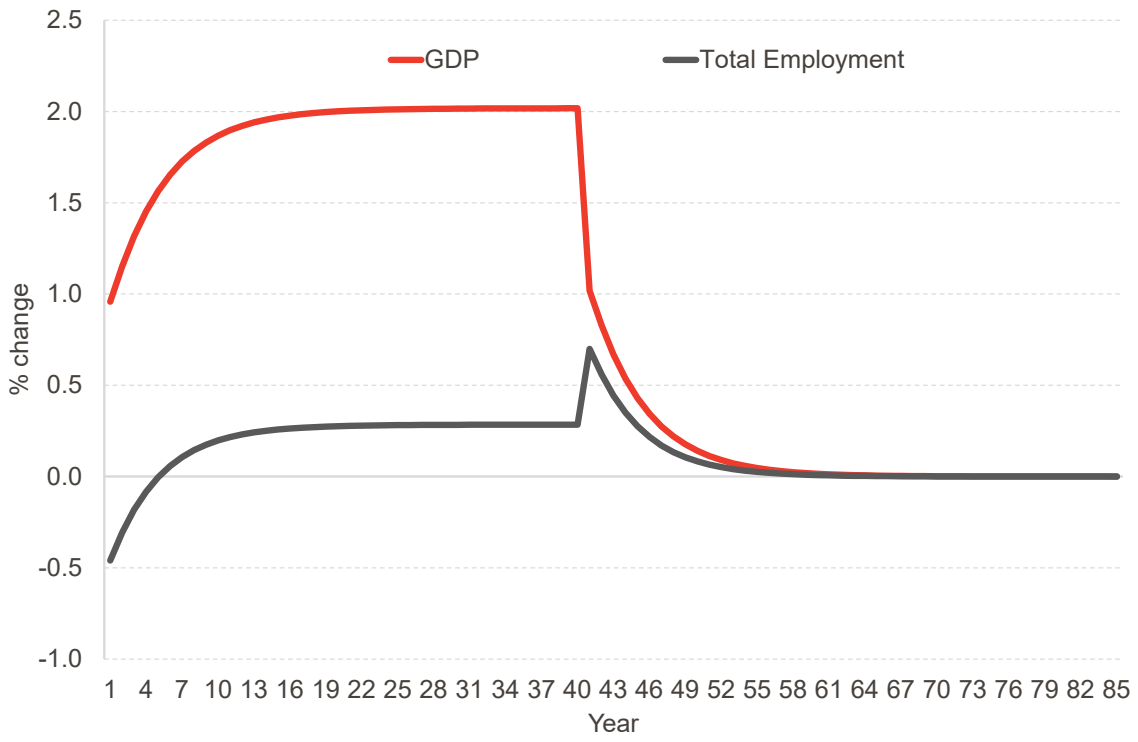
This shows that GDP reaches its equilibrium level around year 19, which is sustained until year 40, and then falls as a result of the individual likely leaving the labour market.

Employment changes initially fall and turn positive in year 6, where they remain positive until year 40.

After they leave the labour market, a 'legacy' effect of college graduates sets in, meaning that despite the labour productivity uplift in the economy being removed, employment will still likely remain higher than its baseline given the contribution of these graduates.

These employment changes therefore initially rise and then remain positive for a further decade, before the stock of human labour returns to its baseline values around year 55.

Chart 1: The impact on Scottish GDP and employment given an increase in labour productivity generated by the single 2021/22 college graduation cohort. (In percentage changes from base year values)



Source: *FAI Calculations*

We have also modelled the increased tax revenues that the boost in economic activity from college graduates supports.

Our estimates suggest that the government budget will likely be £2.8bn better off in the long run from the addition of a single year of college graduates to the Scottish economy.

In 2021/22, The Scottish Government via The Scottish Funding Council provided £740m in funding to colleges across Scotland.

This means that the 'cost' to the government of supporting colleges accounts for around 26% of the total uplift in the government's budget, and around 9% of the increase in GDP.

Economic impact of multiple graduation cohorts

Given that the number of college graduates and their associated skills likely change from year to year, our results are somewhat dependent on the choice of base-year analysed.

Furthermore, the working-age population of Scotland also changes in size each year, so there may be some room for variation in our estimates depending on the year set as the baseline.

We therefore model the contribution of multiple years of graduation cohorts, to understand the overall impact that several years of college graduates have on the economy.

The same method is used as our single graduate analysis, however here we stagger the entry and removal of the productivity uplift to reflect the different 40-year time periods in which graduates participate in the workforce (i.e., those graduating in 2016/17 will enter and leave the labour market earlier than those in 2021/22).

Our modelling suggests that multiple years of college graduation cohorts:

- Help to boost labour productivity by 2% in the long run across the Scottish economy.
- This makes the Scottish economy cumulatively better off by around £52bn over their 40-year working life, when compared to an economy without these skilled graduates.
- These graduates also help to support an additional 203,000 FTE jobs in the Scottish economy over their 40-year participation in the labour force.
- The Scottish Government's £4.1bn investment, via The Scottish Funding Council between 2016/17 and 2021/22, led to a £52bn boost to the GDP of the Scottish economy and a £18.2bn boost to government revenues. The investment in multiple years of college graduates therefore represented 8% of the return in terms of boost in GDP, and 22.5% in terms of the boost to government revenues.

Table 7 and Chart 2 provide detailed long-run effects of changes to labour productivity reflecting the impacts of multiple years of college graduation cohorts between 2016/17 and 2021/22.

The increase in the productivity of the Scottish labour force generated by multiple years of college graduation cohorts is 2%.

When fed into our model, this increase helps to boost GDP (and GDP per capita), supports additional employment and leads to increases in real wages across the Scottish economy. It also boosts investment and exports by more than 1.8%.

Our results suggest that over their 40-year working life, the uplift in productivity from the addition of the multiple cohorts of college graduates cumulatively make the Scottish economy better off by £52bn in the long run when compared to an economy without these graduates.

This corresponds to a £72,000 per college graduate uplift across their 40-year working life, calculated by dividing the overall uplift in GDP by the total number of graduates (£52bn/723,140).

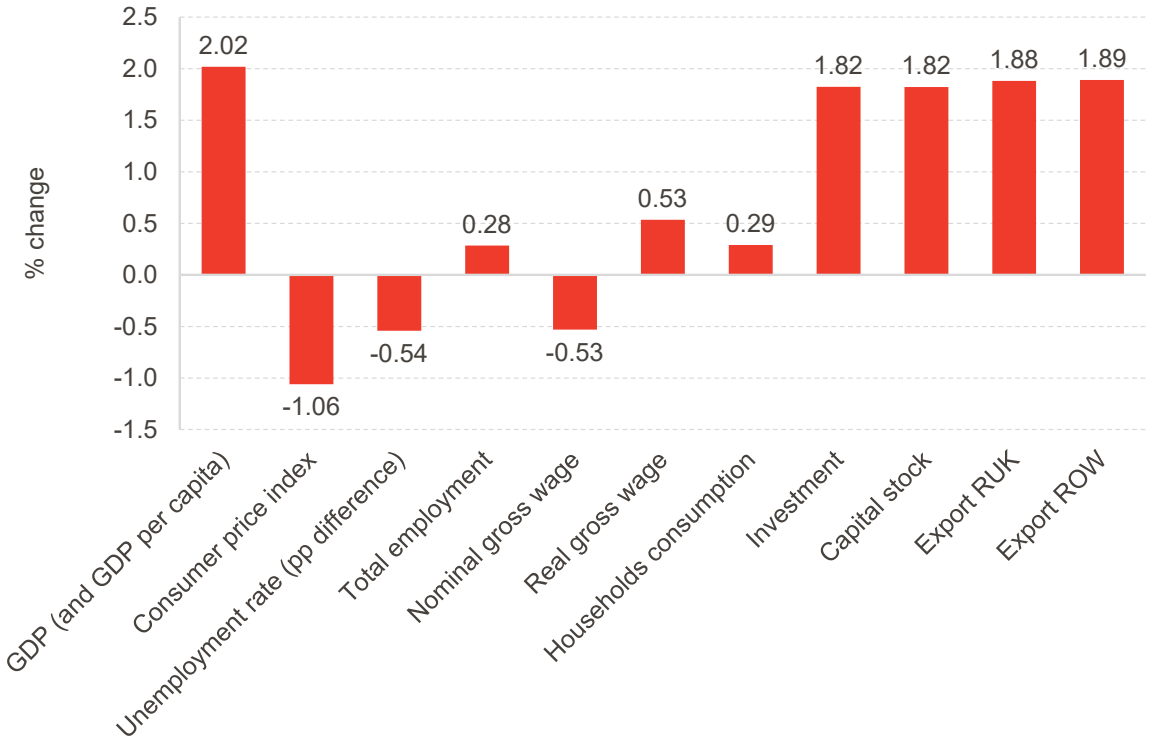
Furthermore, the total employment boost to the economy over the long run is equal to an additional 203,000 FTE jobs across the whole Scottish economy, when compared to an economy without these skilled graduates.

Table 7: Multiple cohort analysis between 2016/17 and 2021/22: long-run (40-year) effects of a change in labour productivity (in percentage changes from base year values).

	Long-run
GDP	2.02
Consumer price index (CPI)	-1.06
Unemployment Rate (pp difference)	-0.54
Total employment	0.28
Nominal gross wage	-0.53
Real gross wage	0.53
Households Consumption	0.29
Investment	1.82
Capital Stock	1.82
Exports rUK	1.88
Export ROW	1.89
Total GDP (£bn)	52
Number of graduates	723,140
GDP per Graduate (£)	72,000

Source: *FAI Calculations*

Chart 2: The impact on the Scottish economy given an increase in labour productivity generated by graduation cohorts between 2016/17 and 2021/22 (in percentage changes from base year values).



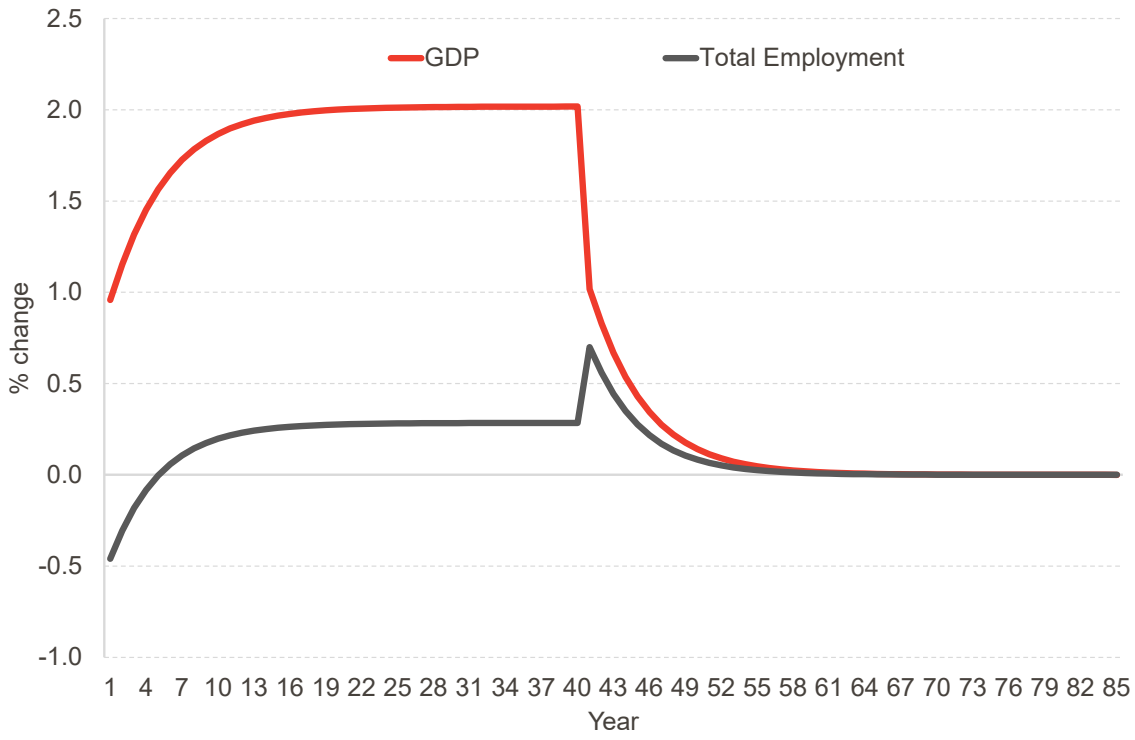
Source: *FAI Calculations*

Chart 3 then highlights the long-term percentage changes in GDP and employment against their base-line levels.

This shows that GDP reaches its equilibrium level around year 5, which is sustained until year 40, and then falls as a result of the individual likely leaving the labour market.

Again, the 'legacy' effect of these graduation cohorts is evident once the graduate cohorts leave the labour market. There is an initial stimulus to employment after the uplift in labour productivity is removed, which remains positive until Year 60 before returning to its baseline level.

Chart 3: The impact on Scottish GDP and employment given an increase in labour productivity generated by graduation cohorts between 2016/17 and 2021/22 (In percentage changes from base year values).



Source: *FAI Calculations*

We, again, model the increased tax revenues that the boost in economic activity from college graduates supports.

Our estimates suggest that the government budget will likely be £18.2bn better off in the long run from the addition of multiple years of college graduates to the Scottish economy when compared to an economy without this productivity uplift.

Table 8 shows the total value of the grants paid by The Scottish Government to Scottish colleges via The Scottish Funding Council between 2016/17 and 2021/22, which total around £4.1bn.

We therefore estimate that the 'cost' to the government of supporting colleges accounts for around 22.5% of the total uplift in the government's budget, and around 8% of the increase in GDP.

Table 8: Scottish Funding Council grants paid to Scottish Colleges (£ million)

	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	Total
SFC Funding	603.6	623.5	703.5	697.6	724.6	740.9	4,093

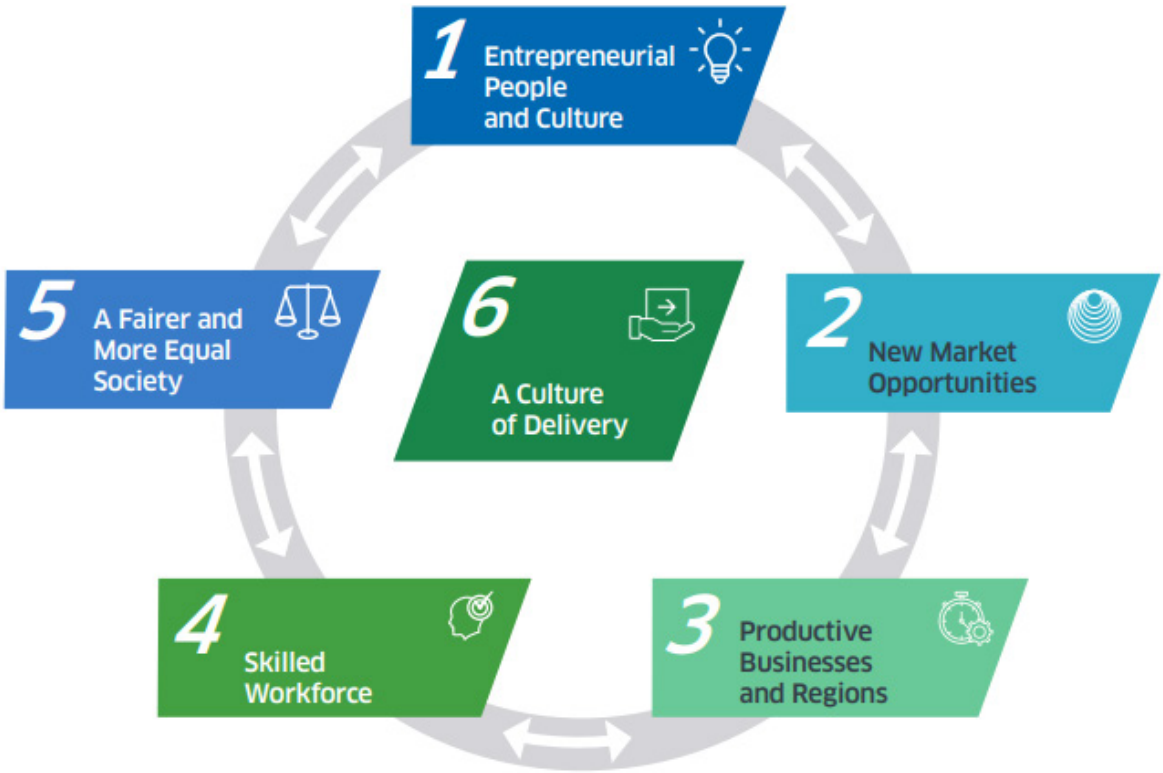
Source: *Scottish Funding Council*

Delivering Scotland's National Strategy for Economic Transformation

In March 2022, The Scottish Government set out its National Strategy for Economic Transformation (NSET), with the aim to utilise Scotland's economic potential to its maximum and provide a more prosperous, productive and internationally competitive economy.

The strategy was set against six policy programmes of action, shown in Diagram 1. These 'pillars' aim to tackle long-term structural challenges, build on economic strengths, and position Scotland to utilise its economic opportunities over the next ten years.

Diagram 1: Pillars of Scotland's National Strategy for Economic Transformation



Source: *Scottish Government*

Colleges have a significant role to play in supporting the Scottish Government in strengthening the pillars of its economic strategy, particularly through their ability to provide essential skills and experiences for graduates entering the labour market.

In particular, colleges are in a unique position to help the government with its overall pillar of fostering a culture of delivery by utilising the interconnectedness of its five policy pillars.

Beyond their ability to provide essential skills and experiences, colleges also help to widen access and break down many of the barriers to education for vulnerable subgroups of the population.

Further to this, they can also help to skill individuals in areas that can help boost growth across all sectors of the economy, foster innovation and entrepreneurship, and boost regional economies.

Throughout this report we highlight the contribution of colleges to each of the policy pillars of Scotland's economic transformation strategy and provide insight into the role they have to play in supporting the government in achieving their policy goals.

4. Developing a skilled workforce for Scotland

One of the key pillars of Scotland's economic transformation strategy focuses on ensuring people have the skills required throughout life to have prosperous careers and meet the demands of an ever-changing economy.

As part of this, the government have prioritised adapting the current education and skills system to be more responsive to economic needs and ambitions.

Colleges play a crucial role in providing highly skilled, well-experienced graduate cohorts to the Scottish labour market, demanding high wage premia with each level of qualification attained.

Their role, in supplying fair and equal access to further and higher education means they are fundamental to supplying and maintaining the stock of skilled individuals within the Scottish labour force.

The ability of colleges to offer a diverse range of courses in all subject areas also means that all sectors of the economy benefit from their graduate cohorts.

Whether it be through the provision of more practical skills, to aid industries like construction or manufacturing; hands-on experience to boost skills in consumer-facing industries such as retail or hospitality, or providing platforms for creative individuals pursuing careers in the arts, theatre or television and film, colleges cater for all individuals and industries.

Supply of highly skilled graduates

There is body of evidence that measures the labour market benefits to an individual of education and training.

These studies find that beyond the obvious educational benefits of further and higher education, these qualifications benefit from a wage and employment premium when compared to those individuals without qualifications.

College qualifications tend to be associated with a higher probability of employment, given the associated higher level of skills that come with higher levels of qualifications.

Table 9 shows the number of college graduates successfully completing nationally recognised qualifications at Scottish colleges and the associated wage premia[5] to these qualifications.

This shows that higher qualification levels do demand higher wages when compared to individuals with no qualifications given the associated higher skill level.

5 Wage premia relates to the marginal returns on hourly earnings compared to individuals with below NVQ-1 level qualifications.

Table 9: Number of recognised completions of qualifications by college graduates by NVQ level, 2016/17 – 2021/22

	Wage Premia	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
NVQ1	2.7%	31,815	28,335	29,065	23,710	18,140	21,055
NVQ2	7.2%	28,295	27,345	30,515	29,090	24,945	25,900
NVQ3	31%	55,120	58,040	59,185	57,515	56,185	52,060
NVQ4	48%	10,960	11,895	11,425	10,730	11,335	10,295
NVQ5	41%	10	10	20	25	65	55
TOTAL	-	126,200	125,625	130,210	121,070	110,670	109,365

Source: *Scottish Funding Council, Mitchell and Morris (2016)*

The wage premia estimates are taken from McIntosh and Morris (2016) and use pooled Labour Force Survey data for 1997-2015 to estimate the associated hourly wage returns by each level of vocational qualifications.

This research also explores marginal returns to education by subject for those holding National Vocational Qualifications at levels 2 and 3, providing insight as to what areas of study tend to have the highest estimated wage returns.

The results find that for those with an NVQ Level 2, despite having lower wage returns in comparison to higher levels of qualifications, occupations in management, secretarial and business-related subjects have returns as high as 10%.

For those with Level 3 NVQ's, the highest level of NVQ considered within this analysis, occupations in Engineering, Manufacturing and Construction have the highest marginal returns, with returns between 20% and 40%.

Employment supported by college spend

As detailed in Section 2, our cohort modelling highlights that there is a direct uplift in labour productivity resulting from a single year of college graduate cohorts of 0.31%.

When fed into our model, these highly skilled graduates help to make the Scottish economy better off by around £8 billion, demonstrating the significant contribution of college graduates to the economy.

However, as well as the contribution of skilled college graduates to the labour force, we also model the contribution of the money spent by colleges.

Using our Input-Output model of the Scottish economy for 2019, we model the contribution of both colleges' operating (OPEX) and capital (CAPEX) expenditures in the same year[6].

We collected these spending figures from both individual and consolidated college accounts published by the Scottish Funding Council.

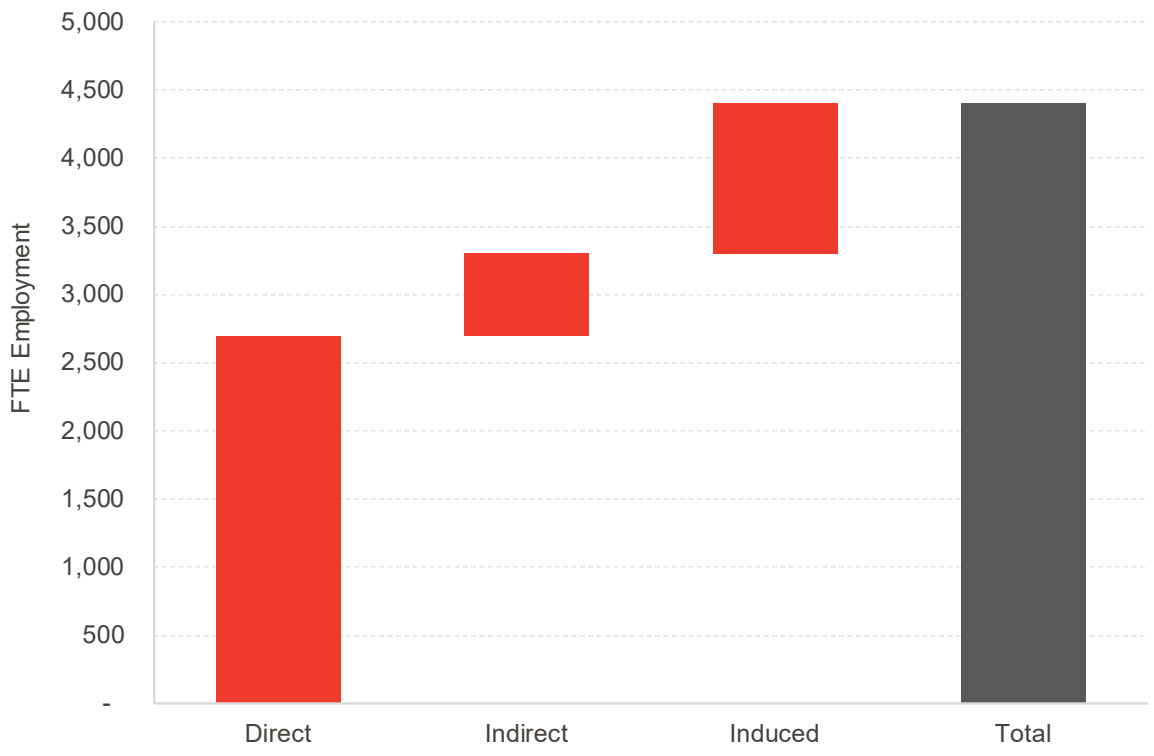
A more detailed methodology for this modelling is provided in Technical Annex B, appended to this report.

Our modelling suggests that on top of workers already employed within colleges, their spending helps to support additional employment across the Scottish economy.

We estimate that college spend supports an additional 4,400 FTE jobs across the Scottish economy, of which 2,700 FTE jobs are supported by the direct spending of colleges alone.

Chart 4 highlights the direct, indirect and induced FTE jobs supported by college spend across the economy.

Chart 4: Economic impact of colleges' spending, FTE employment (2019)



Source: *FAI Calculations*

6 We model college expenditure from 2019 given that our model uses Input-Output tables published by The Scottish Government, for which the latest year is 2019.

As well as the FTE employment supported by direct college spending, we estimate that an additional 1,700 FTE jobs are supported across the wider sectors of the Scottish economy.

These jobs are supported via the supply chains serving colleges and the spending of wages by workers within them i.e., the indirect and induced effects.

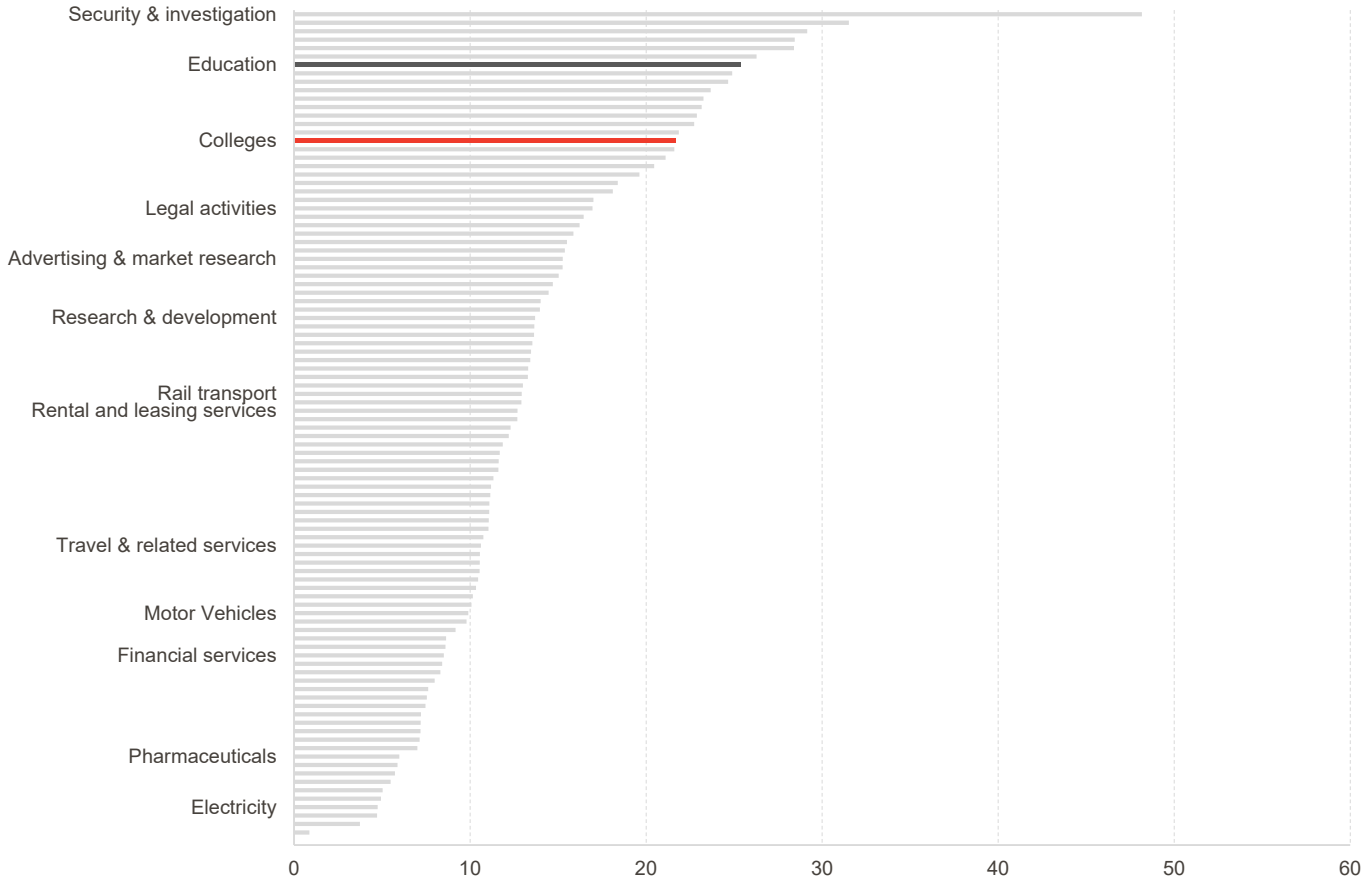
This means that for every 1 job supported by direct college spend, 0.6 jobs are supported elsewhere in the economy.

In fact, when we compare the employment-output multiplier of colleges – the measure of how many jobs are supported per £1m of output – to the other 97 sectors of the Scottish economy, they rank 14th, as shown in Chart 5.

Put simply, this means that similar to the education sector, college spending supports significant employment across the wider Scottish economy.

Unsurprisingly our modelling also suggests that colleges support high employment in the education sector, however also other sectors such as retail, real estate and food and beverage services.

Chart 5: Comparison of Type II FTE jobs-output multipliers across 97 sectors of the Scottish economy & college spend. Selected sectors labelled.



Source: *FAI Calculations*

CASE STUDY

Supporting the development of Scotland's maritime industry, North East Scotland College

Like most institutions across the country, the Scottish Maritime Academy (SMA), a part of North East Scotland College, faced an ongoing challenge of how best to organise its course provision to continue to support the Scottish maritime industry's training needs during, and in the aftermath of, the COVID19 pandemic.

A key element of their response to this challenge was the greater use of digital technology, and particularly hybrid learning, to better accommodate learners that are often spread across the UK and beyond. To support this approach, as well as making greater use of the College's virtual learning environment (VLE), the SMA installed a range of new digital technology, such as high-definition screens, microphones, cameras, and a range of new software, to support the creation of a future-proof hybrid classroom, as well as providing training for those who would be using the new classroom for course delivery.

The hybrid classroom proved a success and was particularly effective when used to deliver a number of the SMA's mandatory 12-week training programmes for learners hoping to progress in careers in fishing and the merchant navy. It allowed students restricted from travelling to join SMA programmes and showed no negative effect on outcomes or retention. Indeed, the success of this approach was recognised when the SMA's hybrid classroom was nominated for awards, by the Northern Star and Fishing News respectively.

While many at the SMA acknowledge that remote learning does have some remaining disadvantages versus face-to-face instruction, particularly around the socialisation and on-site collaboration that is particularly important in the maritime sector, the decision was made that hybrid learning should remain an option for SMA beyond the end of the pandemic. This allows SMA to continue to provide programmes for those in the sector who require upskilling or who want to change careers but for whom flexibility, especially around travel, is required in order to do this.

A huge success story was one fisherman student. He split his 12 weeks up into three different locations: sometimes at college, sometimes at home, and sometimes in the shipyards in Denmark, where he would be working. We said ok, as long as you log in – no problem. And he did, and he passed every exam with flying colours. ~ ***Christopher Bell, the Head of Scottish Maritime Academy***

Hybrid learning has therefore become an increasingly important tool for SMA in terms of attracting a wider range of students, including those from further afield which, in turn, allows it to do more to support the development of the maritime industry at a national rather than local level. Through its adapted digital delivery, the Scottish Maritime Academy is supporting a wider range of individuals with access to career progression opportunities in the industry, while also helping to ensure the Scottish fishing and maritime industry has the skills it needs to thrive and remain internationally competitive.

Addressing skills gaps

In recent years, one of the key policy aims in Scotland and the wider UK has been the need to address skills gaps particularly as the economy transitions to net zero, making many occupations, such as those in oil and gas obsolete.

Further to this, the transition to home and flexible working means the nature of many occupations has changed with a much higher reliance on digital and technology than was the case in the pre-Covid labour market.

As part of this, a recent review commissioned by the Scottish Government sought to explore the skills landscape in Scotland.

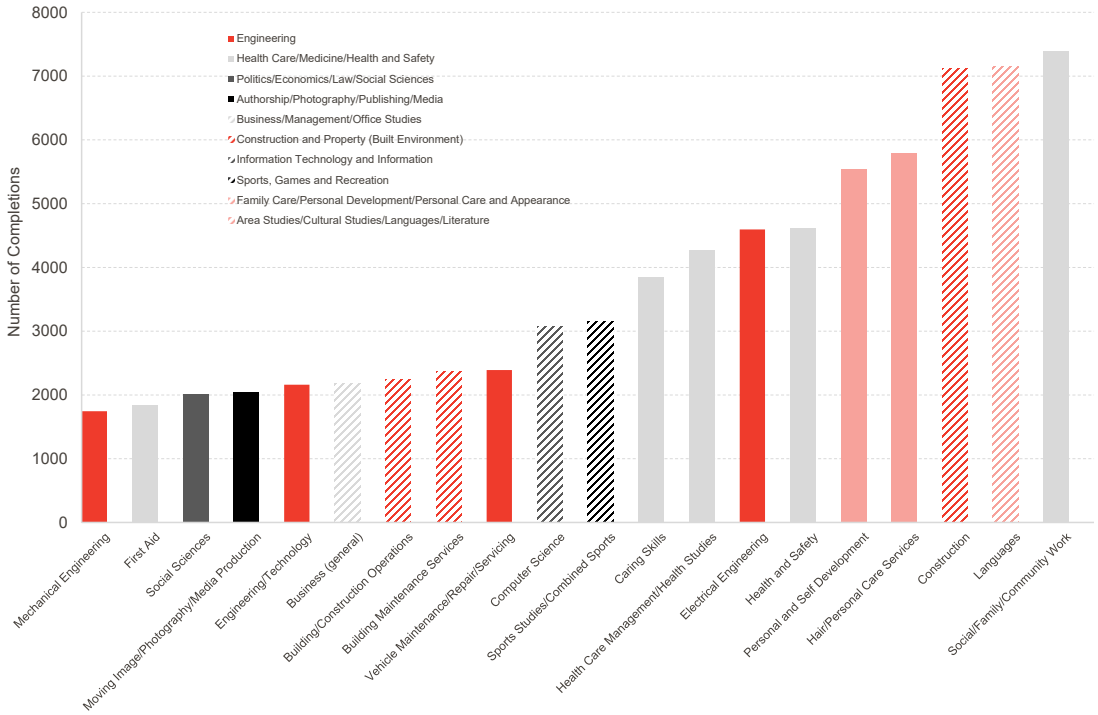
The Independent Review of Skills Delivery Landscape was conducted by James Withers, and provided major recommendations to the government on how to deliver skills in Scotland.

As part of the review, it was identified that skills should not sit separately to higher or further education but instead are a product of a good learning system and that colleges have a significant role to play in delivering skills in Scotland.

Colleges sit at the forefront of 'skilling up' the nation through its diverse and extensive selection of further and higher education courses.

Of the top 20 subjects in terms of number of completions, there are 10 different subject areas represented, as shown in Chart 6, highlighting the breadth and popularity in the variety of courses offered by colleges.

Chart 6: Most enrolled further education courses by subject and subject area, 2021/22



Source: *Scottish Funding Council*

As well as the further and higher education courses provided by colleges, qualifications achieved in Scotland's colleges are often used by individuals to gain entry to university and degree programmes, helping to further skill-up the labour force in Scotland and the wider UK.

An advanced standing is where an individual uses one qualification to gain entry to another i.e., using an HND to gain access to an undergraduate degree.

In 2021/22, 1 in 5 Scottish domiciled degree entrants were college students entering universities within 3 years of completing a college course, which rises to 1 in 3 students when we remove the within 3 years element.

CASE STUDY

Supporting Regional Economic Development through Digital Transformation, Edinburgh College

In October 2021, Edinburgh College launched a Digital Care Hub, in partnership with the University of Edinburgh, designed to provide greater skills and opportunities to health and social care students in the Lothians, with a focus on providing the digital skills required to work in the sector. The hub now sits within the College's School of Health Professions and Social Services, which provides a range of Healthcare, Social Services and Social Care routes for around 4500 students per year.

With the ongoing challenges in Scotland's health and social care system (staff shortages and increased demand, driven by an ageing population and exacerbated by the covid-19 pandemic), the College aimed to design a new future-proofed learning space that would allow an expansion and enhancement of the College's provision in this area. This resulted in the development of the Digital Care Hub, which provides an innovative, immersive space for health and care students (including school-college partnership pupils) - taking them out of the traditional classroom environment and into a state-of-the-art facility. The hub, within the College's Sighthill Campus, equips students with the transferable skills required to fulfil a successful career in areas including Health and Social Care, Dental and Pharmacy with a particular emphasis on technology-enabled care.

With funding support from the University of Edinburgh and several other sources, the Hub opened its doors in 2021. National skills gaps and challenges faced by the sector informed the design of the space, with a focus on technology-enabled care. The facility contains a replica ward with a patient room, a care at home room, a virtual reality suite and an oral health and pharmacy suite – all replicating workplace environments and enabling simulation of real-life situations, leading to a more practical learning experience.

The Digital Care Hub is already having an impact in several ways. Firstly, it encourages the delivery of curriculum with the support of state-of-the-art facilities, which also gives the means to exchange expertise between teams that were previously working in isolation. By extension, the Hub's spaces facilitate moving away from traditional closed book assessment and towards a more authentic, practical approach. Secondly, the Hub helps develop students' digital skills by meaningfully incorporating them within the learning process. In turn, this makes these skills a natural part of future practitioners' roles and helps support technology-enabled care.

At the heart of the hub's innovation, is the award-winning Dementia Care VR Programme, developed as part of a partnership with technology company Cadpeople to create a ground-breaking software programme which uses Virtual Reality to teach a key SQA Module in Dementia Care. This moved the Hub from being a physical entity to a digital learning framework and has supported the college in winning a contract with one of the biggest care providers in Edinburgh for dementia training for support workers. This highlights one of the key impacts of the Hub, as Caroline Hairs (the Head of School) explains:

The biggest priority when designing the spaces was about full-time students and students coming through school-college partnerships. It was about bringing learning to life for them, so that they come in, put their scrubs on, get into rooms and into character and learn about the professionalism. And that is all happening. But what has also happened is that regional employers are interested in our space. So, we have local authorities and NHS boards who are becoming increasingly interested in using our spaces for upskilling the existing workforce.

~ ***Caroline Hairs, Head of School***

As a result of the success of the Hub, the College now receives near-daily requests from external partners interested in the use of facilities and bespoke learning packages, demonstrating not only the Hub's potential in closing the regional skills gap but also in providing a future commercial income stream for the college.

With an increased focus on health and social care integration across Scotland, the Hub therefore enables the College to demonstrate the importance of health, social care, pharmacy, and other care areas working together and supports the college's ambition to provide a symbiotic and work-ready health and care workforce that supports the region's economic growth.

5. Widening access of education in Scotland

In line with the fifth pillar of Scotland's economic transformation strategy to support a fairer and more equal society, the work of colleges to widen access plays a significant role in broadening the accessibility of further and higher education to everyone.

The pillar aims to realign the economy towards wellbeing and fair work, deliver higher employment and wage growth, with the main aim to reduce structural poverty and improve outcomes for disadvantaged communities.

College's support of this is evident in the number of enrolments and completions by students who face barriers in their education due to certain characteristics or demographics.

In this section, we explore the work of colleges to widen access to further and higher education in Scotland.

Deprivation quintile

One of the main barriers to education in Scotland is location, particularly the deprivation and poverty rooted in many of the areas in Scotland.

The location of colleges is pivotal in Scotland, in order to bring education closer to all areas of the country, helping to make further and higher education accessible to everyone.

The 24 colleges are spread across 70 campuses in Scotland, with many having multiple campuses in several different areas.

Scotland's Index of Multiple Deprivation is the relative measure of deprivation in Scotland, which ranks an area's deprivation based on a number of factors such as crime, education and employment.

Table 10 shows that of the 70 college campuses in Scotland, 14 are located within the top 20% most deprived areas of Scotland, with a further 20 in the 40% most deprived areas.

Put simply, this means that around half of Scotland's colleges are located in areas with relatively high deprivation when compared to other areas across the country.

Table 10: College campuses located in top 20% and 40% most deprived areas in Scotland

	College	Campus
Top 20% most deprived areas	Ayrshire	Kilwinning
	Ayrshire	Ayr
	Borders	Galashiels
	Forth Valley	Falkirk
	Glasgow Kelvin	Easterhouse
	West Lothian	Livingston
	Dumfries and Galloway	Dumfries
	Fife	Glenrothes
	Forth Valley	Alloa
	Glasgow Clyde	Anniesland
	New College Lanarkshire	Motherwell
	UHI North Highland	Dornoch
	West	Clydebank
	West	Greenock
Top 40% most deprived areas	City of Glasgow	City
	City of Glasgow	Riverside
	Dundee and Angus	Arbroath
	Dundee and Angus	Kingsway
	Glasgow Kelvin	East End
	New College Lanarkshire	Cumbernauld
	Newbattle Abbey	Newbattle Abbey
	UHI Inverness	Balloch (School of Forestry)
	UHI Moray	Moray Street
	UHI Orkney	UHI Orkney
	UHI West Highland	UHI West Highland
	Edinburgh	Milton Road
	Fife	Kirkcaldy
	Fife	Rosyth
	Glasgow Kelvin	Springburn
	NESCOL	Aberdeen City
	SRUC	Aberdeen
	SRUC	Cupar
	UHI Shetland	UHI Shetland
	West	Paisley

Source: *SIMD 2020*

As well as bringing education closer to everyone in society, colleges also do well to support these individuals in achieving both further and higher education qualifications.

Chart 7 highlights that between 2013/14 and 2021/22, the completion rate of full-time further and higher education courses by those from the bottom 20% of the most deprived areas in Scotland was over 50%.

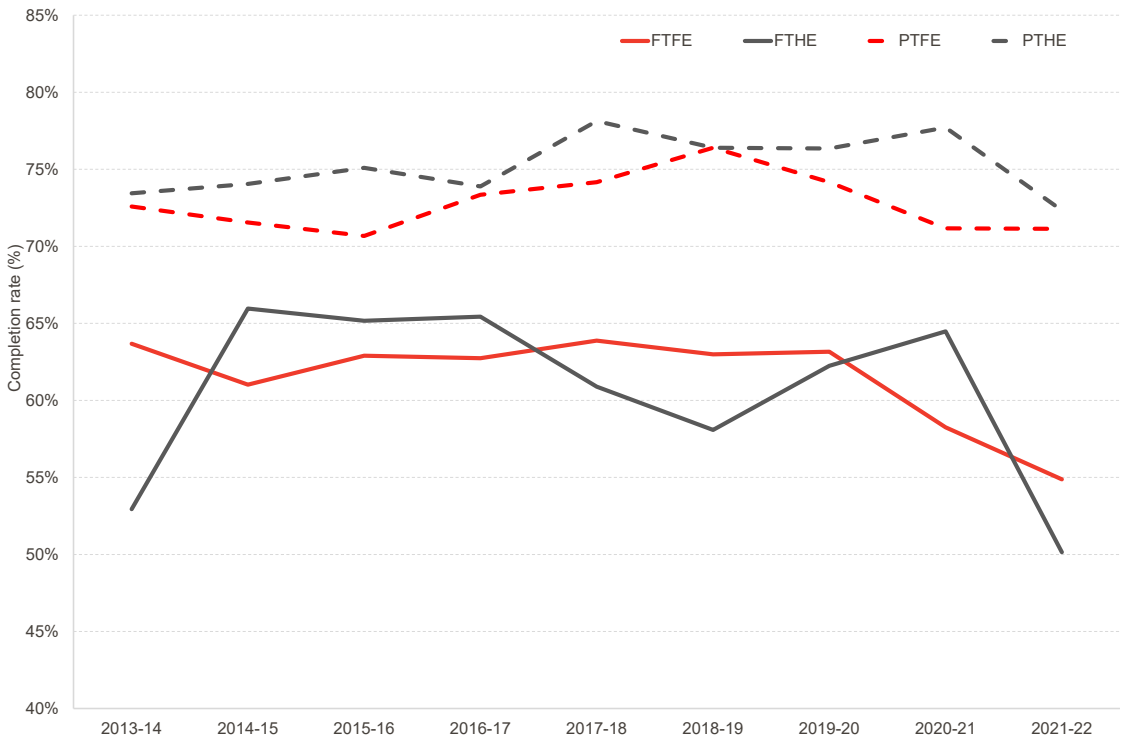
Completion of part-time courses was far higher for individuals from these areas, with a 71% completion rate for further education and 72% for higher education.

However, the significant impact the Covid-19 pandemic has had on individuals ability to complete further and higher education courses is evident, in particular for those from more deprived areas which have fallen around 8 percentage-points between 2019 and 2021.

A report by The Scottish Government in 2020 highlighted this issue further, showing that as many courses moved fully online, students from more deprived areas were more likely to be negatively impacted than peers given reasons such as access to IT, reliable Wi-fi and secure study spaces being more challenging for these individuals.

95% of individuals from the 20% most deprived areas, however, do reach a positive destination once leaving college, the same share of individuals from the top 20% least deprived areas, highlighting the opportunities colleges provide to close the attainment gap.

Chart 7: Completion rate of entrants at Scotland colleges from SIMD0-20 quintile, 2013/14 – 2021/22



Source: *Scottish Funding Council*

Furthermore, the role of colleges in providing opportunities for individuals to pursue further and higher education is also evident for those from more deprived areas.

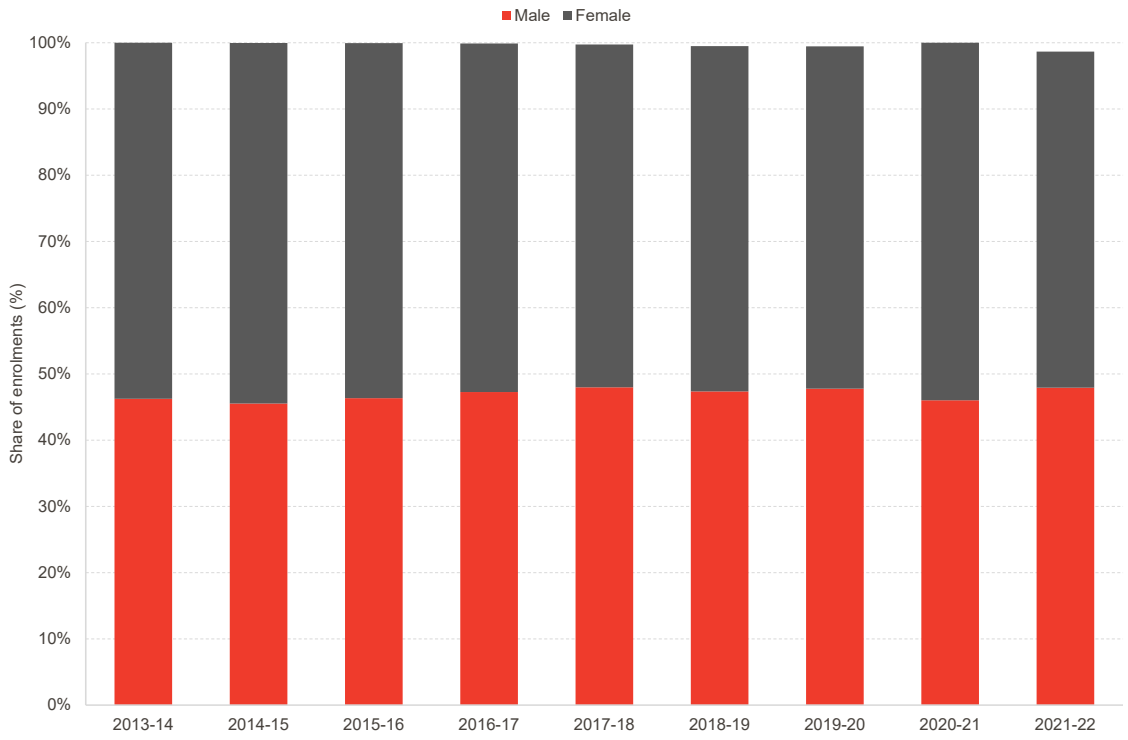
In 2021/22 there were around 5,600 first-degree entrants by Scottish domiciled students from the most deprived areas of Scotland, which had grown around 40% since 2015/16. Of these students, 46% entered university for their first degree through college routes.

Gender, ethnicity and disability status

Colleges also do well to maintain gender balance in their student cohorts. Chart 8 highlights that since 2013/14, the split of male and female enrolments has been relatively balanced, with slightly more females enrolled in full-time further education than males.

Both males and females were also equally likely to reach a positive destination after college, with 95% of individuals going onto a positive outcome.

Chart 8: Proportion of enrolments to full-time further education courses 160+ hours by gender, 2021/22



Source: *Scottish Funding Council*

College students are also diverse in terms of race and ethnicity.

60% of individuals from black and ethnic minority groups completed both full-time higher and further education courses in 2021/22, with this around 76% for part-time enrolments.

As part of its widening access commitments, colleges also offer accessible pathways to further and higher education to those with disabilities.

Economic inactivity is a pressing issue for both the Scottish and UK Governments. The inactivity rate in Scotland is higher than in the UK, with 22.3% of the Scottish working age population currently inactive compared to 20.8% in the UK.

One of the most common reasons for economic inactivity in Scotland is those with long-term illness or health conditions, with around 32% of working-age individuals inactive due to this reason.

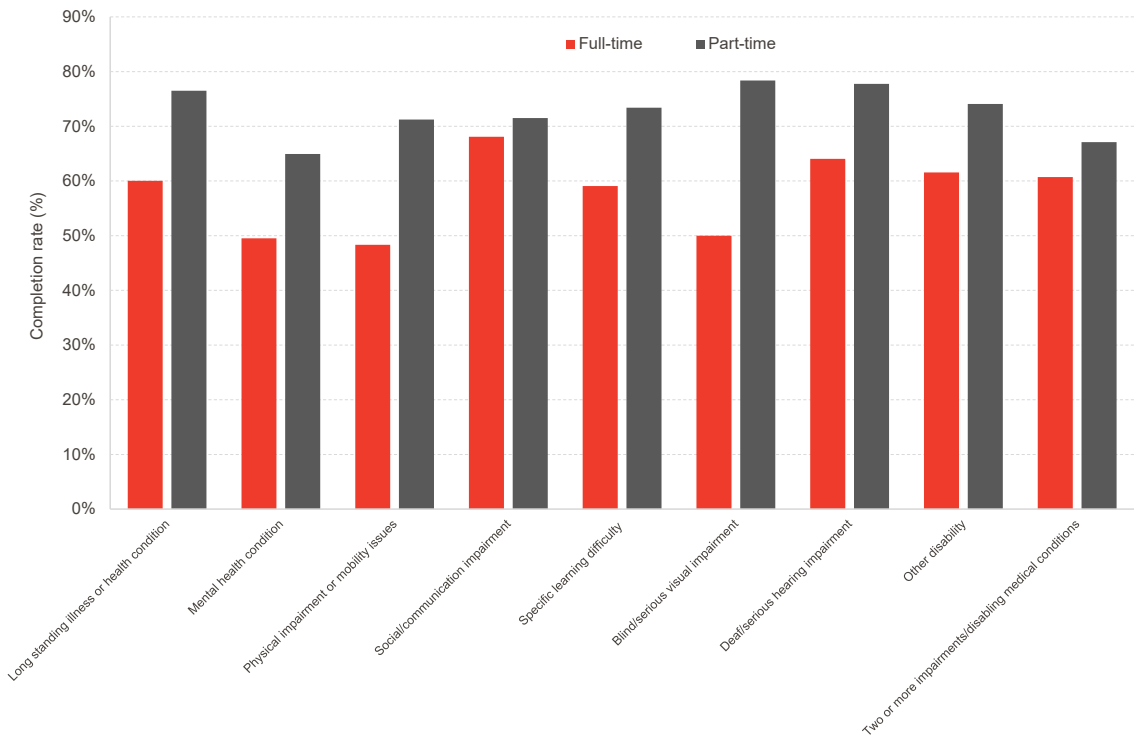
Individuals with disabilities face greater barriers to most education too, given reasons such as physical accessibility, inadequate funding opportunities and lack of one-to-one teaching, particularly in bigger education institutions with high student numbers.

Around 60% of individuals enrolling with a disability completed either full-time higher or further education. This increases to 70% when considering part-time education.

Further to this, the Fraser of Allander Institute has done extensive work into the employment landscape for people with learning disabilities, with the research finding that employment outcomes for these individuals are poor, with little progress made.

Colleges directly support these individuals, with 73% of enrolments of people with specific learning difficulties completed in 2021/22. This was as high as 80% for those enrolling in part-time higher education courses, and 60% for those in full-time higher education courses.

Chart 9: Successful completion rates of further education courses by individuals, by disability, 2021/22



Source: *Scottish Funding Council*

Care-experienced young people

As part of the Scottish Funding Council's National Ambition for Care-Experienced Students, colleges in Scotland also have a requirement to aid the SFC in ensuring that there is no difference in outcomes between care-experienced and non-care-experienced students by 2030.

As part of this, the SFC commissioned a survey of care-experienced students in Scotland's colleges and universities, with a set of recommendations provided to assist the SFC in meeting their national ambition.

Care-experienced young people are far more likely to have a disrupted educational experience, with attainment not only linked to other health and economic outcomes but can also have negative implications for an individual's prospects in later life.

A report by the Scottish Government in 2019 found that despite many care-experienced individuals having positive experiences with the education system, 44% of these children left school at the age of 16, compared to 11% of all school leavers.

Further to this, only 39% of these individuals had one or more qualifications at SCQF level 5 compared to 86% of all pupils.

The same research found that in 2017-18, around 21% of cared-for young people were classed as unemployed nine months after school, highlighting the domino effect on education and labour force participation that being a care-experienced individual can have.

Colleges do well to provide opportunities to care-experienced people, particularly given their ability to provide both part-time and full-time higher and further education courses.

Further education also provides an opportunity for these individuals to attain qualifications that they may not have otherwise done at school, helping to close the attainment gap between care-experienced young people and their peers.

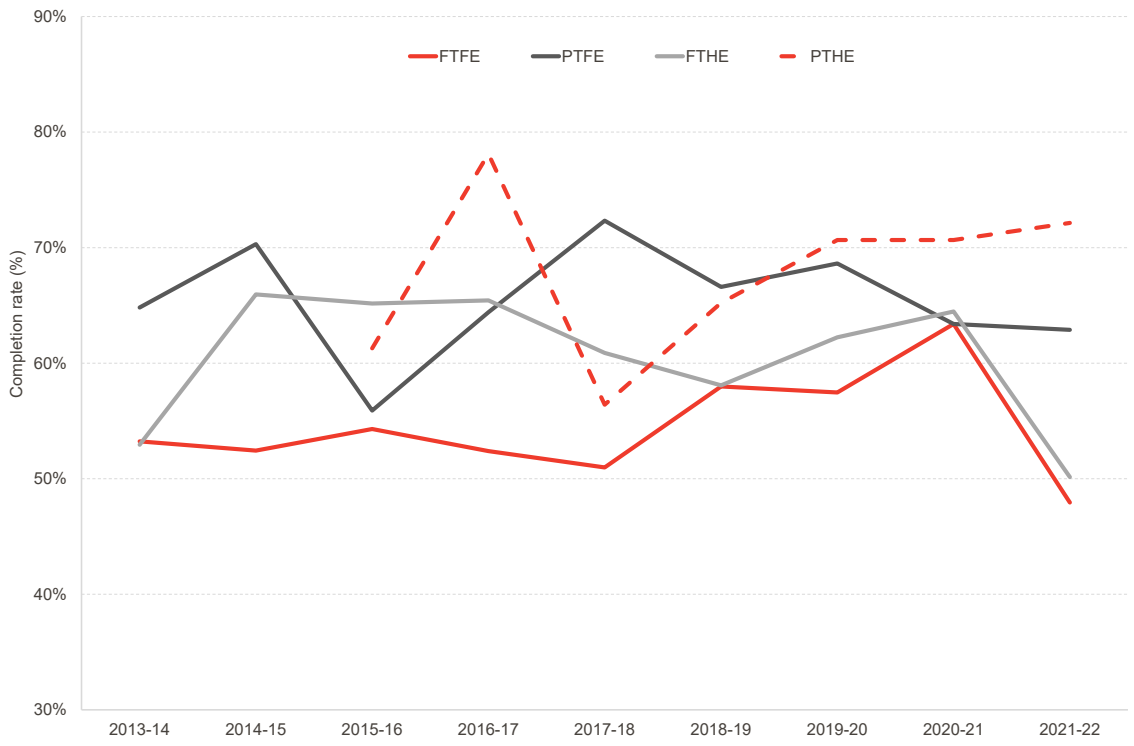
For 2021/22, completion of enrolments by care-experienced individuals was 72% for part-time higher education courses, with completion at 63% for part-time further education courses, Chart 10.

Furthermore, both full-time further and higher education courses had completion rates of around 50%.

However, despite a relatively high share of full-time and part-time completions between 2013 and 2021, the pandemic, again, had a significant impact on those individuals on full-time courses with caring requirements.

Care-experienced individuals were however highly likely to go onto a positive outcome after college, with 95% of these students going on to a positive outcome.

Chart 10: Successful completion rates by care experienced individuals, 2013/14 - 2021/22



Source: *Scottish Funding Council*

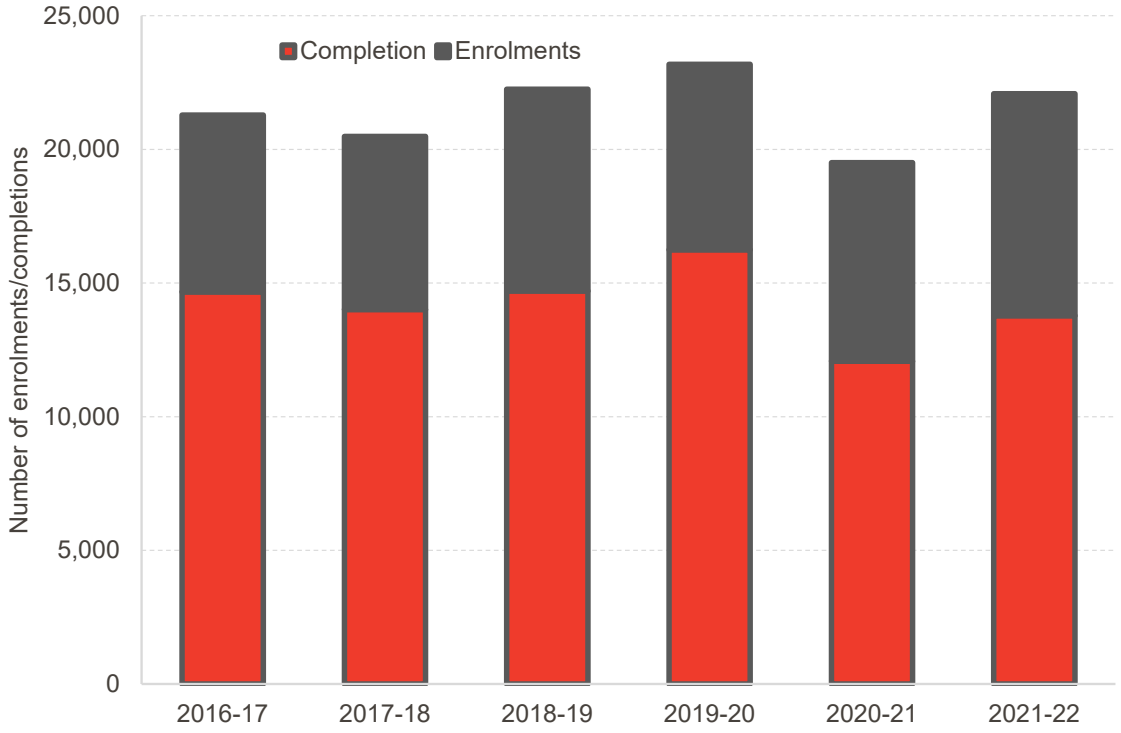
Schools outreach

Another way that Scotland's colleges meet their widening access ambitions is through their school's outreach programmes, delivering further education to students earlier in their learning experience to improve outcomes later in life.

There were over 20,000 school pupils enrolled in Scottish college courses in 2021/22, with around 62% of pupils fully completing these qualifications and a further 21% partially completing these courses, Chart 11.

By offering further education opportunities so early in a young person's life, colleges not only help to strengthen these individuals' skills and human capital, but also provide an opportunity to encourage students to pursue careers in professions where there are skill shortages.

Chart 11: School pupil college enrolment and completions, 2016/17 – 2021/22



Source: *Scottish Funding Council*

6. Productivity, Innovation and Entrepreneurship

With colleges located in all areas of Scotland, both rural and urban, the potential to boost skills and productivity across all regions is vital for colleges to support this pillar.

Boosting the productive and innovative capacity of Scotland's firms, industries, regions, communities and public services is the third pillar of Scotland's national strategy.

Colleges are anchor institutions within their regional economies, helping to drive regional economic and inclusive growth, attracting and retaining talent and expertise to all areas of Scotland.

Throughout this section, we find that:

- College spending helps to support an additional £225m in Gross Value Added (GVA) across the Scottish economy.
- When compared to the other 97 sectors of the economy, colleges have the second highest GVA-output multiplier, the measure of GVA supported per £1m of output.
- The college sector has the same GVA-output multiplier as the education sector, helping to support both growth regionally in the areas they are located and nationally in Scotland as a whole.

At present, there are 24 colleges across Scotland, offering both higher and further education opportunities to all individuals in most areas.

As part of The College Sectors Statement of Ambition these institutions are seen as a vehicle to accelerate strategic partnerships in an area, helping to boost growth locally and regionally, which in turn helps to boost national growth.

Recognising the strength colleges play in regional economies, the Scottish Government have set a number of regional partnerships between schools, colleges and employers.

For example, the Developing the Young Workforce Regional initiative has led to the creation of 21 industry-led regional groups with the aim to encourage and support employers to engage directly with schools and colleges to challenge and support employers to recruit more young people.

The location of colleges is crucial, both in terms of the accessibility it provides, but also the economic activity it helps to generate in that area.

Using our Input-Output model for the Scottish economy we estimate that college spend directly supports an additional £116 million in Gross Value Added, which rises to £225 million when we consider the wider spill over effects across the economy, Table 11.

Table 11: Number of recognised completions of qualifications by Scottish domiciled graduates by NVQ level, 2016/17 – 2021/22

	GVA
Direct	116
Indirect	34
Induced	75
Total	225

Source: *Scottish Funding Council*

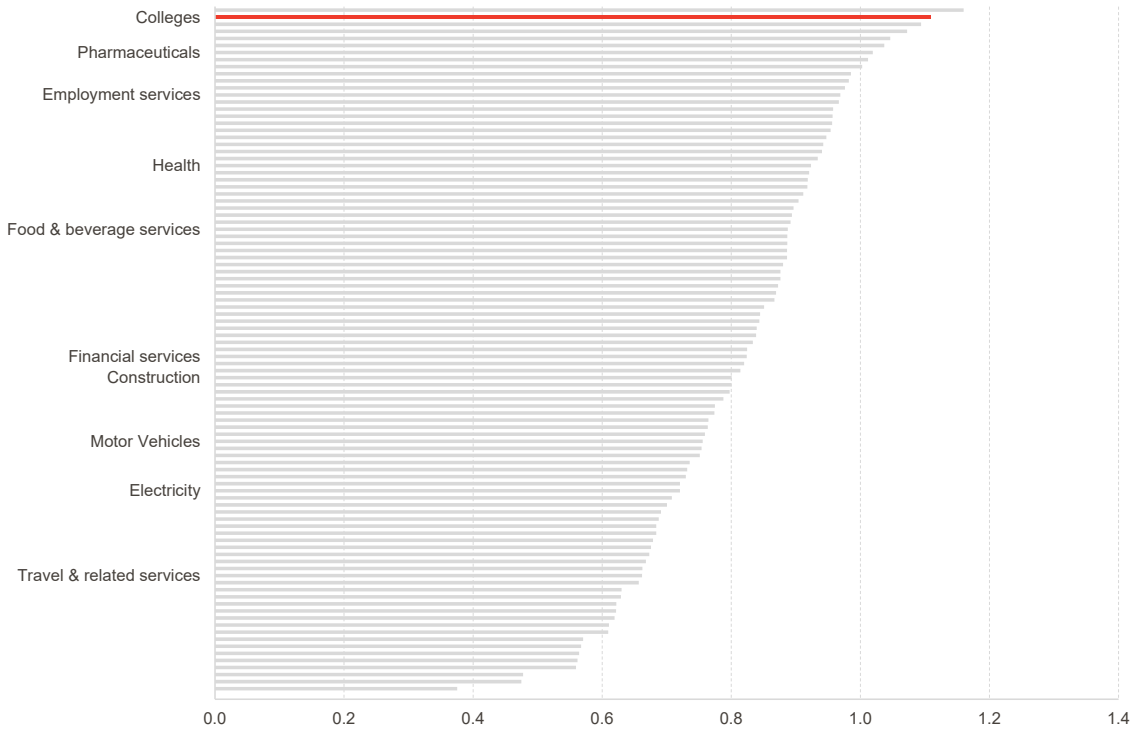
When compared to the other sectors of the economy, colleges are at the forefront of the economic activity they generate.

Chart 12 shows the GVA-output multiplier for colleges when compared to the 97 sectors of the Scottish economy[7]. This multiplier highlights the economic activity generated per £1m of spend by colleges.

Colleges rank 2nd with the same multiplier as the education sector, falling only behind the Security and Investigations sector.

This suggests that as an industry, colleges support significant amounts of value added within the economy, and hence generate substantial economic activity, both regionally where they are located, and nationally within the economy as a whole.

Chart 12: Comparison of Type II GVA-output multipliers across 97 sectors of the Scottish economy & college spend. Selected sectors labelled.



Source: *Scottish Funding Council*

7 The 'Households as employers' sector has been excluded as it is not a conventional industry.

CASE STUDY

Supporting regional economic growth through the development of the aerospace workforce, Ayrshire College

Ayrshire College's Engineering Centre provides a range of courses and bespoke training for those seeking to gain employment, change industry or advance their careers. The centre is known for its authority to carry out Civil Aviation exams, as well as providing specialist apprenticeship training to support the aerospace industry. These longstanding links with the industry were recognised when the College became a platinum partner of the Royal Airforce. In the future, the centre aims to build on these links by becoming a national composites centre for Scotland.

The above highlights the importance of Ayrshire College to the region's economic development. Aerospace engineering is an industry that is anticipated to grow in the years ahead and a crucial part of ensuring the region realises its economic potential lies in ensuring that this industry has the highly skilled workforce required to support that anticipated growth. Currently, this presents a challenge. As explained by Alastair Heron, Ayrshire College's Project Head of Aerospace, around 30% of the current engineering workforce is expected to retire in the next 10 years. At the same time, there are expected to be between 500 and 1300 new vacancies next year at Prestwick airspace cluster – a set of manufacturing, maintenance, repair, and overhaul companies at Prestwick airport. Other notable local companies are also growing. In the years ahead, Excel cables and satellite manufacturer, Mangata, for example, are planning to create 900 and 570 jobs respectively. While welcome, these developments raise the prospects of future skill shortages. Ayrshire College is therefore accelerating its efforts to meet this future skills demand by working on a more targeted approach to training and upskilling people locally and to supporting jobseekers in the Ayrshire area.

To do this, the college maintains a continuous dialogue with a range of employers and local companies and has developed a more strategic needs-discovery-based collaboration with industry partners. In practice, this approach means the college is in discussion with industry partners on the development and delivery of potential bespoke courses to supplement the College's mainstream offer. For example, the College also regularly holds meetings with Prestwick Airspace Operations Group (PAOG) aimed at servicing the Prestwick airspace hub – an important economic player on a national level.

Coupled with this approach, Ayrshire College also looks to address potential barriers to local people entering the industry by, for example, providing better information on job opportunities, delivering more specialised high-quality training, and offering more flexibility on the format and timing of classes. Alastair Heron suggests that the key to this employer engagement approach is communication around what the qualification needs of the industry are and the number of people likely to be required by the industry in the future. To illustrate this point, he gives the example of a partnership with Ryanair whereby three cohorts of learners trained in the evening, outside the normal college schedule.

Through this approach, Ayrshire College is acting as a key economic facilitator at a regional level, playing an active role in ensuring skills supply and skills demand are aligned in a way that both supports the economic development of the region and provides opportunity for people locally to pursue or develop their career in a growing industry.

Supporting Scotland's growth sectors

As well as the economic activity and growth colleges already supported, there are also opportunities for colleges to further support the Scottish Government in achieving its aims within the economic strategy.

In particular, as discussed in Section 3, the ability of college learners to develop skills and become better equipped for the labour market, can help the government address skills gaps and boost sectors where Scotland has a comparative advantage.

As part of its 2015 Economic Strategy, the Scottish Government identified six key growth sectors where Scotland holds a competitive advantage.

The strategy highlighted that if Scotland were to build on this existing strength in these sectors and harness their potential, then this could lead to increased productivity and economic growth.

These sectors include:

- Food and Drink
- Creative Industries (including digital)
- Sustainable tourism
- Energy (including renewables)
- Financial and Business Services
- Life Sciences

Colleges, given the variety of courses that they provide, are well suited to support the government in its ambition to harness the potential in these sectors.

In this section, we highlight the growth sectors in which colleges have a significant role to play in supporting the Scottish government to increase growth through its further and higher education offerings.

Food and Drink

The food and drink industry was identified given Scotland's strengths in agriculture, fishing and aquaculture, as well as the strong food and drinks manufacturing sector with goods such as whisky and fish exported globally from Scotland.

Sectors such as the manufacturing of food and beverage products, contain professions that colleges are already equipped to train people for.

The sector is a £15 billion industry in Scotland, employing over 120,00 people. Given this, the Scottish Government recently published an industry-led strategy for the food and drink industry in Scotland.

The strategy which aims to support a 25% increase in turnover for the sector by 2028, highlights restoring promotional activity to pre-pandemic levels, and recruiting and retaining a highly skilled workforce to adapt and tackle skill shortages in the sector.

Given the offerings of colleges in food and drink-related subjects, the opportunity for further and higher education to be a vehicle for highly skilled, enthusiastic individuals to support growth in the food and drink sector is high.

This is evident in Table 12, which highlights not only the breadth of related subjects available for study in Scotland's colleges, but also the identified growth sectors.

Between 2018/19 and 2021/22, there were over 21,000 completed qualifications in food and drink-related courses in Scotland's colleges, highlighting the high number of individuals entering the labour market trained with the appropriate skills to work in this sector.

In particular, the ability of colleges to boost skills whilst providing opportunities to gain the relevant experience before entering the labour market is invaluable.

This is evident in initiatives such as The Academy, based at the Kirkcaldy campus of Fife college. The restaurant provides dining experiences to the general public and is staffed by students as part of their coursework, meaning students can gain real-world experience of working within a hospitality setting.

Table 12: Growth sector and college course offering comparison in food and drink-related industries

Growth Sectors	College courses
Crop and Animal production, Hunting and related service activities	Baking/Dairy/Food and Drink processing
Fishing and Aquaculture	Cookery
Manufacture of Food products	Hospitality operations
Manufacture of beverages	Hospitality/catering
	Catering services
	Home Economics
	Food Sciences/Technology
	Food and Drink services

Source: *Scottish Funding Council, Scottish Government*

This is even more pivotal as the country looks to shift away from the reliance on oil and gas-related sectors in the face of its net-zero ambitions.

This shift means that the expectation for already strong sectors, like food and drink, will be to utilise its competitive advantage and help to support higher economic growth and employment across the economy.

Colleges, therefore, are already well primed to support both the government and sector in boosting economic activity, helping to train people with the appropriate skills and experience for a career in the food and drink industry.

Sustainable Tourism

This holds in tourism-related offerings too. Scotland has a thriving tourism sector, with its stunning scenery, historic landmarks, and thriving hospitality venues pitching Scotland as one of the most desirable locations to visit globally.

The sector in Scotland currently supports 200,000 jobs, generating over £4 billion in gross value added.

However in recent years, the sector has struggled, particularly over the pandemic, and the ongoing staff shortages seen across the industry.

Colleges already offer a plethora of courses such as Tourism and Travel and hospitality-based courses, helping to provide the essential skills for these individuals to support employment in tourism-related sectors.

Scotland is also currently working towards its Outlook for 2030 strategy, which sets the nations ambition to be the world leader in 21st century tourism.

Despite being set in March 2020, with the world plunged into the Covid-19 pandemic, the strategy was re-launched in November 2022, with input from most industry players as a means to place Scotland as a top tourist destination as we emerged from the pandemic.

As part of the strategy, a number of opportunities for Scotland were identified. Whilst most identified inward investment to Scotland and the means to make the country more attractive, two of the key opportunities were job creation in the sector and making the sector a career of choice.

In our recent article on the future of hospitality in Scotland, the institute found that despite 1 in 14 jobs in Scotland being in the food and accommodation sector, average pay was significantly lower than the Scottish average, with occupations in these sectors seen as less prosperous.

In order for long-term sustainability of these sectors, tourism-facing sectors must be seen as a lucrative career, with an attitude shift required, to see these industries as a long-term career path.

The need for this shift is evident in the 'Rise Fast, Work Young' campaign launched by over 300 businesses and successful hospitality leaders in 2022.

The strategy aims to tackle the significant shortages across the sector by highlighting the opportunities that come with a career in hospitality and attracting a new generation of workers.

Colleges therefore have a pivotal role in not only training future workers in these sectors with the appropriate skills and experience, but also keeping people in these jobs long term and ensuring the sustainability of the tourism sector.

However, they can also help to highlight the long-term positive careers that can be achieved in these industries, driving more individuals into tourism-related occupations and boosting growth in the sector.

Creative Industries

Perhaps some of the most impacted sectors in recent years are those related to creativity. The Covid-19 pandemic had a significant impact on the industry, particularly the arts, theatre and film and TV, as the shutdown of leisure venues, studios and film sets, ground the sector to a near standstill.

In recent years, the sector has been a key player within the Scottish economy, with over 15,000 firms employing more than 70,000 people, as well as a high number of free-lance workers and students also operating within the sector.

The Scottish Government have committed their support to the sector in recent years with the creation of Creative Scotland, the national public body for arts, screen and creative industries, as well as funding projects for film and TV production in Scotland.

One of Scotland's colleges' greatest offerings is the extensive range of courses covering a number of different art forms and creative courses.

Table 13 highlights the sectors defined under the government's growth sector definition for the creative industries, with a list of creative subjects offered currently by Scotland's colleges.

However, creative-related industries are unique, meaning whilst training and experience are essential, the ability to showcase talents or demonstrate your art is essential.

Colleges across Scotland do well to provide this platform, including:

- The provision of The Performing Arts Studio Scotland Theatre, The Music Box and CRE:8, all based at Edinburgh College, provides state-of-the-art facilities for students to use. These create an environment to encourage creativity and allow for talent to flourish[8].
- The delivery of Scotland's only Physical Theatre qualification provided at Fife College. Also the provision of Studio 38 Youth Theatre and Young Professionals, a group designed to offer fun and creative classes to help build confidence and develop new skills for young people pursuing creative professions[9].
- The delivery of a 2-year HND in Musical Theatre and Acting & Performance at North East Scotland College, the only performing art college in the North East of Scotland. The course offers the individuals to participate in weekly singing and choreography classes, and exposure to professionals who have performed in the West End, Broadway and mainstream media[10].

Table 13: Growth sector and college course offering comparison in creative-related industries

Growth Sectors	College courses
Advertising	Journalism
Architecture	Writing (authorship)
Visual Art	Musical Instrument Making/Repair
Crafts and Antiques	Music Technology/Production
Fashion and Textiles	Music Studies
Design	Communication/Media
Performing Arts	Arts and Crafts: Leisure/Combined
Music	Glass/Ceramics/Stone Crafts
Photography	Art Techniques/Practical Art
Film and Video	Music Performance/Playing
Computer Games	Art Studies
Radio and TV	Design (non-industrial)
Writing and Publishing	Moving Image/Photography/Media Production
Libraries and Archives	Print and Publishing
Software/Electronic Publishing	Fashion/Textiles/Clothing (craft)
Cultural Education	Decorative Metal Crafts/Jewellery
	Performing Arts
	Communication Skills
	Dance
	Theatre Production
	Theatre and Dramatic Arts
	Decorative Crafts
	Wood Cane and Furniture Crafts

Source: *Scottish Government, Scottish Funding Council*

8 See Edinburgh College
9 See Fife College
10 See North East College

Energy

Green skills will be at the heart of the Scottish Government's plan to reach net zero by 2045.

Colleges in Scotland are well placed to scale up the provision of these skills in areas that are critical to meeting the governments targets.

As part of this, the need to transition to more renewable forms of energy, and away from the use of fossil fuels in a bid to reduce emissions has become a priority for government.

However, at present, oil and gas-related industries support over 195,000 jobs in Scotland, with many of these occupations at risk of being left obsolete once the economy has fully transitioned to more renewable sources of energy.

This has posed substantial concerns for both these industries and the individuals working in them, with the need to upskill and retrain now a priority to ensure these individuals aren't left behind in the transition.

The role of colleges in aiding the Scottish and UK governments in this transition is crucial.

Mainly through their role in equipping individuals with the essential skills in the energy sector, whether that be through the provision of modern apprenticeship schemes, helping young learners develop the appropriate on-the-job skills whilst achieving qualifications, or via their specific courses such as oil and gas operations, offshore engineering and power/energy engineering.

However, it is not just their ability to service existing skills demand, but also the potential for colleges to implement the relevant skills and experience for individuals to pursue future 'green' jobs, in both their existing courses, but also the development of new courses.

One of the most cited issues with servicing these green jobs is the ability to define what these jobs actually are.

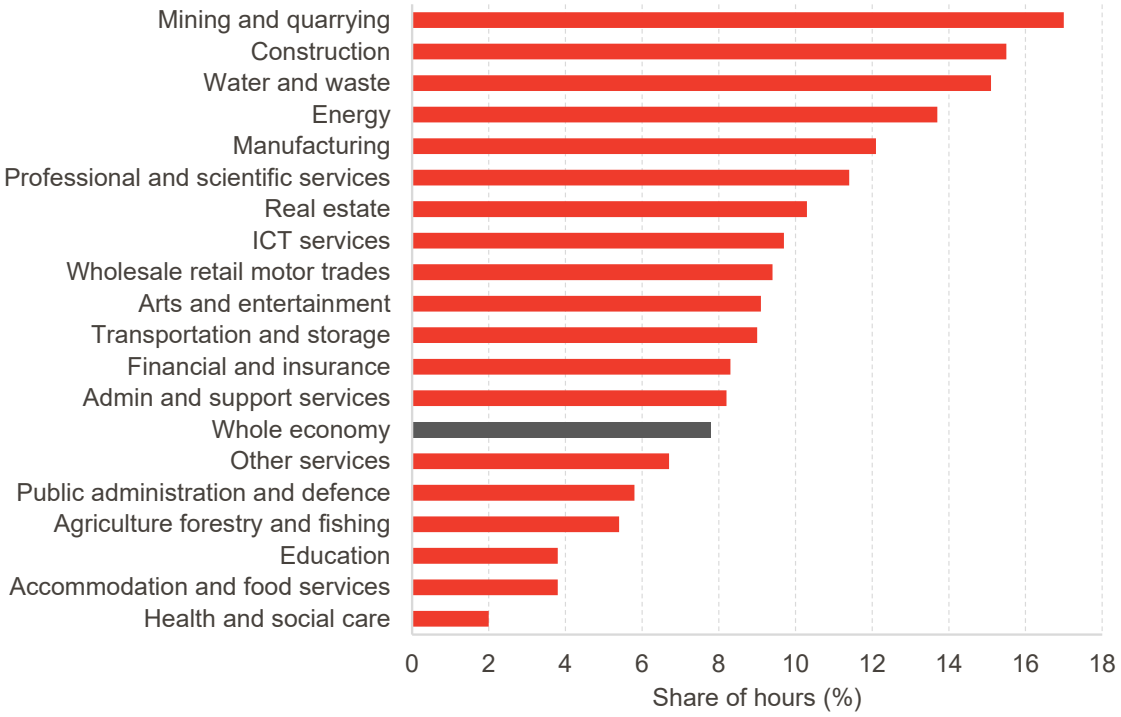
The Office for National Statistics has done extensive work to begin to capture jobs classified as green and understand what tasks within all roles are related to green initiatives.

Chart 13 highlights the share of hours worked that are spent on green tasks by industry for the UK as a whole in 2019.

These results highlight that occupations in Mining and Quarrying, Construction and Water and Waste have the highest proportion of hours worked, spent on green tasks.

However, this also shows that even in industries such as Health and Social Care, and Arts and Entertainment, there are still some parts of the occupations within them that require consideration for green-related tasks.

Chart 13: Proportion of hours worked spent on green tasks, by industry, UK, 2019



Source: *ONS*

When considering Chart 14, which highlights the share of completed qualifications by subject area, it is clear that some of the most commonly completed courses at colleges are in subject areas where occupations tend to have a higher share of hours spent on green tasks.

This is particularly evident for subjects such as engineering and construction, with around 1 in 10 individuals successfully completing courses in either of these subjects.

As well as this, despite occupations in sectors such as health and social care having a lower share of hours spent on green tasks, these are some of the most commonly completed courses at colleges.

Therefore, as the transition to net-zero continues, and the prevalence of green tasks increases, colleges are well primed to continually grow the 'green skills' base across all sectors.

Furthermore, in recent years colleges have recognised the emergence of specialised related occupations in the energy sector and have done substantial work to cater to the ever-changing needs of the industry.

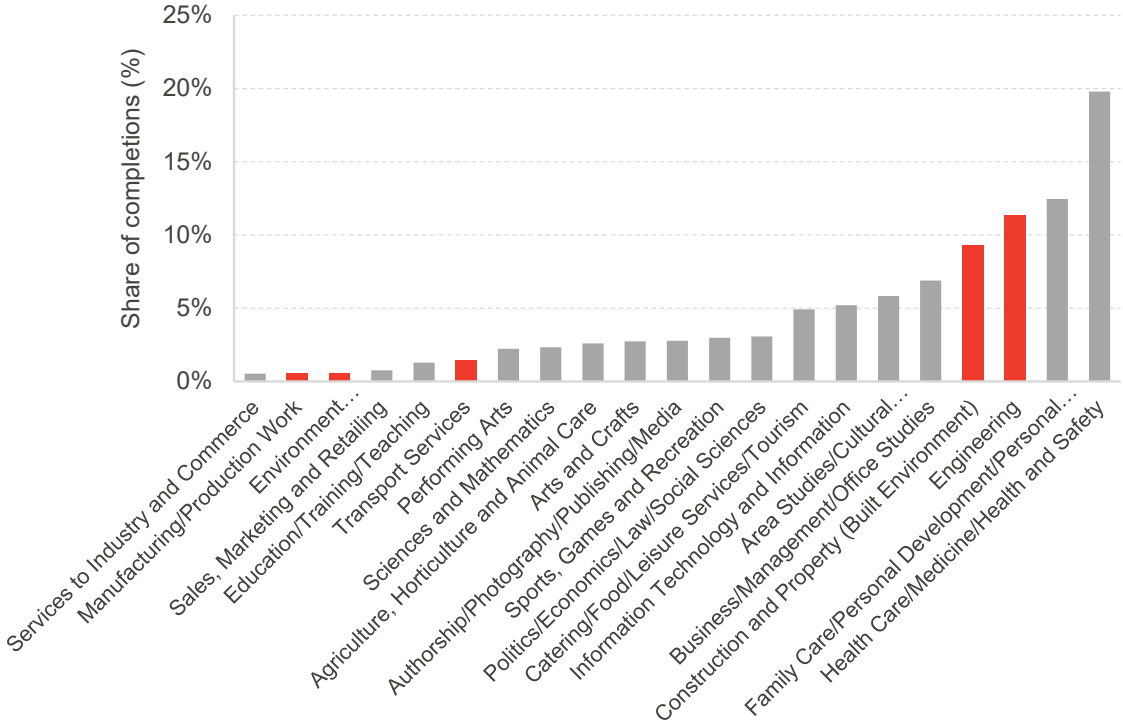
This is particularly evident in the offering of courses in more specialised areas such as environmental protection and conservation, environmental health and safety, and pollution control.

As well as this, the creation of The Renewables and Energy Efficiency Training Centre based at Edinburgh College is another example of how colleges are continually adapting the provision of green skills in Scotland.

The centre aims to provide students, apprentices and industry professionals with the relevant skills and experience required to build low energy homes and help to modify existing homes to be more energy efficient. This includes equipping students with skills to use ground source heat pumps, solar thermal systems and rain/grey water harvesting, among others, to ensure these individuals are provided the essential green skills to energy sector in its transition to net-zero.

This shows that colleges not only help to skill up more obvious industries servicing the energy sector such as construction and engineering, but are also helping to widen the underlying skills base to ensure all sectors are developing green skills in Scotland.

Chart 14: Share of completed successful college qualifications, 2018-19 - 2021/22, Scotland



Source: *Scottish Funding Council*

All of this means that as the Government's goals loom nearer, the role colleges have to play becomes more fundamental, with the need for them to understand the changing nature of skills and how the courses they offer can be tailored to equip the appropriate skills.

This was recognised as part of Scottish colleges' commitment to the climate emergency in the wake of COP26. The statement recognises what colleges have to offer in tackling the climate crisis, identifying 10 key actions.

These include deploying expertise and experience, and working with industries, public sector bodies and employers to improve working practices to make the planet safer.

Therefore, the role that both further and higher education has to play is fundamental to ensure that the government are supported in their net zero ambitions. In particular, it ensures that the skills and training offerings of colleges are continually developed to suit the ever-changing demand on the energy sector.

However, the government must also recognise this, allowing colleges to be part of the discussion on net-zero to ensure the transition is successful and most importantly, ensure that no individual is left behind and can develop the skills to integrate into the energy industry in Scotland.

Fostering innovation and supporting entrepreneurship

One of the key pillars of Scotland's strategy for economic transformation is to establish Scotland as a world-class entrepreneurial destination that seeks to encourage and support entrepreneurial activity in every sector of the economy.

Colleges play a significant role in fostering entrepreneurship in Scotland, given their ability to encourage innovation, teach and develop skills, and overall improve the human capital stock of college graduates.

As part of this aim to foster entrepreneurship, the government's first objective is to embed first-rate entrepreneurial learning across the education and skills systems.

The strategy aims to deliver this aim in the following ways:

- Promote the best available project-based entrepreneurial learning across the school and post-16 education curricula.
- Embed entrepreneurship in the Young Person's Guarantee to cultivate the business leaders of tomorrow.
- Adapt and review Scotland's apprenticeship system so that it is available for start-ups and early scale-ups to use.
- Develop an entrepreneurial campus infrastructure, working with the college and university sector to establish campuses as hotbeds of start-up creation.
- Develop innovative, industry-led pathways to redirect the best entrepreneurial talent into building new companies.

As well as this, the Scottish Government also recently published its National Innovation Strategy, setting out its vision to make Scotland one of the most innovative small nations over the next decade.

The strategy, which aims to build successful innovation clusters, boost investment in innovation and entrepreneurship, and raise productivity through innovative practices recognises the importance that both colleges and universities have to play in improving innovation in Scotland.

The role of colleges, in particular, their higher education offerings, was also recently recognised as a key driving force in creating entrepreneurial campuses across Scotland.

The Blueprint Report, conducted by Ross Tuffee and Professor Joe Little, sets out several actions required by higher education institutions over the next 10 years to help the government strengthen its entrepreneurial aims within the economic strategy.

These include inspiring young people to engage in entrepreneurial activity, establishing policies that support the development of an entrepreneurial mindset in students, and developing support networks for college and university spinouts for staff and students.

Further to this, when the Scottish Government set out its previous innovation and entrepreneurship strategy, Scotland: CAN DO, in 2013, The Scottish Funding Council also set out its ambition for the further and higher education sector to support this.

Over the past 10 years, this has involved setting up funded Innovation Centres across Scotland's universities and, the creation of the Converge Challenge, a programme for students, graduates and staff across Scottish Higher Education providers to accelerate their ideas into businesses.

CASE STUDY

Cross-college collaboration for more effective servicing of industry qualification needs in Scotland, UHI Inverness

Increasing demand for planning and development specialists, coupled with a large proportion of the existing workforce coming towards retirement age, has led a number of local authorities, especially in remote areas of Scotland, to consider ways to tackle the challenge of employing sufficient specialists with new building standards training. Against this backdrop, the Energy Skills Partnerships (ESP) approached UHI Inverness about the possibility of designing and delivering a new flexible qualification that would help to mitigate future skills shortages in the industry while also addressing the existing challenge of individual colleges in Scotland sometimes struggling to recruit a viable cohort in this subject area.

To do this, UHI Inverness partnered with Fife College to design and pilot the required training programme without creating an entirely new apprenticeship. The former already has a successful partnership with ESP, while the latter has longstanding experience in providing building construction apprenticeships in their locality. This unique collaboration was supported by Local Authority Building Standards Scotland (LABSS) and the pilot of the programme is currently in its first year of delivering training for a cohort of apprentices. The partnership sees Fife College deliver the HNC element online over two years while UHI Inverness supports the SQA assessment element, including the processes and reviews required by Skills Development Scotland.

The collaboration with LABSS ensures that there is industry support for the programme, with LABBS providing input on the development of the content, guest lecturers, and mentoring for students. Carrie Higgins, Tertiary Education Leader at UHI Inverness, suggests that, although they need to wait for the first cohort to finish the programme before assessing KPIs, early indications in terms of retention rate and feedback from apprentices and employers, as well as recruitment for the second cohort, point to the fact that the programme is delivering on its objectives.

The programme has also served as an effective case study of how targeted ESP-college partnership and cross-college collaboration can be effective both in directly addressing local economic needs and, at the same time, supporting colleges in preserving programmes that might otherwise be facing closure due to low student numbers. This has inspired plans to look at opportunities for future collaboration using this model. For example, UHI Inverness, UHI Argyle, UHI West Highland and Fife College have come together in response to a similar request from the Civil Engineering Contractors Association (CECA) for ESP support in addressing skills gaps in the civil engineering workforce in Scotland. In response, the four colleges have joined forces in designing a 6-month CECA Scotland Academy qualification. The division of workload in material development meant that colleges that had never delivered the programme before were able to use the expertise of colleges that have, including the opportunities to upskill their staff through the sharing of resources and best practices.

It is quite a breath of fresh air, and there has also been impact beyond the creation of these apprenticeships and opportunities. It has also kick-started a culture where college managers across Scotland are more open to work together, to share resources, which, to be honest, is the only way the colleges will be able to move forward. ~ ***Carrie Higgins***

In recent years, many reports have highlighted the disparity in investment for innovation between colleges and universities, particularly those home to innovation centres.

This was first highlighted in the Independent Review of Innovation Centres conducted by Professor Graeme Reid in 2016, and was again discussed in The Cumberford-Little report commissioned in 2020 by The Scottish Government.

In summary, these reports find that current investment in innovation is primarily funnelled into universities, and there is much less acknowledgement of the potential role that colleges could have as centres of innovation.

Colleges already help to foster innovation in a number of ways, including the support they provide to local businesses to innovate and improve their productivity, but are also enthusiastic to contribute more.

One way they do this is through the provision of Innovation vouchers which provide funding and support to help with the creation of relationships between small and medium enterprises, and colleges in Scotland.

These vouchers are often either specific to a product or process, helping individuals to develop their ideas into goods and services, or are provided to help firms develop their workplace processes and practices.

The Interface programme has helped to significantly boost the innovative capacity of Scotland's colleges over the past few decades.

The nationwide programme, which works with firms to match them to the academic expertise available within Scotland's further and higher education, provides funding and support to help build a relationship and foster new and innovative practises.

A great example of the success of this programme was the matching of James Frew Ltd, a large building services company in Scotland, with West College Scotland supported by an SFC innovation voucher[11].

This partnership utilised the expertise of West College Scotland to help James Frew Ltd design a new planning process for training staff, which involved the monitoring of certification renewals, the development of individual training plans, and the measurement of the impact of this training.

The consensus therefore is that in order to utilise the untapped potential of colleges as drivers of innovation, it requires a change in perception.

This change should see that in order to boost innovation and help create new and innovation products and processes, it will require an improved diffusion of skills and knowledge between business and education providers.

Colleges are therefore pivotal in helping to boost the diffusion of these skills and knowledge, through the partnerships already forged, but also through a better provision of support and funding to allow firms to benefit from the expertise and skills contained in colleges across Scotland.

11 See Interface

Next generation of entrepreneurs

As well as boosting investment in innovation and entrepreneurship, colleges also play a significant role in providing the necessary skills and experience to prime the next generation of entrepreneurs.

Table 14 highlights that there are several entrepreneurial and business-related subjects on offer at Scotland's colleges, with high levels of completion by students.

In particular, these subjects include courses in business-related subjects such as enterprises and financial management, but also more specific business courses such as E-commerce and marketing courses.

The ability for colleges to provide the essential learning and skills for future entrepreneurs, whilst also providing the appropriate funding to allow individuals to pursue their ideas, means they are well primed to support the Scottish Government in strengthening Scotland as an entrepreneurial nation.

Table 14: Number of completions by business and entrepreneurial subject, 2021/22

Subject Area	Course	Number completed successfully
Business/Management/Office Studies	Administration/Office Skills	2,050
	Business (general)	8,505
	Enterprises	205
	Financial Management/Accounting	2,335
	Financial Services	590
	Human Resources Management	1,180
	Management (general)	4,765
	Management Planning and Control Systems	290
	Management Skills (specific)	3,235
	Public Administration	615
	Typing/Shorthand/Secretarial Skills	120
Sales, Marketing and Retailing	E-commerce	25
	Marketing/Public Relations	625
	Retailing/Wholesaling/Distributive Trades	125
	Retailing: Specific Types	25
	Sales Work	20

Source: *Scottish Funding Council*

CASE STUDY

Supporting Business through Innovation and Knowledge Exchange, City of Glasgow College

Since 2017, City of Glasgow College (CGC) played host to the Institute of Innovation and Knowledge Exchange (IKE) – the UK's only professional body for innovators. The institute was set up to formalise the College's approach to innovation support and acts as an institutional link between the College, industry, and the business community, as well as being a key driver of the College's engagement with national economic priorities, opportunities and challenges.

The institute's activity at CGC started with the launch of a suite of professional development programmes featuring certification and accreditation that are offered to businesses and organisations looking to benchmark their innovation performance and capabilities. One of these, the Investor in Innovation certification, looks at an organisation's innovation strategy, culture, skills and capabilities, as well as how well the operating environment and user base are understood, and how innovation within the institution is measured. Following this programme, the IKE supports these private and public sector organisations with the internal development and improvement of their innovation skills and capacities.

As well as supporting local businesses in this way, IKE also allows the College to develop its own innovation activity and enhance its own innovation performance. As explained by Stuart McDowall, the Head of Innovation in STEM and the Institute's Manager:

Innovation, enterprise, and start-up support usually align more with universities rather than colleges. Therefore, the Scottish Innovation and Knowledge Exchange allows the City of Glasgow College access to wider support for things like innovation vouchers and external funds that then can help support the SME community, build new products, new services, new business models.

Although he admits that the scale is unparalleled to universities, through IKE, the City of Glasgow College makes their expertise and curriculum available to businesses and individuals who need academic support for the development of new products and services.

IKE now has several successful examples of this approach in practice. One former engineering student at CGC for example, came to IKE with a request for assistance relating to a mobile device set to monitor water quality, subsequently known as the Aquabot. The IKE team has worked with this new business and initially secured an innovation voucher through the Scottish Funding Council and Interface to help develop the first prototype. The project was recently taken to its next stage which involves building-in sensors for real-time data capture. This was done by approaching sensor technology innovation centre Censis and securing additional funds for the prototype, highlighting IKE's capabilities in supporting small businesses to tap into funding and expertise to drive forward innovative new products.

IKE also supports applied research. In 2019, CGC conducted a research project, with support from IKE, on oxygen depletion in enclosed spaces – a common issue on board ships. The project was funded through the Maritime Education Foundation and conducted by the College's Nautical and STEM faculty who ran a series of experiments culminating in a research paper that won the Research Project of the Year at the Herald Higher Education Awards in 2021.

These examples demonstrate the impact that IKE has had since its inception and hint at the potential for its expansion, through supporting more businesses and organisations to tap into expertise and funding to drive their ideas and innovations. This, coupled with the Institute's focus on applied research, is key to IKE's approach to addressing industry problems and identifying solutions, including closing skills gaps through workforce training and supporting innovation by acting as a hub for the development of new ideas. The College is now looking to expand its work in this area and is currently considering the development of an innovation centre at its Riverside campus. This would create more space for experimentation, the incubation of businesses, and pedagogical innovation development for curriculum teams – all of which CGC considers critical to expand its support for local businesses within Glasgow and beyond.

Conclusions

Colleges are a significant contributor to the Scottish economy, both in the highly skilled graduate cohorts they provide to the labour market and the economic growth their activity generates.

In this report, we modelled the economic contribution of a single and multi-year graduation cohort to Scotland's economy.

Our modelling finds that a single year of college graduates helps to boost labour productivity by 0.31%, making the Scottish economy cumulatively better off by £8bn in the long run when compared to an economy without the contribution of these graduates.

This uplift in productivity also boosts employment by 31,000 FTE jobs, and increases investment, real wages and exports across Scotland.

This makes government revenues £2.8bn better off in the long-run as a result of the productivity uplift. Given that in 2021/22, the Scottish Government via the Scottish Funding Council provided £740m in funding, we estimate that this accounts for 26% of the total uplift in government revenue and 9% of the uplift in GDP.

When considering multiple years of graduate cohorts we find that the uplift in labour productivity is 2%, which makes the economy £52bn better off than if this productivity uplift had not occurred.

This boost in productivity from these graduates also helps to support 203,000 additional FTE jobs.

Overall we find that the direct uplift in productivity from several years of college graduate cohorts helps to boost government revenues by £18.2bn in the long run.

Therefore, given that over the same period the Scottish Government via the Scottish Funding Council funded around £4.1bn, we estimate that the 'cost' to the government of supporting these graduates accounts for 22.5% of the total uplift in revenue and 8% of the uplift in GDP.

As well as this, we find that the money colleges spend helps to support additional Gross Value Added and employment across the economy.

College spending can be seen to support an additional £225 million in GVA across the Scottish economy, and on top of the 10,700 FTE jobs already supported within colleges, supports an additional 4,400 FTE Scottish jobs across the economy.

They also make a significant contribution to the wider sectors of the Scottish economy, particularly in terms of employment, with the 14th highest employment-output multiplier, and 2nd highest GVA-output multiplier, when compared to the other 97 sectors of the Scottish economy.

These results demonstrate the substantial economic contribution that colleges make in all sectors of the economy and highlight the crucial role colleges have to play in helping The Scottish Government meet the aims of their National Strategy for Economic Transformation.

This includes the continual provision of highly skilled and experienced individuals to boost the overall skills of the Scottish workforce, but also through their widening access goals to make education more accessible to under-represented groups in society and breaking down barriers to education.

Colleges are therefore fundamental to the prosperity of the Scottish economy on top of their role to ensure that every individual in Scotland has access to education and can achieve the qualifications that will allow them to lead prosperous lives.

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Technical Annex A: Modelling Methodology

The AMOS framework used for the system-wide impacts of the productivity uplift is a Computable General Equilibrium model calibrated to the 2018 Scottish Input-Output Table (IOT). Within the model, there are 25 industrial sectors along with four main components of final demand – domestic transactors, government, investment and exports. In this version of the AMOS framework government and tourism expenditure is assumed to be fixed in real terms and expenditure by industry for both is based on information within the IOT. Exports are split between Rest of the UK (RUK) and the Rest of the World (ROW).

Scotland is a small, open, regional economy so external RUK and ROW prices are exogenous i.e, price changes in Scotland do not affect prices in the UK or the Rest of the World. Commodity markets are assumed to be competitive. Financial flows are not explicitly modelled, and the interest rate is assumed to be exogenously determined at UK level. The numeraire is the external price level; prices in the rest of the UK and the rest of the world are exogenous.

The model assumes that producers minimise costs using a nested multilevel production function. The combination of intermediate inputs with RUK and ROW inputs is based on the Armington function (Armington, 1969). Output is produced from a combination of composite intermediates and value-added, where labour and capital combine in a constant elasticity of substitution (CES) function to produce value-added, allowing for substitution between these factors in response to relative price changes. Based on previous evidence the elasticity of substitution is set to 0.3. Industrial intermediate consumption is based on fixed Leontief coefficients based on the Scottish IOT.

All simulations are run in a multi-year setting and the model is initially assumed to be in steady-state equilibrium, implying that, with no exogenous disturbance, the model simply replicates initial values over all subsequent time periods.

The supply side of the economy determines the use of capital and labour in the model. Capital, in the first period, is fixed but in subsequent periods each sector's capital stock is updated through investment, which responds partially to the gap between the desired and actual (adjusted for depreciation) levels of capital stock – in line with the neoclassical investment formulation. Capital is immobile between sectors.

We assume a fixed labour force in the model, but unemployment varies over time and is calibrated to base-year employment. Based on the work of Layard et al (2015) and Nickel and Bell (1995), the labour market is characterised by the presence of imperfect competition in which workers' bargaining power is inversely related to the rate of unemployment.

$$ln\left(\frac{w^S}{cpi^S}\right) = c - \delta \ln(u^S) \; (1)$$

w^S is the wage rate in Scotland, cpi^S is consumer price index, c a calibration parameter and δ the unemployment rate elasticity set to 0.113. x. A full model listing is given in Lecca (2013).

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Technical Annex B: Modelling the economic contribution of college expenditure

Collecting estimates of college expenditure

Using the consolidated college accounts data, we have identified the following headings of spend in which we can apportion operating expenditure (OPEX) across:

a. Teaching departments
b. Teaching support services
c. Other support services
d. Administration and central services
e. General education
   i. Premises
   ii. Maintenance
   iii. Utilities
f. Other
g. Catering and residences
h. Other income generating activities
i. Other

NB: *We have not considered (i) – (l) as these capture some financial costs, which are not relevant within the lens of this part of the modelling, as well some maintenance costs, of which we account for under capital spend.*

The consolidated accounts provide total operating expenditure for each college under the above headings; however, in order to match these spend figures to their relevant sector (defined using SIC codes) for the purpose of our modelling, we must estimate the more granular spend within these headings.

Put simply, we want to understand what the composition of spend under these wider headings is so that we can accurately reflect what sectors this spend occurs in.

To do this we have used Supply and Use tables for Scotland to estimate the proposed spend and shares. The use tables provide estimates of the inputs (of products) used by each industry to produce their own output.

Given that colleges are captured under the central government element of national accounts, it is more difficult to capture it's spend using our method, therefore we use the education sectors purchases as a proxy.

We first identified the sectors that education currently purchases from and matched to the operating expenditure headings set out above i.e., identifying that where a college spends in electricity, gas, water and sewerage, and water management sectors from the supply and use table, this will fall under utilities in the college accounts.

Once we have matched the relevant sectors to their relevant OPEX heading, we attribute spend under these headings i.e. in the Use table we estimate that within education 48% is spent on gas, 30% on electricity and so forth.
These shares can then be applied to the total utilities spend for each college from the consolidated accounts and aggregated to provide a total utilities estimate that matches the total utilities figure provided in the accounts.

We do this for each college and OPEX heading until we have total college spend by sector, which when aggregated gives a total estimate of operating expenditure of colleges in Scotland in each sector it likely spends in, shown in Table 1.

We therefore estimate that total operating expenditure for the college sector in Scotland in 2019 is £168m.

Table 1: Proposed operating expenditures for colleges by SIC code, 2019

Sector (SIC)	Estimated spend (£000)	% share
17 (Paper products)	2,871	2%
18 (Printing)	7,197	4%
35.1 (Electricity)	7,215	4%
35.2 (Gas)	4,022	2%
36-37 (Water & Sewerage)	2,465	1%
38-39 (Waste, remediation etc)	1,346	1%
41 (Construction of buildings)	1,741	1%
43 (repair & maintenance of buildings)	19,549	12%
47 (Retail - consumables for teaching)	15,128	9%
56 (Food and Beverage Serving Activities	7,943	5%
61 (Telecommunications)	2,496	1%
62 (Computer Services)	5,492	3%
65 (Building Insurance)	2,795	2%
68 (Building Rentals)	16,483	10%
69.1 (Legal)	1,997	1%
69.2 (Accounting & tax)	2,163	1%
70 (Head office & Consulting)	2,787	2%
73 (Advertising & market research)	3,287	2%
74 (Other Professional Services)	3,287	2%
78 (Employment Services)	7,822	5%
80 (Security & investigation)	2,247	1%
84 (PAD) - RATES	3,630	2%
85 (Education: exam fees & Childcare)	44,915	27%
Total	**168,879**	-

In order to estimate capital expenditure, we use individual college reported accounts.

Most college accounts categorise their additions to capital under three headings:
1. Buildings
2. Equipment
3. Vehicles

Some college accounts report under more specific headings, for ease we provide the following match:

- Fixtures and Fittings, and Assets under Construction are categorised under the overall buildings heading
- Computer equipment is categorised under Equipment.

In total, we estimate that capital expenditure by colleges for 2019 was £33m.

Data for constructing the Input-Output model

Using our Input-Output model of the Scottish economy for 2019, we model the contribution of both colleges operating (OPEX) and capital (CAPEX) expenditure in the same year.

Input-Output tables describe the flow of goods and services across the economy. They show how industries buy and sell from each other, compensate labour, and sell to sources of final demand such as Government, households and exports. Input-Output tables are a simple transformation of Supply and Use tables.

While individual data sources can suffer heavily from accurate measurement, bias, definitions and other issues, Supply and Use tables are constructed from many government datasets. The inclusion of many datasets allows for (a) each dataset to act as a check for other datasets and (b) to place heavier weight on more reliable datasets. As a result, Supply and Use tables are considered the cornerstone of National Accounts. These, along with input-output tables, are produced by many advanced economies and are used to create significant economic statistics, such as GDP.

We have also introduced employment data to produce estimates of employment impacts. These data sources include the ONS Workforce Jobs dataset and the ONS Business Register and Employment Survey.

It is important to note that given this model uses 2019 national accounts data and therefore does not account for the various challenges posed by the Covid-19 pandemic.

Modelling Methodology

Our estimates model the impact of an uplift in college sector expenditure across Scotland.

The impact of an increase in this expenditure in these sectors results in the sectors increasing their output. This is known as the direct impact.

These industries purchase goods and services in order to undertake their activities (e.g. electricity to power buildings, or equipment for teaching purposes). These suppliers, in turn, purchase goods and services from their own suppliers and so on, down the supply chain. This is known as the indirect impact.

Employees are required to produce the additional output associated with both the direct and indirect impacts. These employees are paid wages, which are spent on goods and services around the UK. This results in additional output and employment, particularly in industries such as retail and food & accommodation services (i.e. bars, restaurants, hotels). This is known as the induced impact.

The total uplift in output in the economy resulting from an increase of £1m of final demand (e.g. college sector activity) is known as the output multiplier. Similarly, we can produce employment-output multipliers and GVA-output multipliers which represent the increase in employment or GVA from an increase of £1m of final demand.

The size of the multiplier is primarily affected by the proportion of (a) purchases from other industries [mainly affecting the direct and indirect effect], (b) leakages from the economy in the form of profits and imports [which reduces the multiplier at each stage], and (c) employee compensation such as wages [proportionately high wages increase the induced impact].

Understanding our terminology

Our estimates are presented using output, GVA and FTE jobs.

Output: The value of all goods and services produced. This is most easily thought of as the turnover of firms. However, output is selected over turnover because a large amount of activity is not undertaken by firms (e.g. by government and third sector which can have no turnover but produce a large amount of goods and services).

GVA: Gross value added is a measure of the contribution to an economy and is very similar to GDP (gross domestic product).

It is a preferred measure than output as a firm could buy £1m of goods and sell these on for a further £1m – clearly no value has been created here despite output counting this as a £1m contribution.

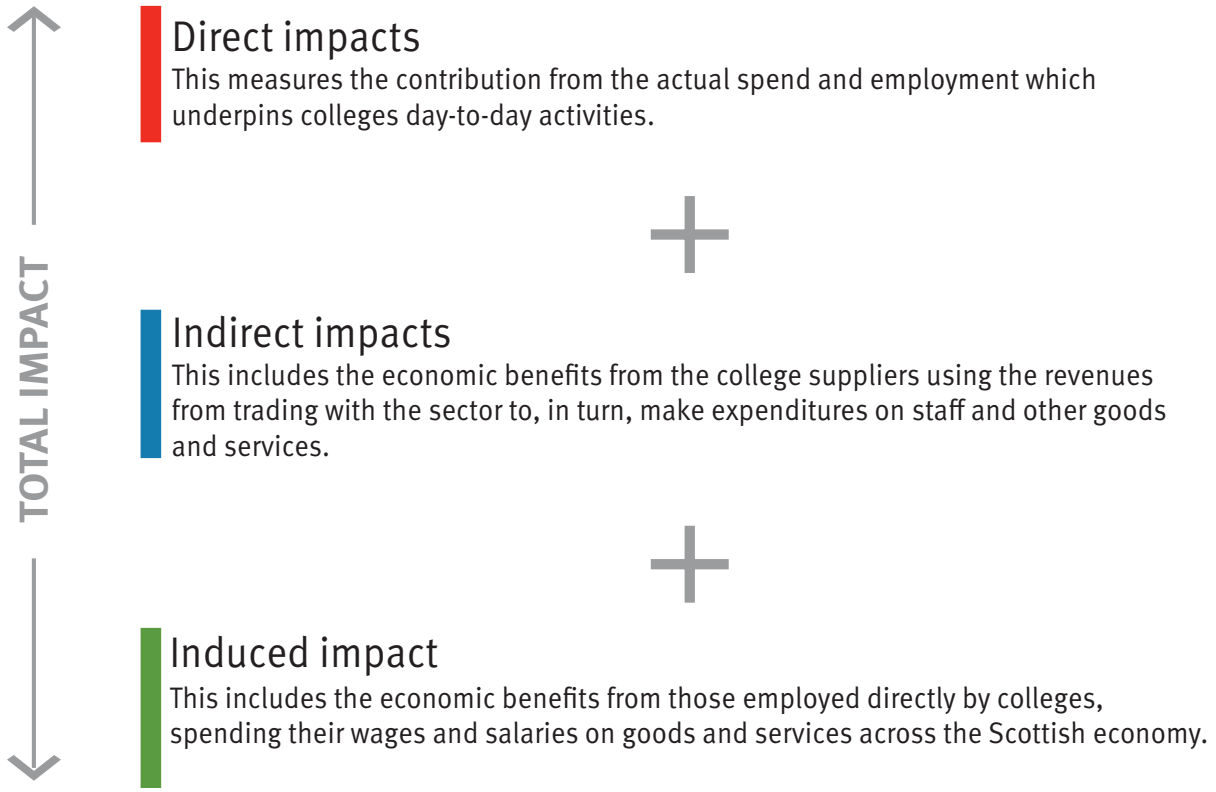
GVA can be described simply as subtracting costs of goods and services inputs from the sales. This is not the same as 'profits' since GVA also includes taxes on production, compensation of employees (e.g. wages, pensions), and gross operating surplus (e.g. company or self-employed profits). And an organisation can have no profit but can contribute to the economy by paying salaries.

Full-time Equivalent (FTE) Jobs: Full-time equivalent simply tries to account for the fact that supporting a part-time job does not have the same impact as supporting a full-time job. For calculating FTE, a full-time job equals one FTE while a part-time job equals half an FTE. In particular this avoids large overestimation in industries such as retail.

It should be noted that, while we have used the terms interchangeably in this report, there is a difference between "employees", "employment" and "jobs". For example, employment includes self-employment, while employees does not. And one employee can have multiple jobs.

Our results refer to the direct, indirect and induced impacts of college sector expenditure in Scotland, Diagram explains each of these impacts.

Diagram 1: Direct, indirect, and induced effects explained (college sector example)



Source: *Fraser of Allander Institute*

Our results

In 2019, college sector expenditure supported around £471 million output, 4,400 FTE jobs and £225 million in Gross Value Added (GVA), in addition to the economic activity and employment already supported in the sector.

Of these jobs, 2,700 are supported by colleges direct spending alone, with a further 1,700 jobs supported across Scotland as a result of spill-over effects into the wider economy.

Table 2 highlights the direct, indirect (supply-chain spill-overs) and induced (wage-spending spill-overs) impact of college sector expenditure in Scotland.

Table 2: Economic impact of college sector expenditure on Scottish output, FTE employment and Output, £ million, 2019-2020*

	Output (£m)	Employment (FTE)	GVA (£m)
Direct	203	2,700	116
Indirect	68	600	34
Induced	200	1,100	75
	470	4,400	225

** Numbers may not sum due to rounding. Columns may not sum as a result.*

Source: *FAI Calculations*

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