

Evidence-based insights into the Scottish Research Pooling Initiative

The four indicators of performance used to gain independent insight of the Research Pooling Initiative (RPI) are given in the table below.

Indicator	Data Source	Date Range
Performance in national research assessment exercises	Submissions to RAE2008 Submissions to REF2014	2001 to 2007 2008 to 2013
Performance of papers	SciVal	2005 to 2018
Research Income	HESA Finance (Table 5b/Table 5) & HESA Staff Full Time Equivalent	AY 2013/14 to 2017/18
Doctoral degrees awarded	HESA Student Qualifiers Full Person Equivalent (FPE)	AY 2007/08 to 2017/18

REF2014 is the first national research assessment exercise in which *all* pools existed as established features of the Scottish research landscape. Comparisons with results of RAE2008 are of limited value due to shifts in assessment criteria and changes to the number of Units of Assessment. Issues relating to grade inflation is also a limiting factor. Analyses instead focus on shifts between assessment exercises in the performance of submitted outputs.

A roughly 13-year window is regarded as sufficient to gauge the performance of pools (the precise window used depends on start date of individual pools). During the period 2005-2018, the research pools evolved from newly formed groupings into consolidated pan-institutional research entities. Longitudinal tracking of performance is possible through analysis of published papers using external citation databases, in this case SciVal.

Analysis of externally reported research income (2013/14 to 2017/18) and doctoral degrees awarded (2007/08 to 2017/18) gives an indication of the significance of pools in the research landscape, in particular around critical mass and sustainability.

The performance of research pools in the national research assessment exercises

The REF2014 research environment

A review of REF5 Environment Templates was undertaken to determine which REF2014 submissions cited pooling as a discernible part of their research environment. Figure 1 illustrates a mapping of Scottish institutions to REF Units of Assessment (UoA) based on the environment templates.

There is some evidence of joint institutional submissions to the REF2014, indicating a shared commitment, at least amongst larger research-intensive universities, to regard research excellence as aligned to critical mass and intra-pool collaboration. Without pre-judging the outcome, if the same REF2014 joint submissions are planned for REF2021, this would demonstrate a commitment, at least for some disciplines and some institutions, to continuity in the absence of significant recent investment.

Further, some pools are very narrowly defined in their mapping e.g. SICSA, whilst others have a broader spectrum e.g. SRPe.

	Disciplinary Pools							Thematic Pools			
	SAGES	SULSA	ScotCHEM	SUPA	SRPe	SICSA	SIRE	MASTS	ETP	SINAPSE	Soillse
Aberdeen	7 17	5 6 8 10	8	8 10	8 10 15	11	18	5	8 15	1	28
Abertay Dundee	5 7 15					5 15					
Dundee	17	5		15	10 14 15	11	19		14		
Edinburgh Napier					13	11		7			
Edinburgh	7	5	8	9	10 15	11	18	7		1	28
Glasgow	7	5	8	9	15	11	18	7	15		28
Glasgow Caledonian					15	11			15		
Glasgow School of Art											
Heriot-Watt			8	9	10 15	11		7			28
Robert Gordon		3			15	11			15		
St Andrews	17	5	8	9		11	18	5		4	
Stirling	17					11	19	6 17		4	
Strathclyde			8	9	3 14	11	19	14	13		
UHI	7							7			28
UWS				13 15	15	11					

Figure 1: Mapping of Scottish institutions to REF Units of Assessment (UoA) based on whether submissions cited pooling within their REF5 Environment Template(s). Numbers indicate mapped UoA(s). Circle and line denotes Joint Submission. Shading relates to Main Panel membership of UoA: Red = Main Panel A, Blue = Main Panel B, Green = Main Panel C, Yellow = Main Panel D

Trends in research quality: Examining RAE2008 vs. REF2014

To tease out evidence of longer-term transitions as a result of the RPI we examined pools that are closely aligned to REF Units of Assessment (UoAs). ScotCHEM, SUPA and SICSA are closely aligned to REF UoAs 8, 9 and 11 (see Figure 1). These UoAs have not significantly changed in scope since RAE2008.

The mapping below was used to compare the performance of outputs submitted by pool member institutions to RAE2008 vs. REF2014. Comparisons were also undertaken for Mathematical Sciences (RAE2008 UoAs 20 and 21, REF2014 UoA 10) to give insight of the performance of a non-pooled disciplinary area, noting that some institutions i.e. Edinburgh, Heriot-Watt, include mathematics within Edinburgh component of SRPe, so this comparison is not entirely distinctive.

Research Pool	REF2014 Unit of Assessment	RAE2008 Unit of Assessment
ScotCHEM	8 - Chemistry	18 - Chemistry
SUPA	9 – Physics	19 - Physics
SICSA	11 – Computer Science and Informatics	23 – Computer Science and Informatics

We also used the N8 Partnership (eight research-intensive universities in Northern England: Durham, Lancaster, Leeds, Liverpool, Manchester, Newcastle, Sheffield and York) and GW₄ Alliance (four research-intensive universities in the South West region of the UK: Bath, Bristol, Cardiff and Exeter) as a suitable benchmark from which the relative performance of the research pools can be contextualised.

We were not able to undertake comparative analysis of non-STEM subjects because these are more dispersed regarding their submission strategy e.g. in Scotland only Aberdeen, Abertay and Edinburgh submitted to UoA 23, whereas Dundee, Edinburgh, Glasgow, GCU, Stirling, Strathclyde and UWS submitted to UoA 22 (Social Policy).

The submitted outputs were imported as publication sets into SciVal based on their Digital Object Identifier (DOI). The performance of outputs was characterised using the following basket of indicators:

Indicator	Description
Scholarly Output	Number of outputs imported into SciVal. This will be less than the total number of outputs submitted to RAE/REF due to deduplication (in cases where the same paper has been submitted by multiple institutions) and coverage issues associated with citation databases
FWCI	Field Weighted Citation Impact. Ratio of citations received, relative to the expected world average for the subject field, publication type and publication year. Score 1 = cited as expected. This indicator allows benchmarking of entities regardless of differences in their size, disciplinary profile, and publication-type composition
% Papers in top 10%	Percentage of papers in top 10% most cited publications in the world aka the whole Scopus database
% Publications in top 10%	Percentage of publications in top 10% most cited-journals in the world. Underpinning metric is Source Normalised Impact per Publication (SNIP). This indicator allows benchmarking of entities regardless of differences in their size and disciplinary profile
% intra-pool collaboration	Percentage of outputs with co-authors based in differing pool institutions
% international collaboration	Percentage of outputs with a non-UK co-author(s)

The summary tables within [Appendix A](#) compare the output performance for RAE2008 vs. REF2014 of ScotCHEM, SUPA and SICSA with the N8 Partnership and GW₄ Alliance. Also shown is how outputs submitted by Scottish institutions to Mathematical Sciences compare, RAE2008 vs. REF2014, and with the N8 Partnership and GW₄ Alliance.

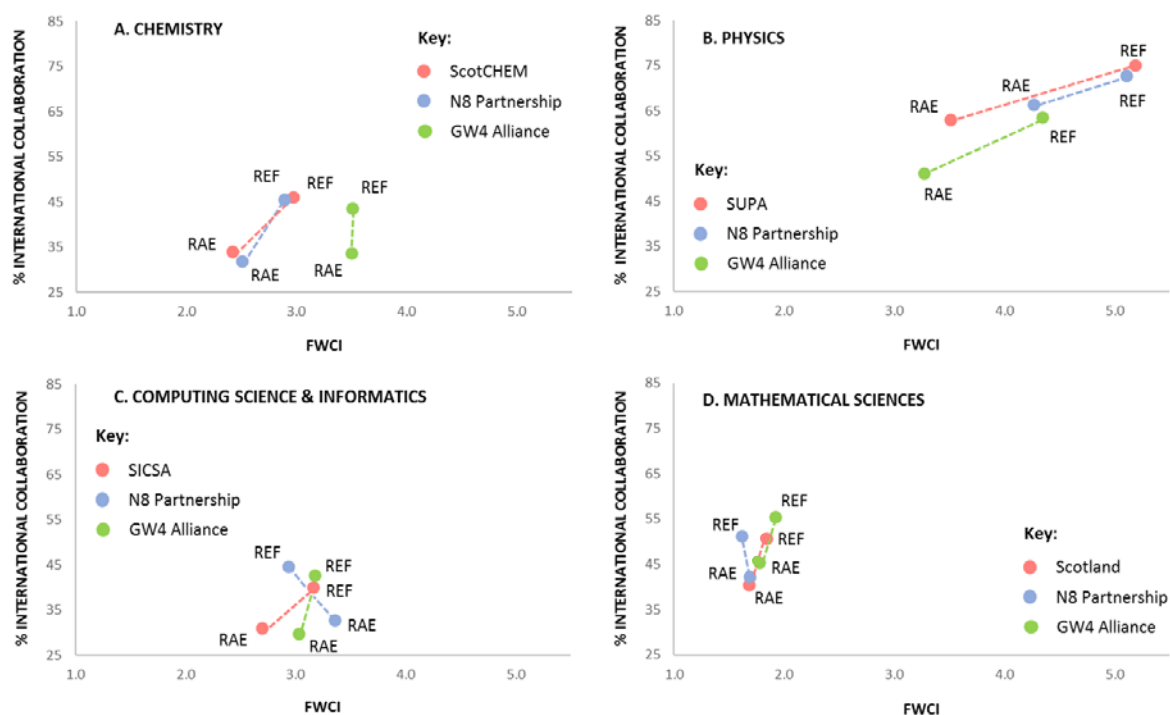


Figure 2: Performance of outputs submitted by pool member institutions to REF2014/RAE2008 UoAs Chemistry (A), Physics (B) and Computing Science & Informatics (C). UoA Mathematical Sciences (D) included as comparator non-pooled disciplinary area.

The pattern of increased citation performance for the research pools across the four selected UoAs (Figure 2 – A to D) is regarded as a UK-wide trend¹. These data suggest that increased citation performance is associated with growth in international collaboration. Collaboration between institutions in Scotland for the UoAs examined exceeds that of N8 Partnership and GW4 Alliance (Figure 3). The performance indicators suggest that Scottish institutions were starting from a higher baseline compared with the N8 and GW4 research groupings, which may have been facilitated through the RPI.

¹ <https://www.ref.ac.uk/2014/results/analysis/comparisonwith2008raeresults/>

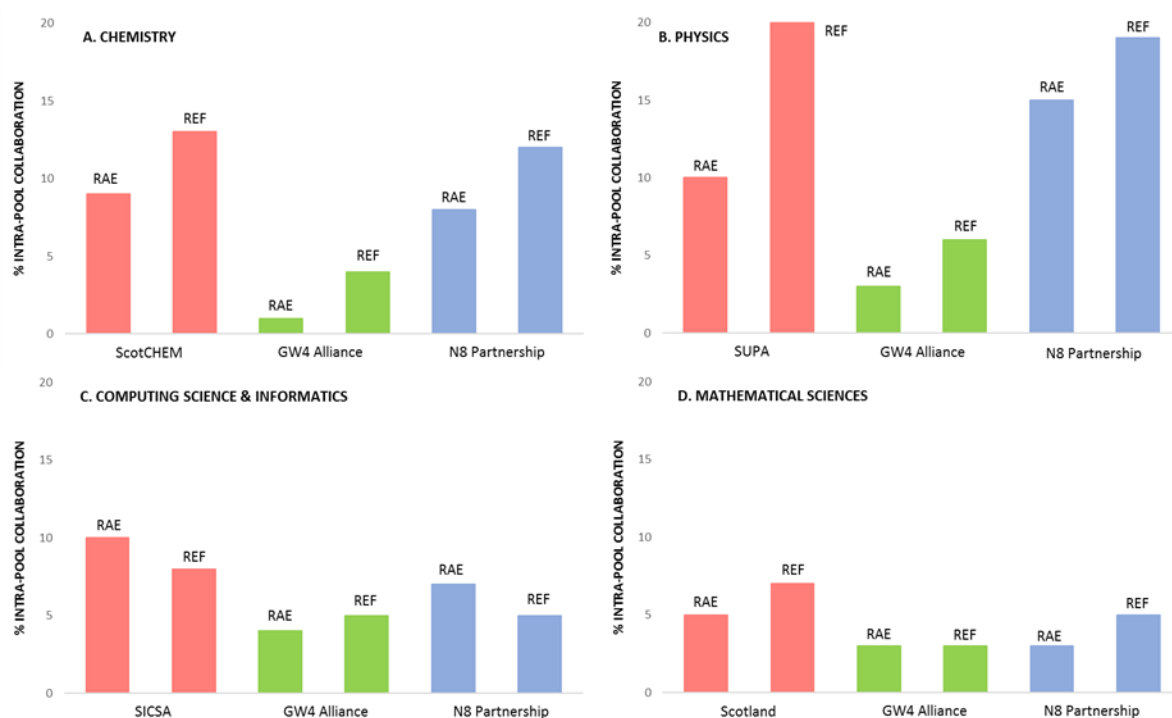


Figure 3: Percentage of outputs submitted by pool member institutions to REF2014/RAE2008 UoAs Chemistry (A), Physics (B) and Computing Science & Informatics (C) with co-authors based in differing pool institutions. Mathematical Sciences included as a comparator non-pooled disciplinary area (D).

Comparative performance of the research pools based on research outputs

The RPI was in part a response to the perceived increasing competitiveness of English HEIs, particularly the 'golden triangle' institutions. To test the effectiveness of research pooling as an antidote to this competition we undertook a comparative analysis of the research pools vs. the 'golden triangle' institutions (Oxford, Cambridge, Imperial, Kings, UCL, LSE). We also benchmarked the performance of pools against the N8 Partnership and GW4 Alliance group of institutions.

Groupings replicating the current institutional composition of research pools, the so-called 'golden triangle' institutions, the N8 Partnership and the GW4 Alliance were created in SciVal using the 'Define a new Group of Institutions' function within the My SciVal module.

To identify outputs with a similar disciplinary focus compared with the research pools, the following major subject area² filters were applied to above-mentioned institutional groupings.

ASJC Major Subject Area	Research Pool(s)
Environmental Science	SAGES & MASTS
Chemistry	ScotCHEM
Computer Science	SICSA
Economics, Econometrics and Finance	SIRE
Engineering	SRPe & ETP
Biochemistry, Genetics and Molecular Biology	SULSA
Physics & Astronomy	SUPA

² Using the All Science Journal Classification System (ASJC), titles in Scopus/SciVal are divided into 27 major subject areas and 300+ minor subject areas

Using the Benchmarking Module in SciVal the performance of research outputs (papers) was analysed for the period 2005 to 2018, using the indicators described below:

Indicator	Description
No. Papers	Number of papers indexed in Scopus. This indicator is not used as a measure of performance. Instead it is used to underpin calculations of % growth and to ensure interpretations of citation-based indicators are better contextualised
FWCI	Field Weighted Citation Impact. Ratio of citations received, relative to the expected world average for the subject field, publication type and publication year. Score 1 = cited as expected. This indicator allows benchmarking of entities regardless of differences in their size, disciplinary profile, and publication-type composition
% Papers in top 10%	Percentage of papers in top 10% most cited publications in the world aka the whole Scopus database
% Publications in top 10%	Percentage of publications in top 10% most cited-journals in the world. Underpinning metric is Source Normalised Impact per Publication (SNIP). This indicator allows benchmarking of entities regardless of differences in their size and disciplinary profile

The analysis comes with a number of caveats, notably:

1. Field Weighted Citation Impact (FWCI) includes citations received in the year of publication plus the following three years thus any interpretation of trends must be undertaken with caution as there is a risk of e.g. positive/negative skew whilst citations are still accruing.
2. The use of major subject area filters enables comparisons across institutional groupings within broad disciplinary areas but cannot be used to characterise or infer absolute performance of the research pools. The use of major subject area filters also artificially excludes a number of papers, for example, SRPe members do not solely publish in 'Engineering' journals, they also publish in journals classified as 'Materials Science', 'Computer Science', 'Medicine' etc.
3. Given the collaborative nature of UK research, high levels of duplication across datasets are unavoidable e.g. a paper with co-authors from Edinburgh, Manchester, Bath and Imperial will appear in all four groupings. This effect is particularly apparent in data related to '% Publications in Top 10%' indicator.

A summary of key trends in the comparative research performance of the pools relative to the 'golden triangle', N8 Partnership and GW4 Alliance is given below and is based largely on the first phase of the RPI investment. The raw data are available as a series of line graphs in [Appendix B](#).

ASJC Major Subject Area 'Environmental Science'

Indicator	Summary of Trends
No. Papers	77% increase in SAGES & MASTS publication activity over phase 1 - GW4 Alliance and Golden Triangle grew at a faster rate over the same period – 131% and 80% respectively - N8 Partnership grew at a slower rate (65%)
FWCI	- Citedness of SAGES & MASTS papers is relatively stable over full reporting period, but is below that of Golden Triangle, GW4 Alliance and N8 Partnership - Gap in performance SAGES & MASTS vs. Golden Triangle is consistent over full reporting period but does not show signs of widening - Gap in performance SAGES & MASTS vs. N8 Partnership narrows significantly towards the end of phase 1 to almost negligible levels
% Papers in top 10%	- Proportion of SAGES & MASTS papers in top 10% is stable over Phase 1 - Gap in performance SAGES & MASTS vs. Golden Triangle (~5%) and SAGES & MASTS vs. GW4 Alliance (7%) is consistent over Phase 1 - Gap in performance SAGES & MASTS vs. N8 Partnership shows significant signs of narrowing during the latter stages of Phase 1
% Publications in top 10%	Proportion of SAGES & MASTS publications in top 10% closely matches Golden Triangle, N8 Partnership and GW4 Alliance in early stages of Phase 1, but after 5 years a gap of ~5% is apparent

ASJC Major Subject Area 'Chemistry'

Indicator	Summary of Trends
No. Papers	~59% increase in both ScotCHEM and Golden Triangle publication activity over phase 1 - N8 Partnership (29%) and GW4 Alliance (31%) grew at a slower rate over same period
FWCI	- Citedness of ScotCHEM papers (1.5) is relatively stable over phase 1 and is broadly comparable to both the N8 Partnership and GW4 Alliance - Citedness of Golden Triangle (1.8 to 2.0) over the same period is consistently higher than ScotCHEM, N8 Partnership and GW4 Alliance
% Papers in top 10%	- Proportion of ScotCHEM papers in top 10% grew modestly at the beginning of Phase 1 surpassing GW4 Alliance and N8 Partnership before falling back to comparable levels - Proportion of Golden Triangle papers in top 10% is ~5% higher than ScotCHEM, N8 Partnership and GW4 Alliance
% Publications in top 10%	- Proportion of publications in top 10% increased significantly across all groups over Phase 1 e.g. ScotCHEM 16% vs. 26% - ScotCHEM, N8 Partnership and GW4 Alliance are broadly comparable; gap between latter groups and Golden Triangle has widened since 2012

ASJC Major Subject Area 'Computer Science'

Indicator	Summary of Trends
No. Papers	21% increase in SICSA publication activity over phase 1 - Golden Triangle (51%) and GW4 Alliance (44%) grew at a faster rate over same period; N8 Partnership was slower (14%)
FWCI	- Already experiencing a growth trajectory prior to funding citedness of SICSA papers continued to increase into Phase 1 - Citedness of SICSA papers reached comparable levels to the Golden Triangle during the middle of Phase 1
% Papers in top 10%	- Proportion of SICSA papers in top 10% relatively stable over Phase 1 and of a comparable level to the N8 Partnership (19%) - Proportion of Golden Triangle papers in top 10% is ~5% higher than SICSA, N8 Partnership and GW4 Alliance over Phase 1
% Publications in top 10%	- Close association in proportion of publications in top 10% between SICSA and N8 Partnership over Phase 1 (40-50%) - Proportion of publications in top 10% ~5% higher in Golden Triangle cf. SICSA

ASJC Major Subject Area 'Economics, Econometrics and Finance'

Indicator	Summary of Trends
No. Papers	~34% increase in SIRE and GW4 Alliance publication activity over phase 1 - N8 Partnership and Golden Triangle grew at a faster rate over same period - 58% and 47% respectively
FWCI	- Towards the mid to latter stages Phase 1, citedness of SIRE papers increases to a level comparable with N8 Partnership and GW4 Alliance - Golden Triangle papers are more cited than SIRE over Phase 1 although the gap appears to be narrowing (note that citations taken longer to accrue in Economics vs. STEM, observation may therefore be a false positive)
% Papers in top 10%	- Proportion of SIRE papers in top 10% grew over Phase 1 to a level comparable to N8 Partnership and GW4 Alliance - Proportion of Golden Triangle papers in top 10% is ~7% higher than all three other groups at the closing of Phase 1
% Publications in top 10%	- Proportion of Golden Triangle (41%) publications in top 10% is relatively stable over Phase 1 - Proportion of SIRE publications in top 10% grew from 21% at start of Phase 1 to 26% during the latter stages

ASJC Major Subject Area 'Engineering'

Indicator	Summary of Trends
No. Papers	~80% increase in both SRPe & ETP publication activity over phase 1 - GW₄ Alliance (88%) and Golden Triangle (85%) grew at a faster rate over same period - N8 Partnership grew at a slower rate (67%)
FWCI	- Citedness of SRPe & ETP papers is relatively stable over the full reporting period and closely matches performance of N8 Partnership - Increase in citedness during the early stages of Phase 1 but failed to materialise longer-term - Citedness of Golden Triangle (> 2.0) over Phase 1 is consistently higher than all three other groups, although gap with GW₄ Alliance is increasingly narrow
% Papers in top 10%	- Proportion of SRPe & ETP papers in top 10% is relatively stable over the full reporting period and closely matches performance of the N8 Partnership - Possible shoots of increased % during the early stages of Phase 1 but failed to materialise longer-term cf. GW₄ Alliance - Proportion of Golden Triangle papers in top 10% is ~7% higher than SRPe & ETP and N8 Partnership
% Publications in top 10%	- Close association in proportion of publications in top 10% between SRPe & ETP N8 Partnership and GW₄ Alliance over full reporting period (35-50%) - Proportion of publications in top 10% 3-8% higher in Golden Triangle cf. all three other groups

ASJC Major Subject Area 'Biochemistry, Genetics and Molecular Biology'

Indicator	Summary of Trends
No. Papers	33% increase in SULSA publication activity over phase 1 - GW₄ Alliance (58%), Golden Triangle (55%) and N8 Partnership (40%) grew at a faster rate over same period
FWCI	Citedness of SULSA papers grew over Phase 1 from a similar baseline to N8 Partnership and GW₄ Alliance (1.7) to a level comparable to the Golden Triangle (1.9) at the start of Phase 2
% Papers in top 10%	Proportion of SULSA papers in top 10% grew over Phase 1 from a mid-point level between N8 Partnership and the Golden Triangle to a level comparable with the Golden Triangle (23%) at the start of Phase 2
% Publications in top 10%	Proportion of SULSA publications in top 10% grew over Phase 1 to a level comparable to the Golden Triangle (30%)

ASJC Major Subject Area 'Physics and Astronomy'

Indicator	Summary of Trends
No. Papers	89% increase in SUPA publication activity over phase 1 - GW₄ Alliance (71%), Golden Triangle (59%) and N8 Partnership (57%) grew at a slower rate over same period
FWCI	- Citedness of SUPA papers grew from a level comparable to the N8 Partnership at the start of 'Phase 1 – SUPA' to match that of the Golden Triangle during 'Phase 1 – SUPA II' - Citedness of GW₄ Alliance papers grew to exceed SUPA and the Golden Triangle, although possibly explained by citation skew associated with smaller size
% Papers in top 10%	- Proportion of SUPA papers in top 10% grew from a level comparable to N8 Partnership (17%) at the start of 'Phase 1 – SUPA' to match the Golden Triangle (21%) by the end of the same phase - Proportion of SUPA papers (19%) in top 10% fell to a level comparable to N8 Partnership (17%) during latter stages of 'Phase 1 – SUPA II'
% Publications in top 10%	Close association in proportion of publications in top 10% over the full reporting period between all groups

There is clear differentiation in the research performance for the main subject areas examined between the Golden Triangle institutions and the comparable subject areas in Scotland, the N8 partnership and the GW₄ Alliance. Notable exceptions are SULSA and SUPA who reached or exceeded the performance of Golden Triangle over the period 2005-2018 that might be attributed to the RPI. A number of subject areas aligned to pools in Scotland have performances that are broadly comparable to the N8 Partnership and GW₄ Alliance, notably ScotCHEM, SICSA and SRPe & ETP. With the exception of SUPA, growth in the number of papers published by pools has failed to keep pace with the Golden Triangle and the N8 Partnership; this is not necessarily detrimental if a lower number of outputs is associated with significant increases in performance such as those recorded for SULSA.

The Scottish research environment: leverage on investment

To understand whether pooling has “made Scotland better as a research environment.”³ We sought to evaluate how research pools have pro-actively leveraged opportunities drawn from the collaborative research capacity and critical mass they have built using data provided by the pools.

Research outputs

Each research pool was asked to identify up to 50 members who they considered to have proactively leveraged opportunities related to research pooling. Leveraged opportunities are described broadly to include, for example, research grants won, high quality published output, developing impact case studies. The table below is a summary of the members identified.

Research Pool	No. members identified	% female
ETP	N/A	-
MASTS	18	28
SAGES	44	27
ScotCHEM	40	9
SICSA	38	8
SINAPSE	50	22
SIRE	N/A	-
SRPe	50	8
SULSA	40	3
SUPA	50	22
Soillse	30	33

Representative pool groupings were created in SciVal using these data. The data were cleaned to remove hyper-authored papers (≥ 100 co-authors). A review of hyper-cited papers (raw citations and/or FWCI) was also undertaken to reduce data skew associated with ‘extreme outliers’. Although such papers may represent major scientific breakthroughs, particularly in SUPA, their inclusion has the potential to distort interpretations of overall performance. The following research pools were not included in the analysis: Soillse, owing to the poor disciplinary coverage of arts and humanities in Scopu; and SIRE, which is not currently funded under the RPI.

The Benchmarking Module in SciVal was used to analyse the performance of papers over the first phase of investment using the following indicators: FWCI, % Papers in top 10%, % Publications in top 10% and % international collaboration. Full descriptors are provided in previous sections.

³ Research Fortnight 28 Nov 2018: challenges and expectations

Overall performance of the research pools is given below.

Research Pool	number of papers identified	FWCI	% Papers top 10%	% Pubs. top 10%	% International Collaboration
MASTS	176	1.6	18	22	48
SAGES	913	2.2	27	41	55
ScotCHEM	2557	1.6	22	23	46
SICSA	302	1.7	21	45	54
SINAPSE	947	1.8	26	41	38
SRPe	973	1.6	18	39	48
SULSA	1375	2	33	33	55
SUPA	3611	2.1	32	36	70

A key indicator is FWCI, which indicates how the number of citations received by a group of papers compares with the average number of citations received by all other 'similar' papers indexed in the Scopus database (aka 'the world'). 'Similar' papers are those in the Scopus database that have the same publication year, publication type (in this case, articles) and discipline. A FWCI score of 1.00 indicates that a group of papers have been cited as expected compared to 'the world' average for similar papers.

A FWCI >1.00 indicates that a group of papers have been cited more than expected based on the world average for similar papers. All the research pools meet this criterion; SAGES, SULSA and SUPA have scores >2.0, indicating the research outputs are c.100% more cited than expected. Similarly, a high proportion of papers attributed to the researchers identified by the pools are present in the top 10% most cited papers in the world e.g. a third of outputs associated with core members of SULSA and SUPA. Further, a high proportion of papers are present in the top 10% most cited journals in the world e.g. ≥40% of publications associated with core members of SAGES, SICSA, SINAPSE and SRPe.

Research income (2013/14 to 2017/18)

Research income (i.e. expenditure resulting from externally awarded research grants and contracts) comprises multiple sources including, Research Councils and National Academies, Charities (UK, EU and Overseas), UK Government, EU Government, Industry (UK, EU and Overseas). HESA Cost Centres are an established mechanism for coding higher education activities⁴ and were mapped onto the research pools as below. SINAPSE and SOILLSE were excluded as they form only small components of very broad cost centre codes. Note that SAGES & MASTS data does not include income associated with the Scottish Association for Marine Science (SAMS).

HESA Cost Centre(s)	Research Pool(s)
111 Earth, marine & environmental sciences; 124 Geography & environmental studies	SAGES & MASTS
113 Chemistry	ScotCHEM
121 IT, systems sciences & computer software engineering	SICSA
129 Economics & econometrics	SIRE
115 General engineering; 116 Chemical engineering; 117 Mineral, metallurgy & materials engineering; 118 Civil engineering; 119 Electrical, electronic & computer engineering; 120 Mechanical, aero & production engineering	SRPe & ETP
112 Biosciences	SULSA
114 Physics	SUPA

⁴ <https://www.hesa.ac.uk/support/documentation/cost-centres>

The Heidi Plus⁵ BI suite and the mapping above was used to extract total research income (2013/14 to 2017/18) and FTE of R&T staff (average over 2013/14 to 2017/18) data for the research pools. As a comparator two non-pooled disciplinary areas were included, Psychology and Behavioural Sciences (HESA Cost Centre 104) and Mathematics (HESA Cost Centre 122). The individual performance of institutions (total income per R&T FTE) was also analysed but restricted to research pools with at least 10 R&T FTE associated with relevant cost centres to avoid distortion associated with small sample sizes.

The analysis below presents data for the UK market share of pool research income and total income per R&T FTE for the research pools compared to the top region in the UK. The underpinning data, with further detail on the UK regional pattern is given in [Appendix C](#) and [Appendix D](#).

	Market share of total income	Income per R&T FTE
Research Pools		
SAGES & MASTS	£149m, 13% of UK total - Third in UK - South East top (£244m, 21%)	£536k per R&T FTE - Top in UK
ScotCHEM	£158m, 14% of UK total - Third in UK - South East top (£171m, 15%)	£898k per R&T FTE - Fifth in UK - East of England top (£1.7m)
SICSA	£138m, 18% of UK total - Second in UK - South East top (£150m, 19%)	£307k per R&T FTE - Third in UK - Northern Ireland top (£381k)
SIRE	£11.6m, 7% of UK total - Fifth in UK - London top (£49m, 28%)	£69k per R&T FTE - Seventh in UK - East of England top (£379k)
SRPe & ETP	£425m, 9% of UK total - Fifth in UK - London top (£819m, 18%)	£556k per R&T FTE - Sixth in UK - East of England top (£883k)
SULSA	£678m, 20% of UK total - Top in UK	£1.15m per R&T FTE - Second in UK - East of England top (£1.3m)
SUPA	£253m, 15% of UK total - Third in UK - London top (£302m, 18%)	£1.1m per R&T FTE - Second in UK - East of England top (£1.7m)
Benchmark non-pooled disciplinary areas		
Mathematics	£40m, 8% of UK total - Sixth in UK - South East top (£89m, 18%)	£164k per R&T FTE - Sixth in UK - East of England top (£510k)
Psychology & Behavioural Sciences	£54m, 9% of UK total - Third in UK - London top (£219m, 37%)	£190k per R&T FTE - Fourth in UK - London top (£412k)

To contextualise the performance of pools further, the total research income and research income per R&T FTE of the research pools was compared with data for the N8 Partnership and GW4 Alliance. Figure 4 shows that research income per R&T FTE is lower for pools compared to the N8 Partnership and GW4 Alliance. Notable exceptions include mature pools SAGES & MASTS, SULSA and SUPA, both of which have a higher income per R&T FTE cf. N8 Partnership and GW4 Alliance. Similar to results of region-based analyses, non-pooled disciplinary areas do not perform as strongly as pooled areas.

⁵ <https://www.hesa.ac.uk/services/heidi-plus>

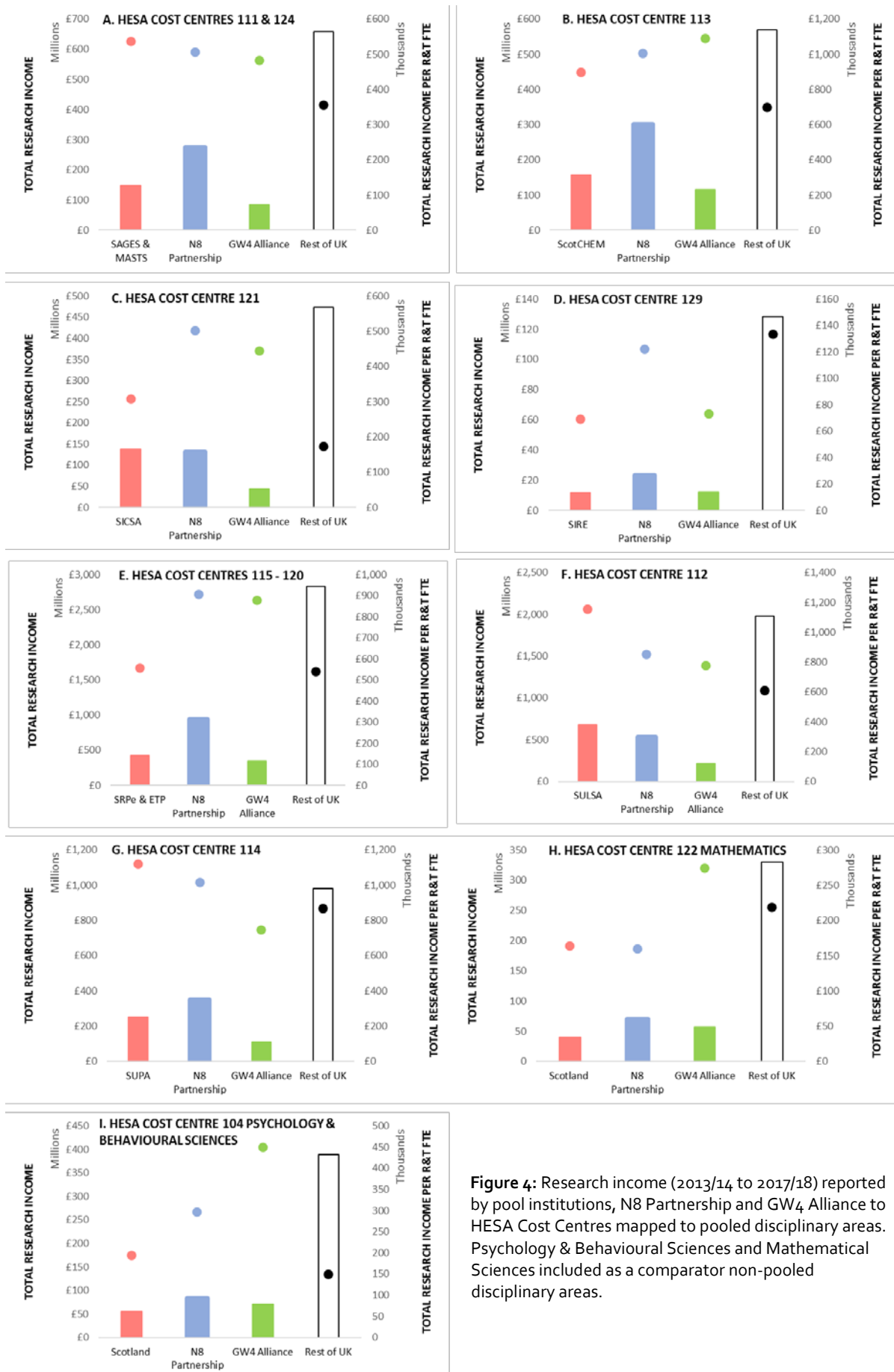


Figure 4: Research income (2013/14 to 2017/18) reported by pool institutions, N8 Partnership and GW4 Alliance to HESA Cost Centres mapped to pooled disciplinary areas. Psychology & Behavioural Sciences and Mathematical Sciences included as a comparator non-pooled disciplinary areas.

Doctoral degrees awarded (2007/08 to 2017/18)

UK higher education institutions report data on students to HESA (Higher Education Statistics Agency) against up to 165 Joint Academic Coding System (JACS) Principal Subject Codes⁶. A mapping of the JACS codes to relevant research pools is given below.

SINAPSE is excluded from this analysis as they form a small component of multiple JACS codes. Meaningful analyses are not possible for Soillse (JACS Codes (Q5) Celtic studies) due to small sample size. MASTS doctoral awards are not limited to the JACS codes identified. It was not possible to disentangle such awards from JACS codes mapped to other pools due to insufficient data granularity.

JACS 3.0 Principal Subject Code (2012/13 to present)	JACS 2.0 Principal Subject Code (used from 2007/08 to 2011/12)	Research Pool(s)
(F7) Science of aquatic & terrestrial environments (F8) Physical geographical sciences (L7) Human & social geography	(F7) Science of aquatic and terrestrial environments (F8) Physical geographical sciences (L7) Human & social geography	SAGES & MASTS
(F1) Chemistry	(F1) Chemistry	ScotCHEM
(I1) Computer science (I2) Information systems	(GW4) Computer science (G5) Information systems	SICSA
(L1) Economics	(L1) Economics	SIRE
(H1) General engineering (H2) Civil engineering (H3) Mechanical engineering (H4) Aerospace engineering (H5) Naval architecture (H6) Electronic & electrical engineering (H7) Production & manufacturing engineering (H8) Chemical, process & energy engineering (H9) Others in engineering	(H1) General engineering (H2) Civil engineering (H3) Mechanical engineering (H4) Aerospace engineering (H5) Naval architecture (H6) Electronic & electrical engineering (H7) Production & manufacturing engineering (H8) Chemical, process & energy engineering (H9) Others in engineering	SRPe & ETP
(C1) Biology (C2) Botany (C3) Zoology (C4) Genetics (C5) Microbiology (C7) Molecular biology, biophysics & biochemistry (C9) Others in Biological Sciences	(C1) Biology (C2) Botany (C3) Zoology (C4) Genetics (C5) Microbiology (C7) Molecular biology, biophysics & biochemistry (C9) Others in Biological Sciences	SULSA
(F3) Physics (F5) Astronomy	(F3) Physics (F5) Astronomy	SUPA

Based on the JACS mapping and using the Heidi Plus⁷ BI suite it is possible to extract the total number of doctoral degrees awarded (2007/08 to 2017/18) for the research pools. Mathematical sciences was included as a non-pooled disciplinary areas for comparison.

The data summarised below show the trends in doctoral degrees awarded and changes in the UK market share of doctoral degrees awarded. Comparisons are based on the number of doctoral degrees awarded in 2007/08-2008/09 vs. 2016/17-2017/18. The underpinning data are given in [Appendix E](#). The data show that over the past decade Scottish research pools increased their UK market share of doctoral degrees awarded, underpinned by very strong rates of growth.

⁶ <https://www.hesa.ac.uk/support/documentation/jacs>

⁷ <https://www.hesa.ac.uk/services/heidi-plus>

	Growth in doctoral degrees awarded (2007-09 vs. 2016-18)	Change in market share (2007-09 vs. 2016-18)
Research Pools		
SAGES & MASTS	40% increase - Growth comparable to South East (46%) and North West (38%)	- No change ~9% - Increase in ranking from fifth to joint fourth with Yorkshire and the Humber - South East top (23.9%)
ScotCHEM	53% increase - Growth second fastest in UK behind West Midlands (89%)	- Increase from 12.7% to 15.3% - Increase in ranking from third to first
SICSA	10% increase - Growth very modest compared to other key regions e.g. South East (79%)	- Decrease from 13.5% to 11.2% - Decrease in ranking from second to third - London top (18.6%)
SIRE	367% increase - Fastest rate of growth in UK	- Increase from 2.6% to 9.7% - Increase in ranking from ninth to fifth - South East top (17.9%)
SRPe & ETP	90% increase - Growth significantly higher than London (67%) and South East (25%)	- Increase from 8.7% to 10.7% - Increase in ranking from sixth to fourth - London top (18.2%)
SULSA	30% increase - Growth significantly higher than South East (5%) and London (1%)	- Increase from 15.1% to 17.2% - Increase in ranking from second to first
SUPA	115% increase - Fastest rate of growth in UK, outpacing London (73%) and South East (20%)	- Increase from 9.7% to 13.7% - Increase in ranking from fourth to third - London top (20.3%)
Benchmark non-pooled disciplinary area		
Mathematics	29% increase - Growth modest compared to other key regions e.g. London (78%)	- Decrease from 10.4% to 8% - Decrease in ranking from third to fifth - South East top (19.3%)

To contextualise the performance of pools further, we also compared growth in the number of doctoral degrees awarded with the N8 Partnership and GW₄ Alliance groups. Figure 5 shows pool growth rates exceeded that of the N8 Partnership leading to significant gains in particular for SULSA and SUPA. Notable is SIRE who exceeded the GW₄ Alliance by unprecedented growth in the number of doctoral degrees awarded.

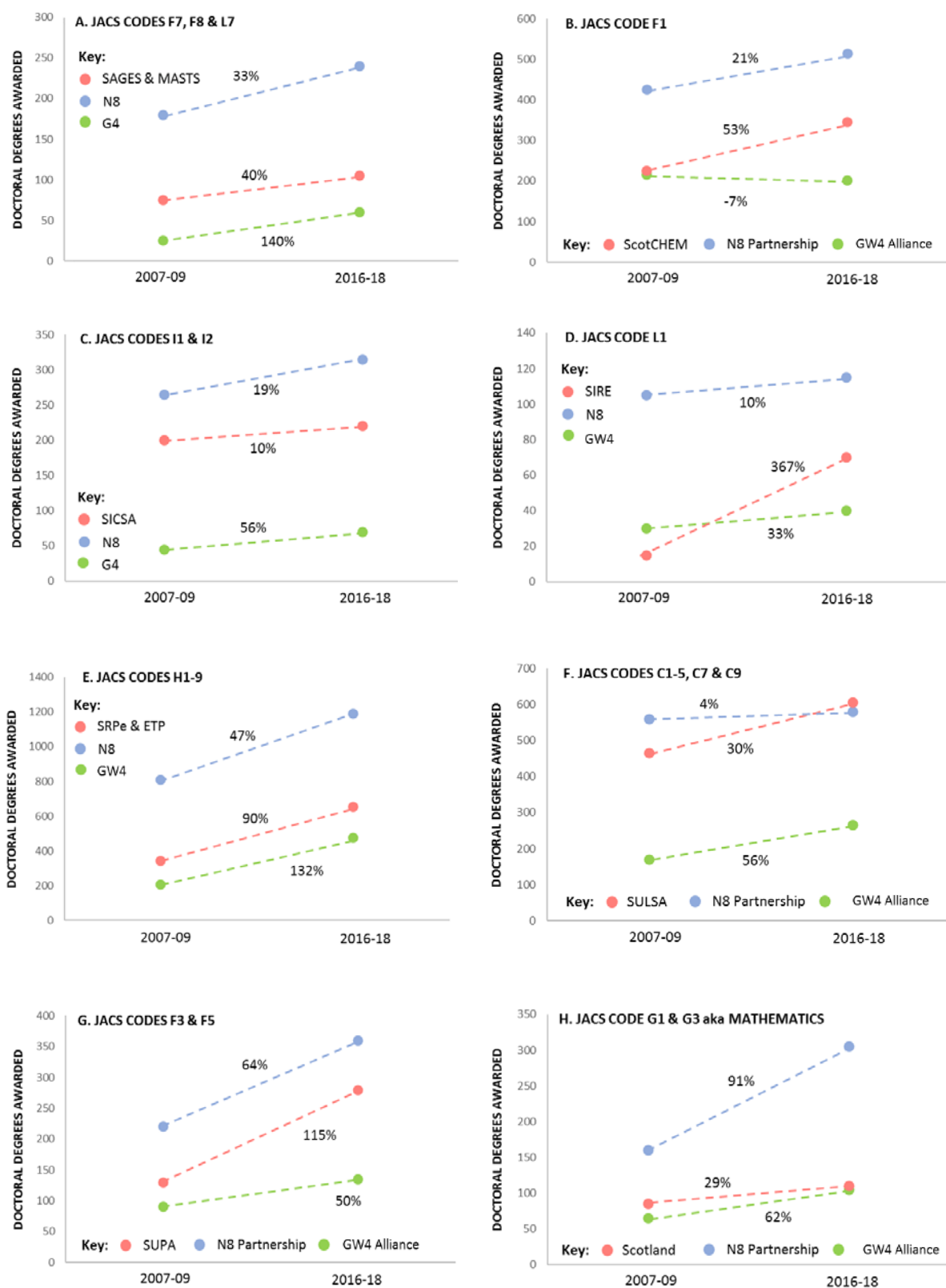


Figure 5: Number of doctoral degrees awarded by pool institutions, N8 Partnership and GW4 Alliance in disciplinary areas mapped to pools, 2007/08-2008/09 vs. 2016/17-2017/18. Mathematical Sciences included as a comparator non-pooled disciplinary area. Percentage = growth.

Appendix A – Performance of outputs submitted by Pool Institutions to RAE2008 vs. REF2014, broken down by Unit of Assessment

CHEMISTRY	ScotCHEM		N8 Partnership		GW4 Alliance	
Indicator	RAE2008	REF2014	RAE2008	REF2014	RAE2008	REF2014
Scholarly Output	596	747	1102	954	512	443
FWCI	2.4	3.0	2.5	2.9	3.5	3.5
% Papers in top 10%	33	39	33	38	35	47
% Publications in top 10%	49	59	45	56	41	61
% intra-pool collaboration	9	13	8	12	1	4
% international collaboration	34	46	32	46	34	44

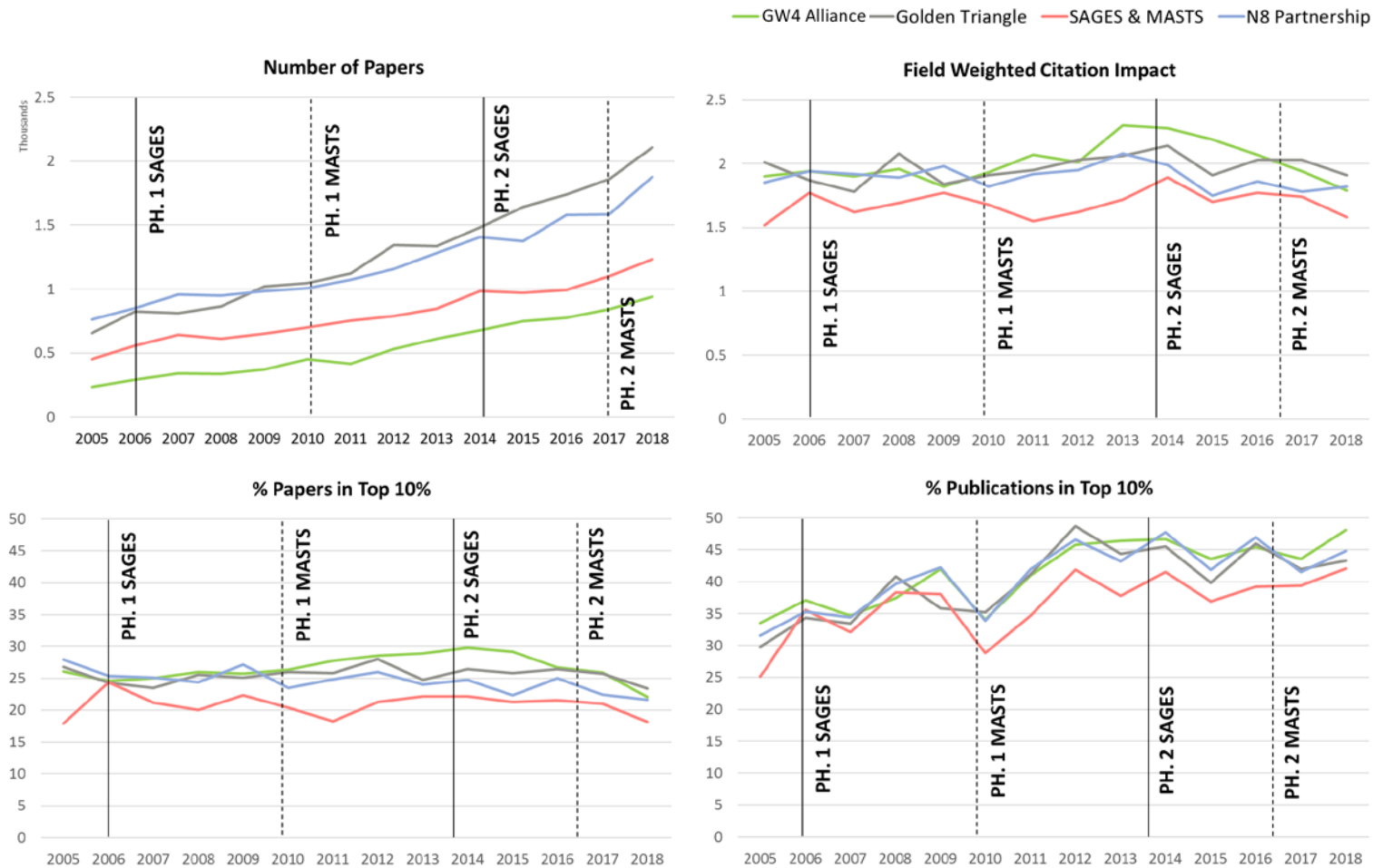
PHYSICS	SUPA		N8 Partnership		GW4 Alliance	
Indicator	RAE2008	REF2014	RAE2008	REF2014	RAE2008	REF2014
Scholarly Output	730	683	1145	983	497	490
FWCI	3.5	5.2	4.3	5.1	3.3	4.4
% Papers in top 10%	44	55	39	52	39	52
% Publications in top 10%	60	62	48	48	53	55
% intra-pool collaboration	10	20	15	19	3	6
% international collaboration	63	75	66	73	51	64

COMPUTING SCIENCE & INFORMATICS	SICSA		N8 Partnership		GW4 Alliance	
Indicator	RAE2008	REF2014	RAE2008	REF2014	RAE2008	REF2014
Scholarly Output	633	958	773	673	232	305
FWCI	2.7	3.2	3.4	2.9	3.0	3.2
% Papers in top 10%	33	38	37	35	37	33
% Publications in top 10%	50	54	57	58	56	58
% intra-pool collaboration	10	8	7	5	4	5
% international collaboration	31	40	33	45	30	43

D. MATHEMATICAL SCIENCES	Scotland		N8 Partnership		GW4 Alliance	
Indicator	RAE2008	REF2014	RAE2008	REF2014	RAE2008	REF2014
Scholarly Output	570	773	906	951	447	575
FWCI	1.7	1.8	1.7	1.6	1.8	1.9
% Papers in top 10%	16	20	21	18	24	21
% Publications in top 10%	40	40	34	37	47	48
% intra-pool collaboration	5	7	3	5	3	3
% international collaboration	41	51	42	51	45	56

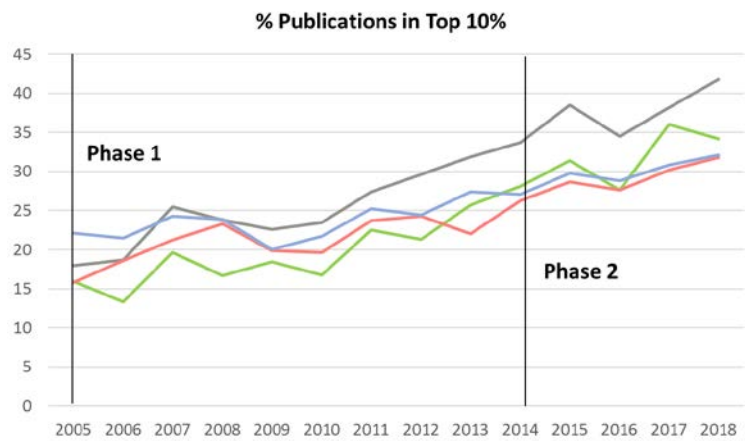
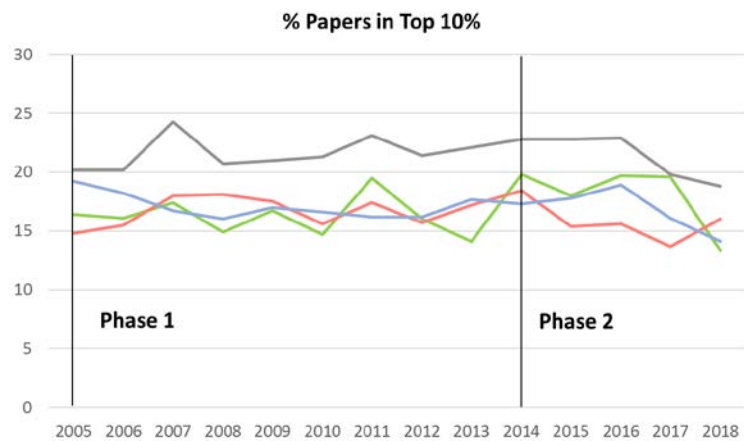
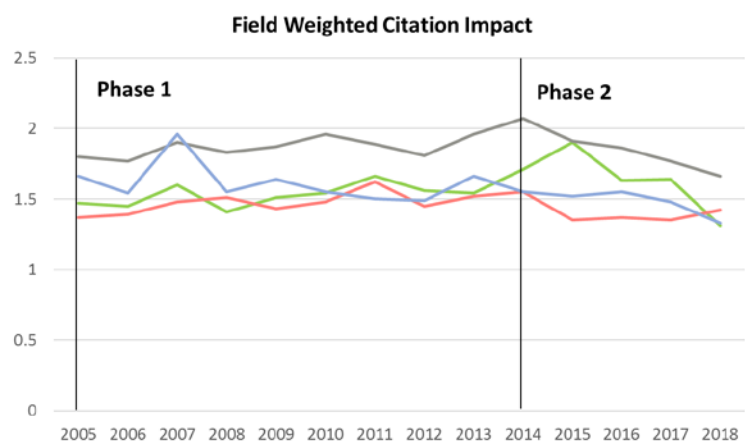
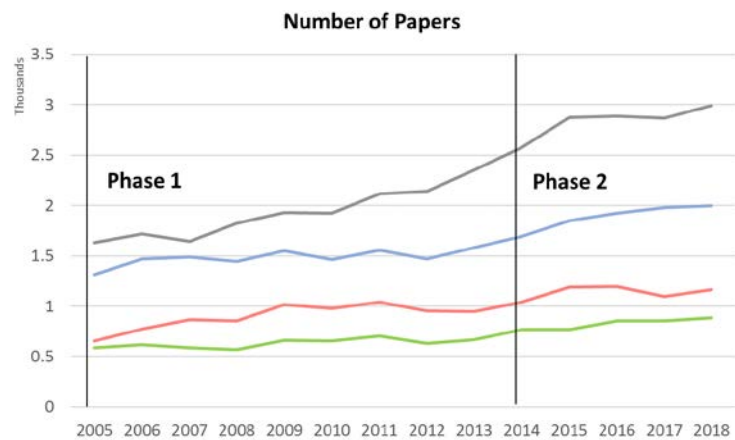
Appendix B – Performance of papers (2005-2018) published by Research Pool Institutions, Golden Triangle, N8 Partnership and GW₄ Alliance in ASJC Major Subject Areas mapped to pool disciplinary areas. Phases of funding annotated.

ASJC Major Subject Area 'Environmental Science'

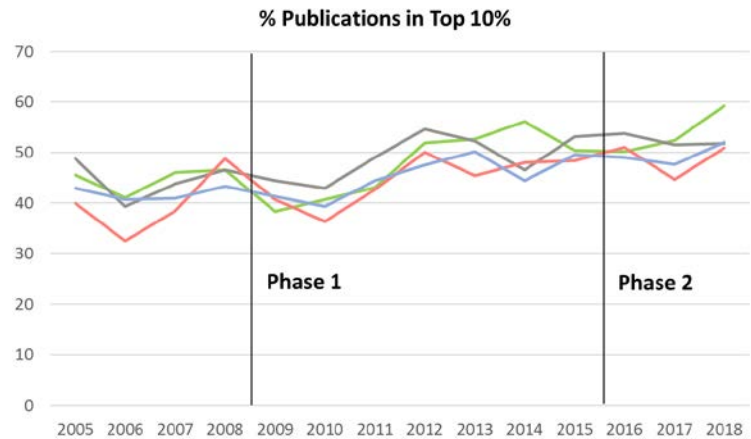
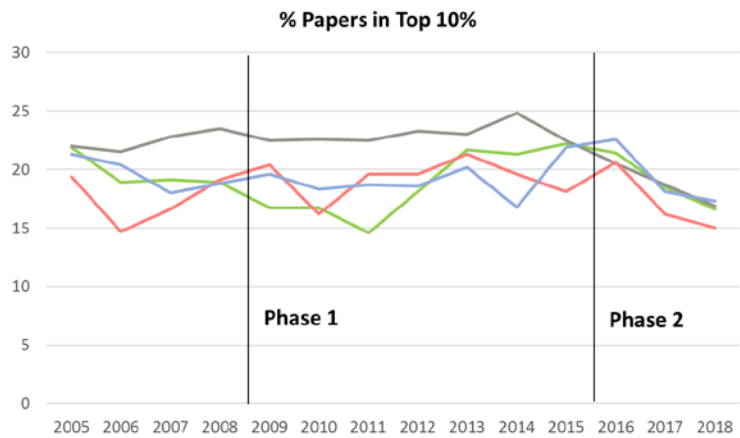
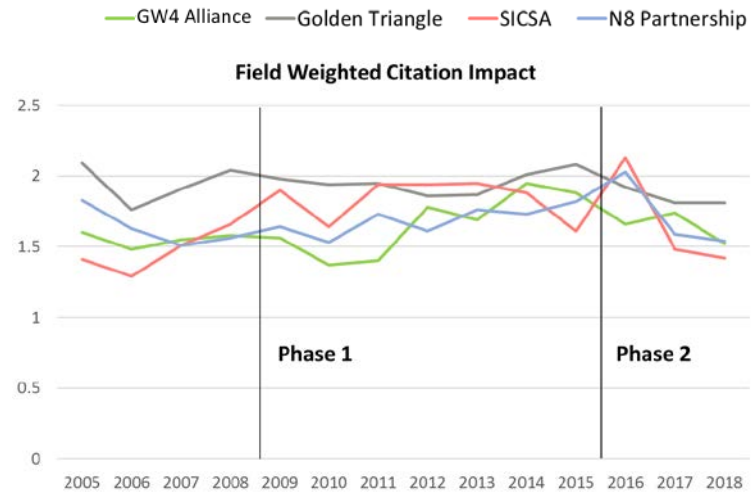
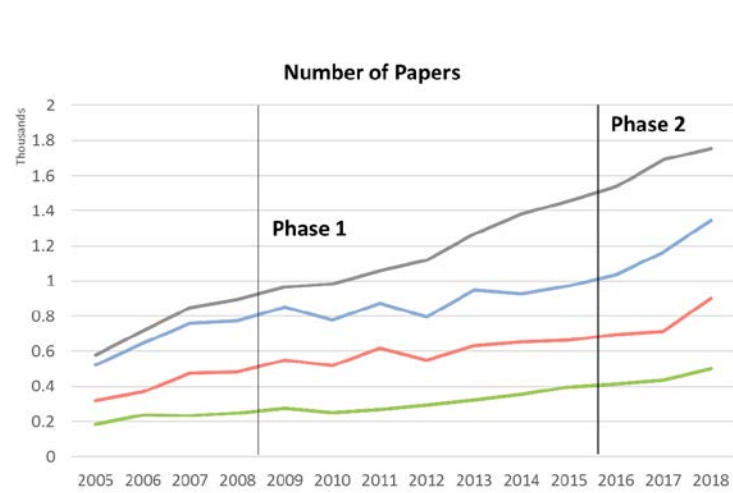


ASJC Major Subject Area 'Chemistry'

— GW4 Alliance — Golden Triangle — ScotCHEM — N8 Partnership

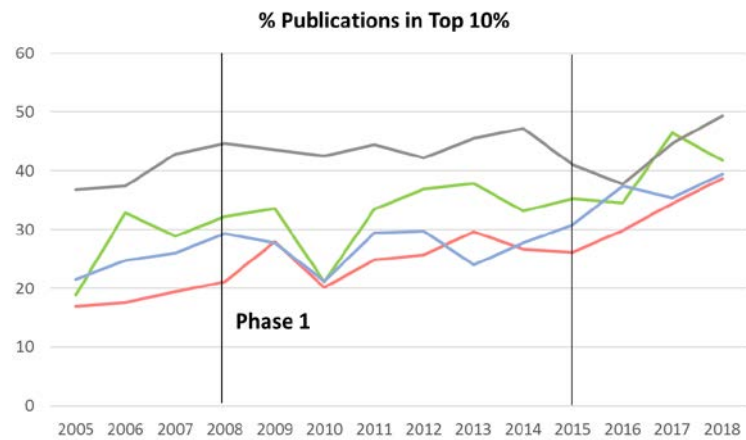
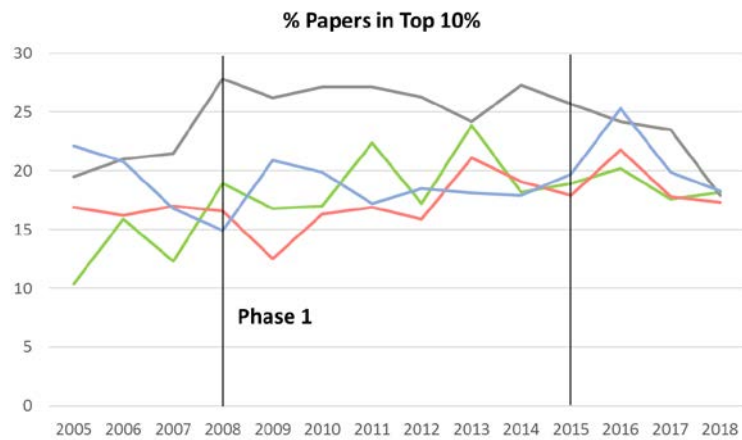
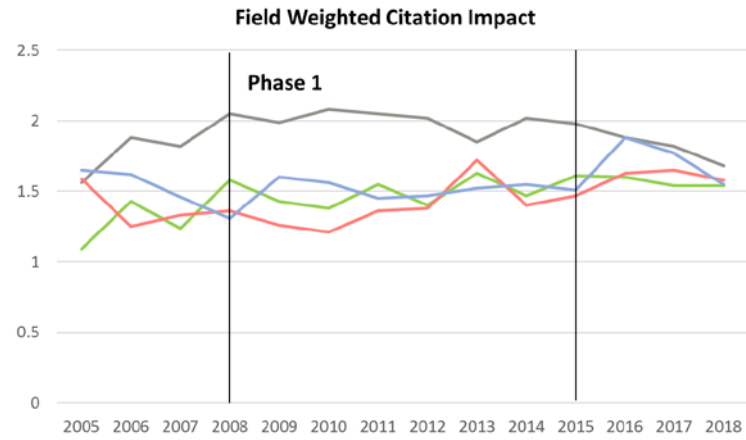
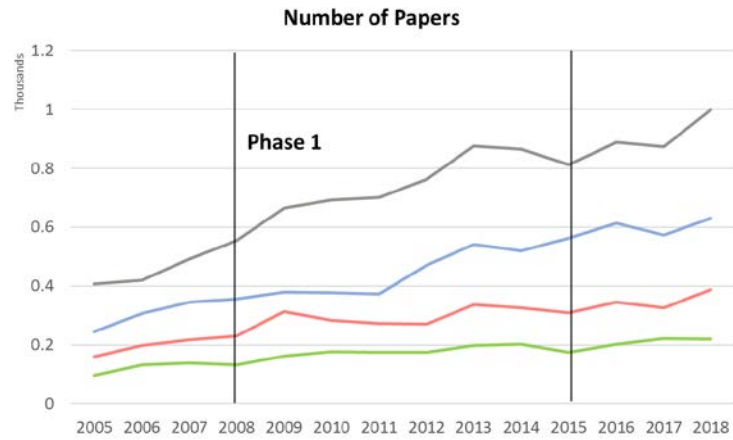


ASJC Major Subject Area 'Computer Science'

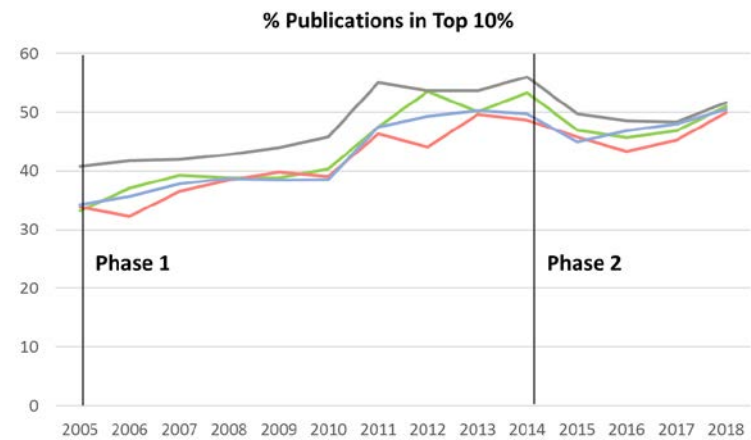
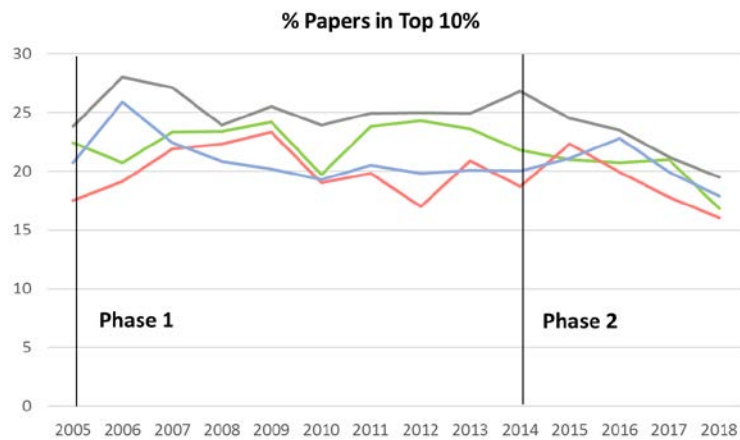
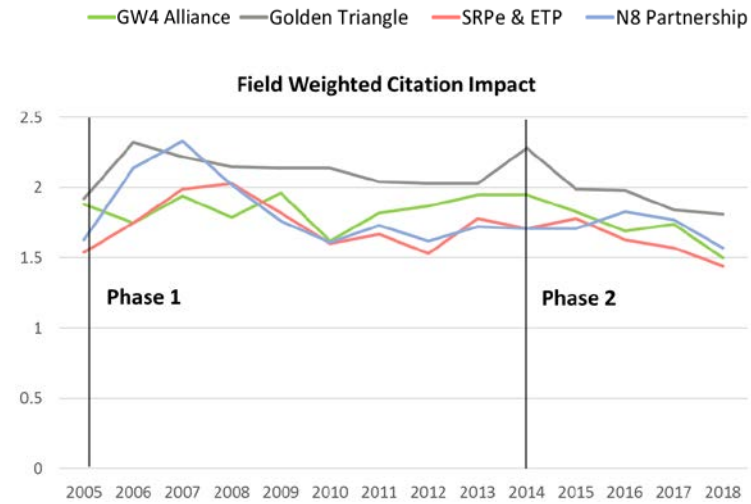
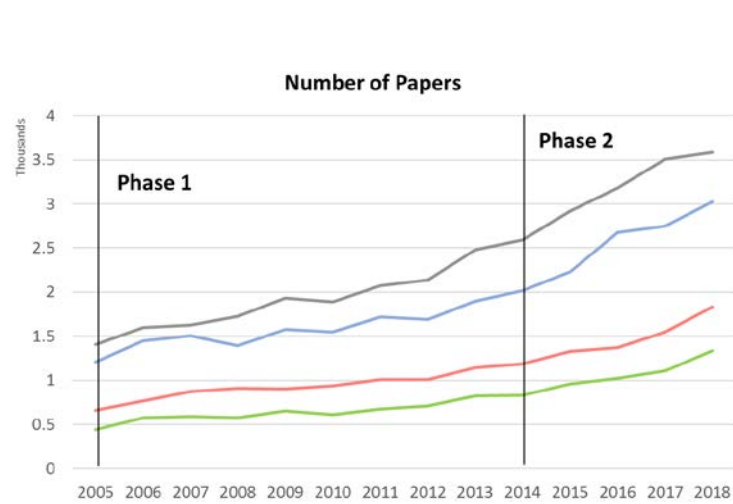


ASJC Major Subject Area 'Economics, Econometrics and Finance'

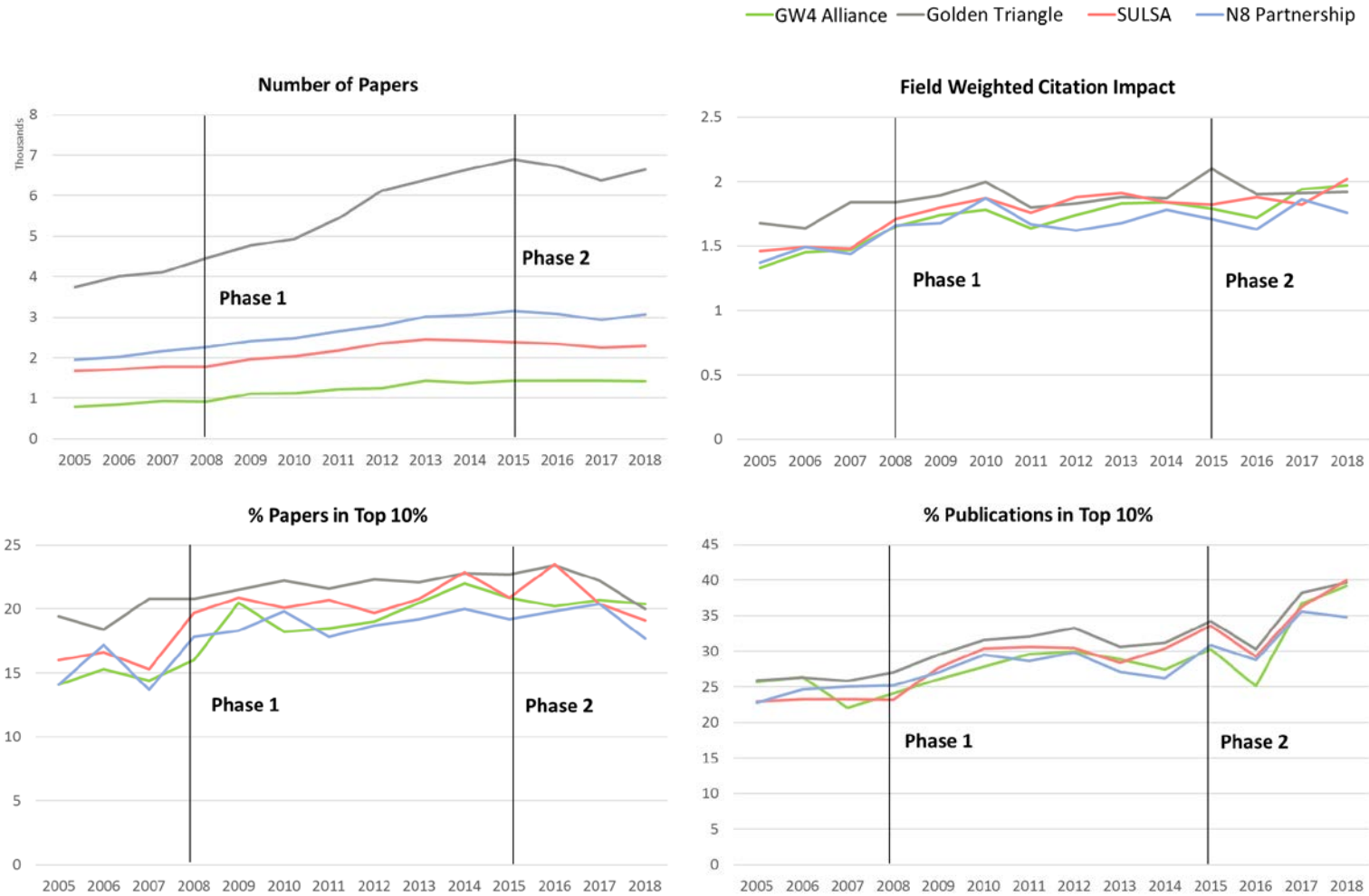
GW4 Alliance Golden Triangle SIRE N8 Partnership



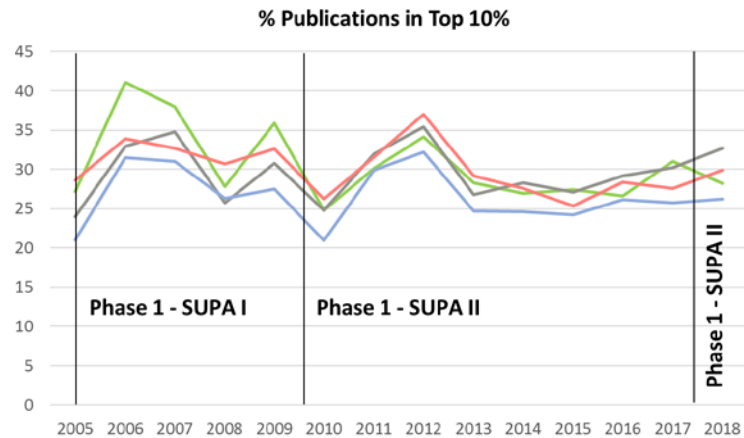
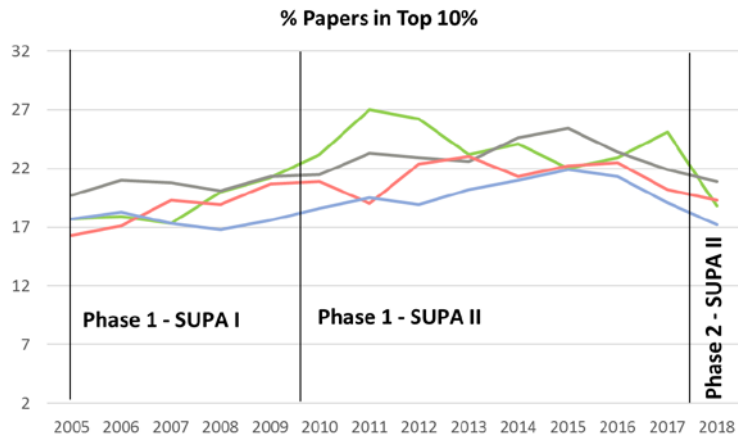
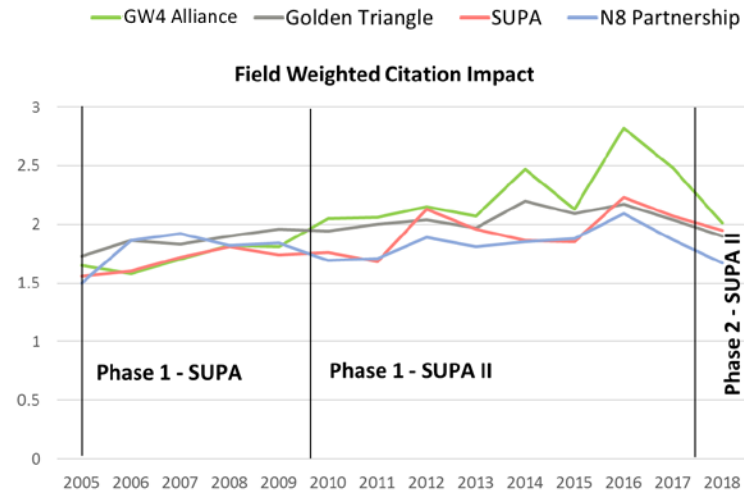
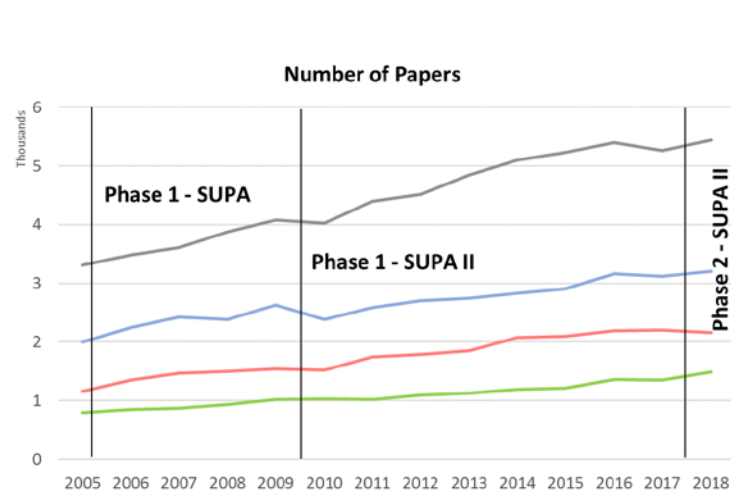
SRPe & ETP aka ASJC Major Subject Area 'Engineering'



ASJC Major Subject Area 'Biochemistry, Genetics and Molecular Biology'



ASJC Major Subject Area 'Physics and Astronomy'



Appendix C – Research Income (2013/14 to 2017/18) – Total (£) and per R&T FTE (£ per FTE) – broken down by UK region

'Research Pools'

HESA Cost Centres 111 (Earth, marine & environmental sciences) and 124 (Geography & environmental studies)

Region	Total Income (£)	Market Share	R&T FTE	£ per FTE
East Midlands	£29,036,000	2%	168	£172,833
East of England	£86,678,000	7%	179	£484,235
London	£165,637,000	14%	325	£509,652
North East	£57,952,000	5%	182	£318,418
North West	£98,095,000	8%	282	£347,855
Northern Ireland	£8,545,000	1%	36	£237,361
Rest of Scotland	£6,199,000	1%	15	£413,267
SAGES & MASTS	£149,039,000	13%	278	£536,112
South East	£244,414,000	21%	476	£513,475
South West	£100,272,000	9%	298	£336,483
Wales	£51,372,000	4%	169	£303,976
West Midlands	£33,082,000	3%	160	£206,763
Yorkshire and The Humber	£136,690,000	12%	292	£468,116
Total	£1,167,011,000	100%	2860	£408,046

HESA Cost Centre 113 (Chemistry)

Region	Total Income (£)	Market Share	R&T FTE	£ per FTE
East Midlands	£47,384,000	4%	120	£394,867
East of England	£120,908,000	11%	71	£1,702,930
London	£128,411,000	11%	181	£709,453
North East	£39,798,000	3%	84	£473,786
North West	£163,575,000	14%	166	£985,392
Northern Ireland	£23,394,000	2%	38	£615,632
Rest of Scotland	£565,000	<1%	25	£22,600
ScotCHEM	£158,152,000	14%	176	£898,590
South East	£171,745,000	15%	176	£975,824
South West	£88,735,000	8%	91	£975,110
Wales	£40,744,000	4%	68	£599,176
West Midlands	£52,747,000	5%	89	£592,663
Yorkshire and The Humber	£108,767,000	9%	194	£560,655
Grand Total	£1,144,925,000	100%	1479	£774,121

HESA Cost Centre 121 (IT, systems sciences & computer software engineering)

Region	Total Income (£)	Market Share	R&T FTE	£ per FTE
East Midlands	£48,953,000	6%	244	£200,627
East of England	£43,290,000	6%	194	£223,144
London	£121,119,000	15%	546	£221,830
North East	£33,732,000	4%	213	£158,366
North West	£80,248,000	10%	358	£224,156
Northern Ireland	£24,431,000	3%	64	£381,734
SICSA	£138,287,000	18%	449	£307,989
South East	£150,151,000	19%	485	£309,590
South West	£45,529,000	6%	249	£182,847
Wales	£26,744,000	3%	153	£174,797
West Midlands	£37,233,000	5%	310	£120,106
Yorkshire and The Humber	£36,596,000	5%	283	£129,314
Total	£786,313,000	100%	3,548	£221,621

HESA Cost Centre 129 (Economics & econometrics)

Region	Total Income (£)	Market Share	R&T FTE	£ per FTE
East Midlands	£4,560,000	3%	132	£34,545
East of England	£38,682,000	22%	102	£379,235
London	£49,064,000	28%	322	£152,373
North East	£2,306,000	1%	76	£30,342
North West	£3,889,000	2%	102	£38,127
Northern Ireland	£25,000	0%	4	£6,250
SIRE	£11,678,000	7%	169	£69,101
South East	£28,107,000	16%	249	£112,880
South West	£5,798,000	3%	91	£63,714
Wales	£3,341,000	2%	40	£83,525
West Midlands	£7,228,000	4%	104	£69,500
Yorkshire and The Humber	£20,784,000	12%	97	£214,268
Total	£175,462,000	100%	1488	£117,918

HESA Cost Centres 115 (General engineering), 116 (Chemical engineering), 117 (Mineral, metallurgy & materials engineering), 118 (Civil engineering), 119 (Electrical, electronic & computer engineering) and 120 (Mechanical, aero & production engineering)

Region	Total Income (£)	Market Share	R&T FTE	£ per FTE
East Midlands	£305,764,000	7%	694	£440,582
East of England	£491,931,000	11%	557	£883,180
London	£819,798,000	18%	1,090	£752,108
North East	£118,855,000	3%	342	£347,529
North West	£282,710,000	6%	721	£392,108
Northern Ireland	£86,310,000	2%	178	£484,888
Rest of Scotland	£776,000	<1%	7	£110,857
South East	£509,577,000	11%	885	£575,793
South West	£312,152,000	7%	448	£696,768
SRPe & ETP	£425,097,000	9%	764	£556,410
Wales	£179,656,000	4%	325	£552,788
West Midlands	£388,912,000	9%	702	£554,006
Yorkshire and The Humber	£621,570,000	14%	735	£845,673
Total	£4,543,108,000	100%	7,448	£609,977

HESA Cost Centre 112 (Biosciences)

Region	Total Income (£)	Market Share	R&T FTE	£ per FTE
East Midlands	£147,805,000	4%	406	£364,052
East of England	£427,574,000	13%	322	£1,327,870
London	£618,457,000	18%	725	£853,044
North East	£78,395,000	2%	212	£369,788
North West	£354,803,000	10%	627	£565,874
Northern Ireland	£55,341,000	2%	91	£608,143
Rest of Scotland	£8,421,000	<1%	92	£91,533
South East	£400,023,000	12%	502	£796,859
South West	£168,496,000	5%	326	£516,859
SULSA	£678,386,000	20%	587	£1,155,683
Wales	£119,600,000	4%	198	£604,040
West Midlands	£134,406,000	4%	248	£541,960
Yorkshire and The Humber	£223,127,000	7%	414	£538,954
Total	£3,414,834,000	100%	4750	£718,912

HESA Cost Centre 114 (Physics)

Region	Total Income (£)	Market Share	R&T FTE	£ per FTE
East Midlands	£86,031,000	5%	139	£618,928
East of England	£165,806,000	10%	93	£1,782,860
London	£302,534,000	18%	289	£1,046,830
North East	£71,122,000	4%	85	£836,729
North West	£214,731,000	13%	220	£976,050
Northern Ireland	£35,058,000	2%	42	£834,714
South East	£264,801,000	16%	320	£827,503
South West	£82,570,000	5%	119	£693,866
SUPA	£253,008,000	15%	226	£1,119,504
Wales	£39,225,000	2%	68	£576,838
West Midlands	£101,552,000	6%	125	£812,416
Yorkshire and The Humber	£79,506,000	5%	128	£621,141
Grand Total	£1,695,944,000	100%	1854	£914,749

Non-pooled disciplinary areas

HESA Cost Centre 122 (Mathematics)

Region	Total Income (£)	Market Share	R&T FTE	£ per FTE
East Midlands	£21,850,000	4%	155	£140,968
East of England	£69,964,000	14%	137	£510,686
London	£86,076,000	17%	386	£222,995
North East	£13,251,000	3%	109	£121,569
North West	£35,188,000	7%	241	£146,008
Northern Ireland	£1,432,000	0%	23	£62,261
Scotland	£40,523,000	8%	247	£164,061
South East	£89,819,000	18%	429	£209,368
South West	£56,985,000	11%	226	£252,146
Wales	£7,592,000	2%	75	£101,227
West Midlands	£51,521,000	10%	219	£235,256
Yorkshire and The Humber	£24,077,000	5%	159	£151,428
Total	£498,278,000	100%	2406	£207,098

HESA Cost Centre 104 (Psychology and Behavioural Sciences)

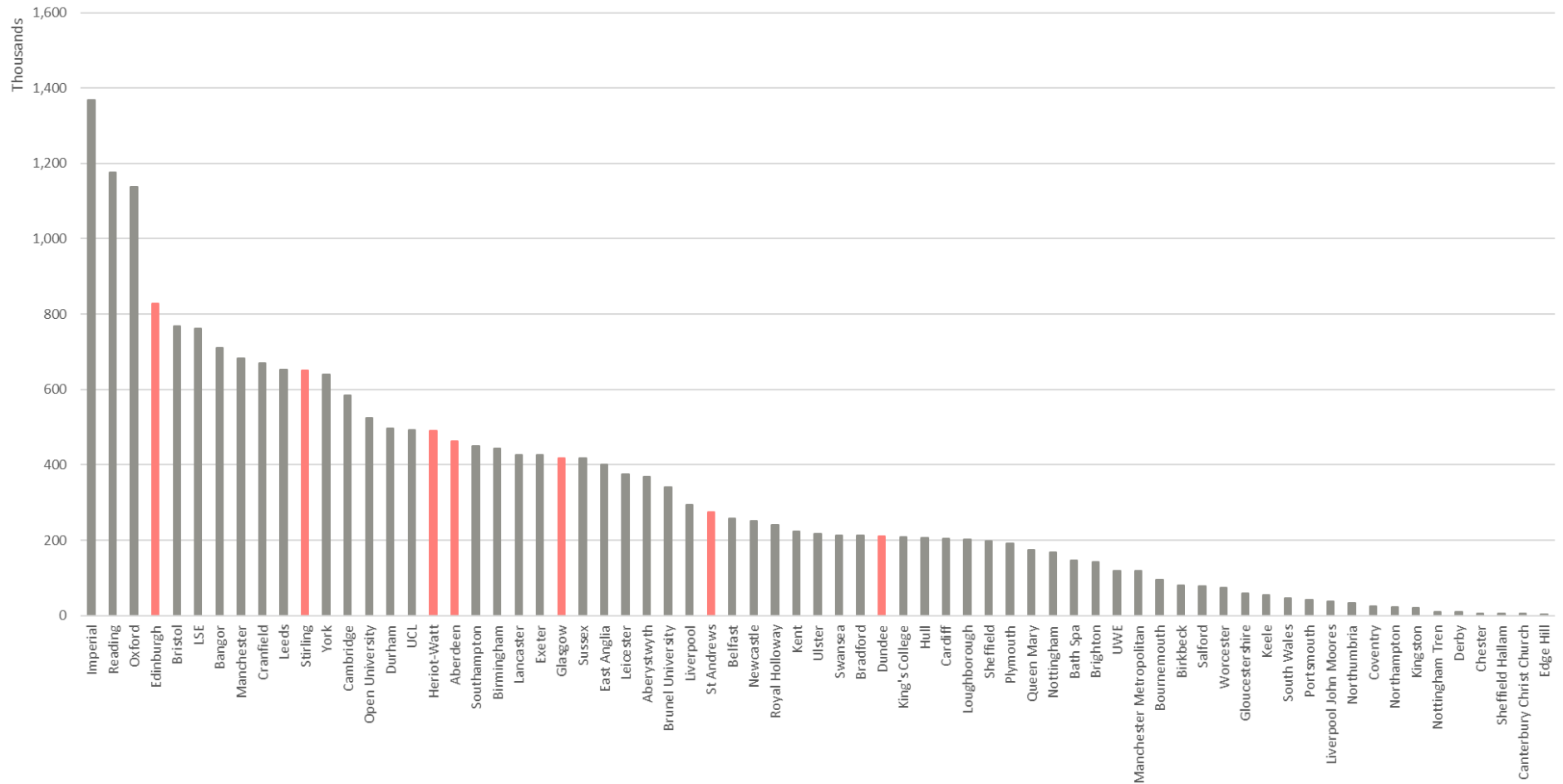
Region	Total Income (£)	Market Share	R&T FTE	£ per FTE
East Midlands	£17,090,000	3%	305	£56,033
East of England	£13,289,000	2%	144	£92,285
London	£219,097,000	37%	531	£412,612
North East	£20,109,000	3%	141	£142,617
North West	£41,313,000	7%	329	£125,571
Northern Ireland	£10,756,000	2%	53	£202,943
Scotland	£54,956,000	9%	288	£190,819
South East	£66,190,000	11%	430	£153,930
South West	£38,396,000	6%	247	£155,449
Wales	£51,054,000	9%	204	£250,265
West Midlands	£31,999,000	5%	321	£99,685
Yorkshire and The Humber	£32,664,000	5%	323	£101,127
Total	£596,913,000	100%	3,316	£180,010

Appendix D – Total research income (2013/14 to 2017/18) per R&T FTE – broken down by institution

'Research Pools'

HESA Cost Centres 111 (Earth, marine & environmental sciences) and 124 (Geography & environmental studies)

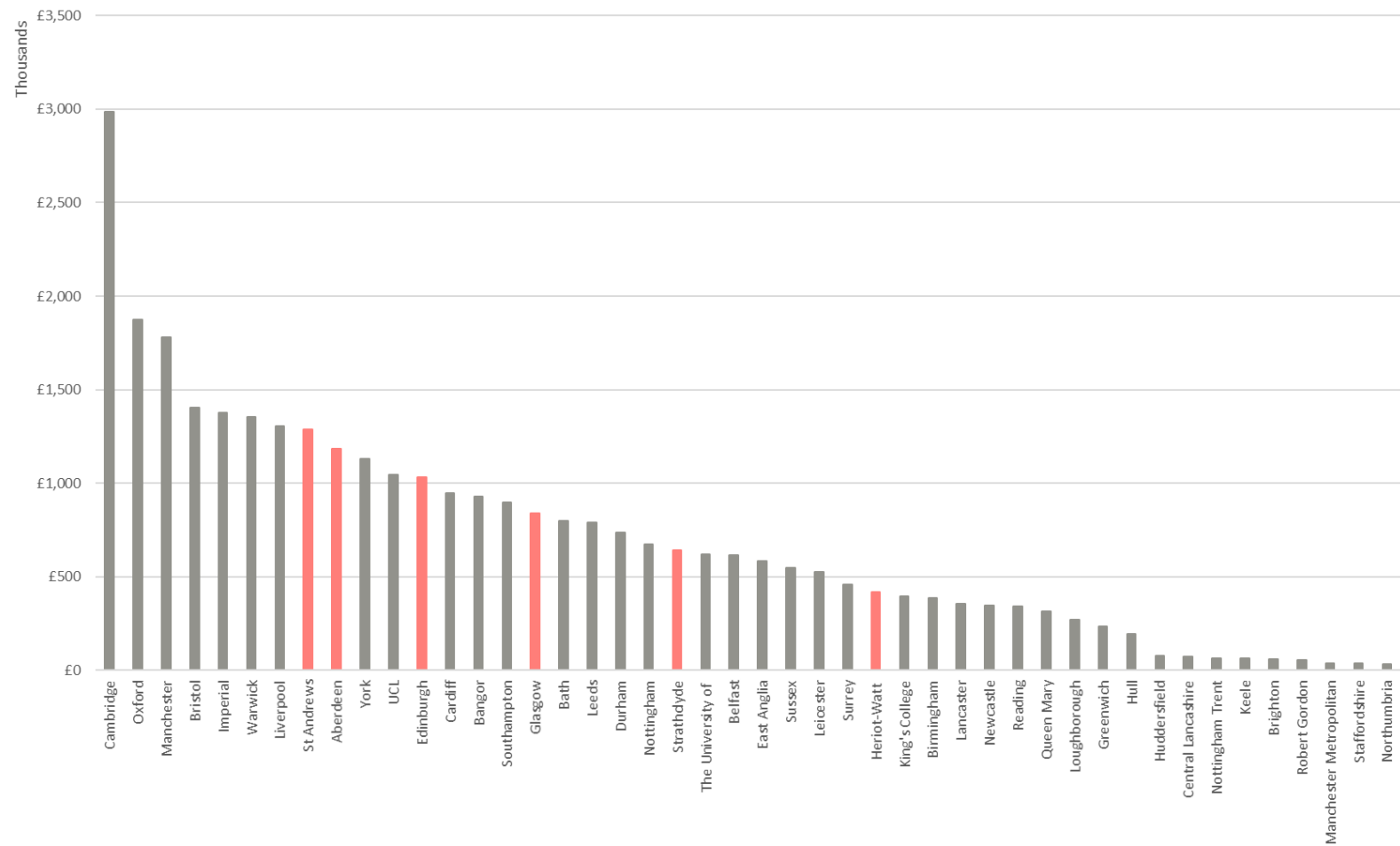
Pink = SAGES and/or MASTS pool members



HESA

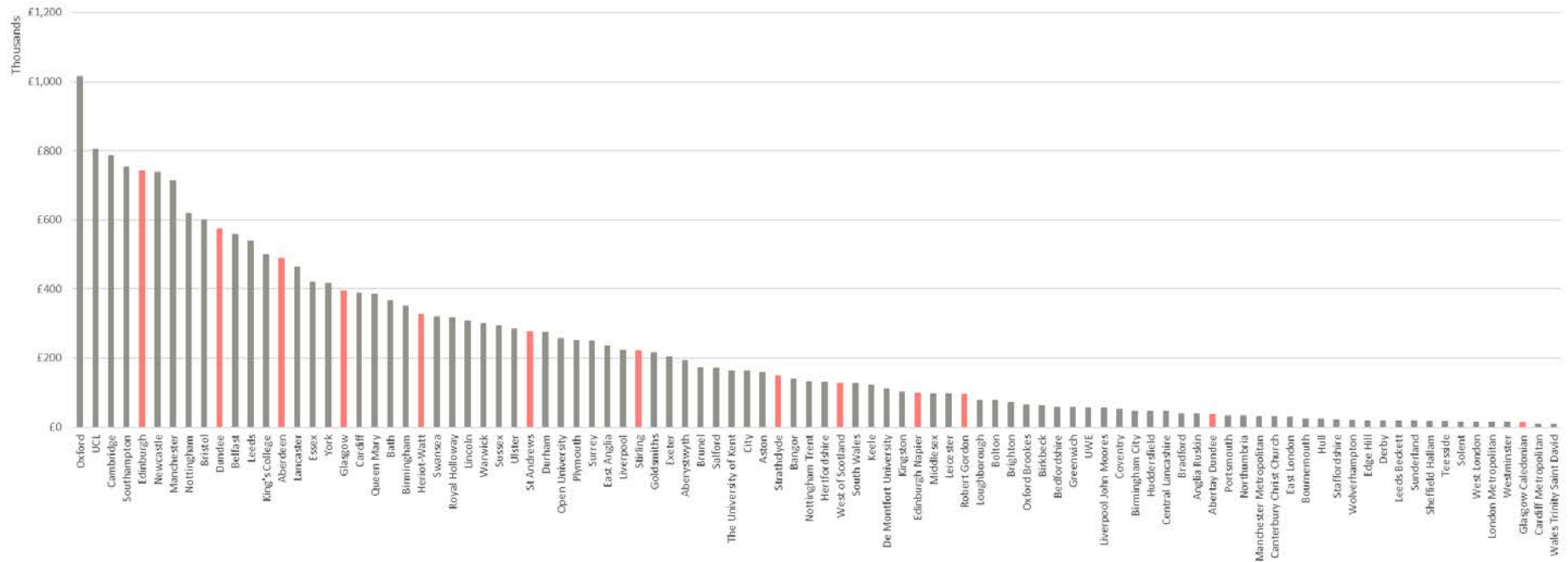
Cost Centre 113 (Chemistry)

Pink = ScotCHEM pool members



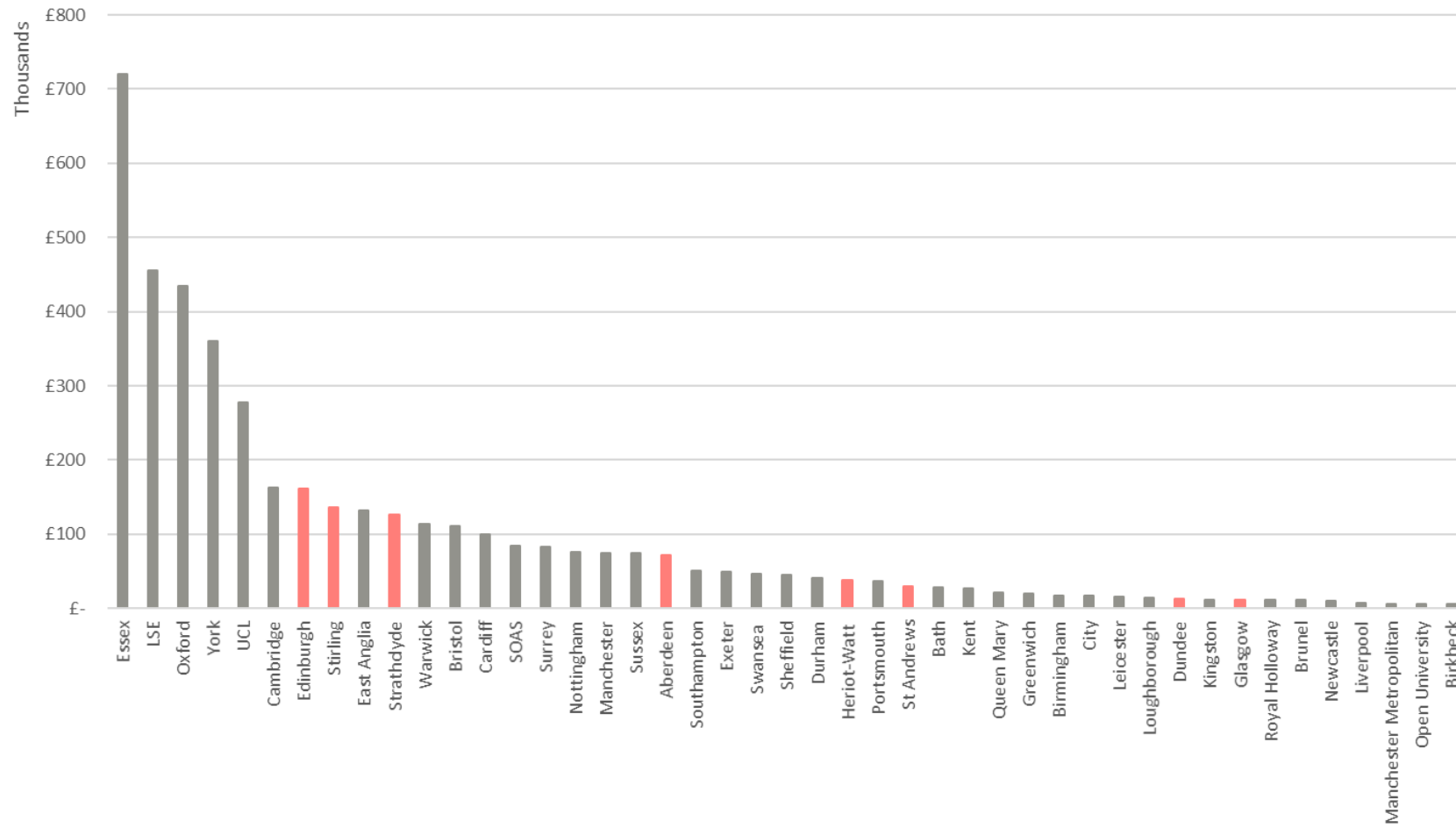
HESA Cost Centre 121 (IT, systems sciences & computer software engineering)

Pink = SICSA pool members



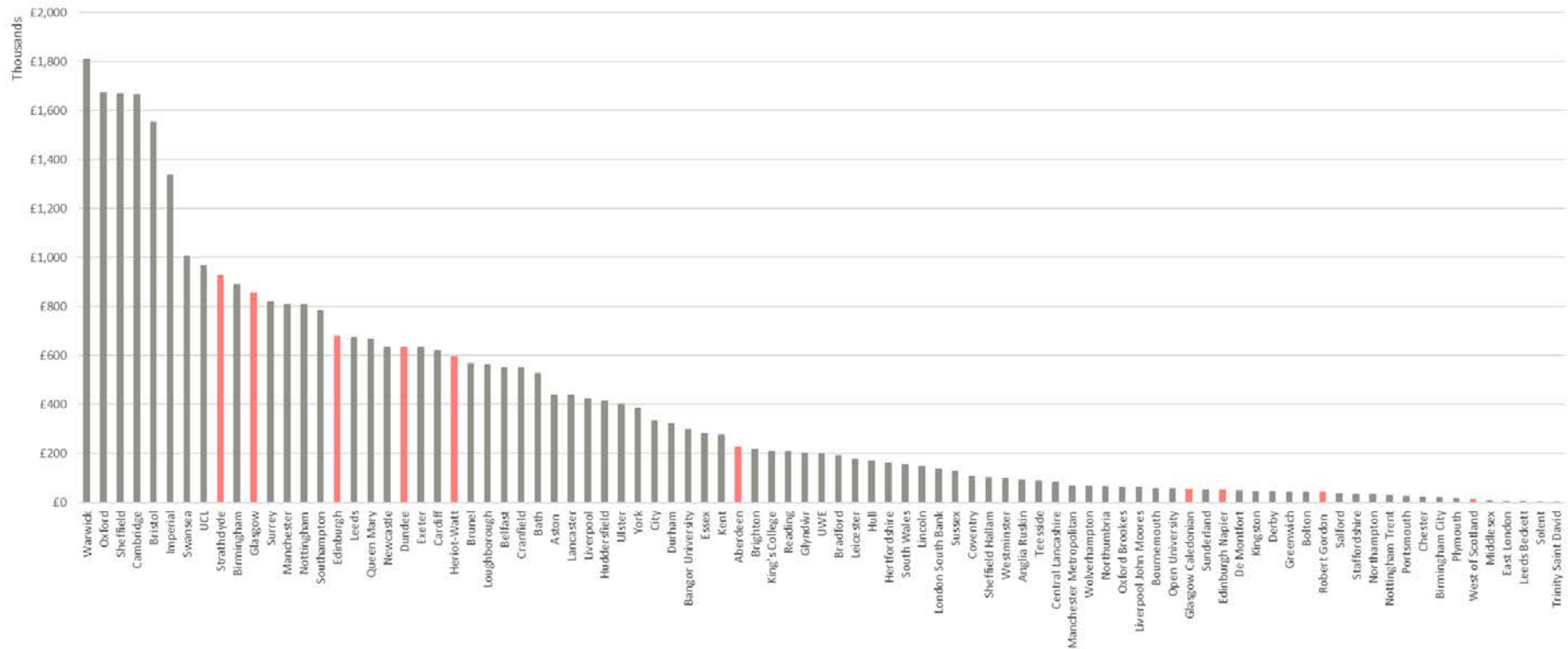
HESA Cost Centre 129 (Economics & econometrics)

Pink = SIRE pool members



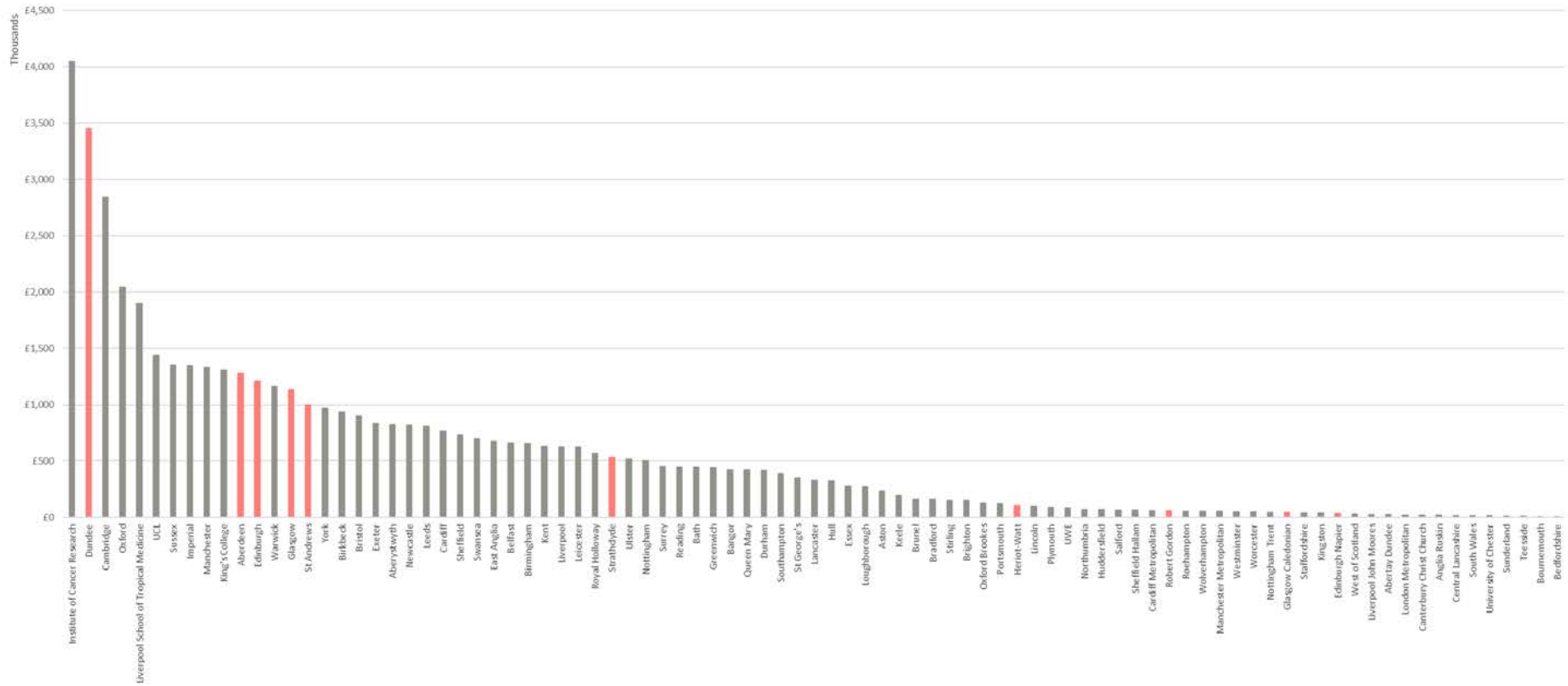
HESA Cost Centres 115 (General engineering), 116 (Chemical engineering), 117 (Mineral, metallurgy & materials engineering), 118 (Civil engineering), 119 (Electrical, electronic & computer engineering) and 120 (Mechanical, aero & production engineering)

Pink = SRPe and/or ETP pool members



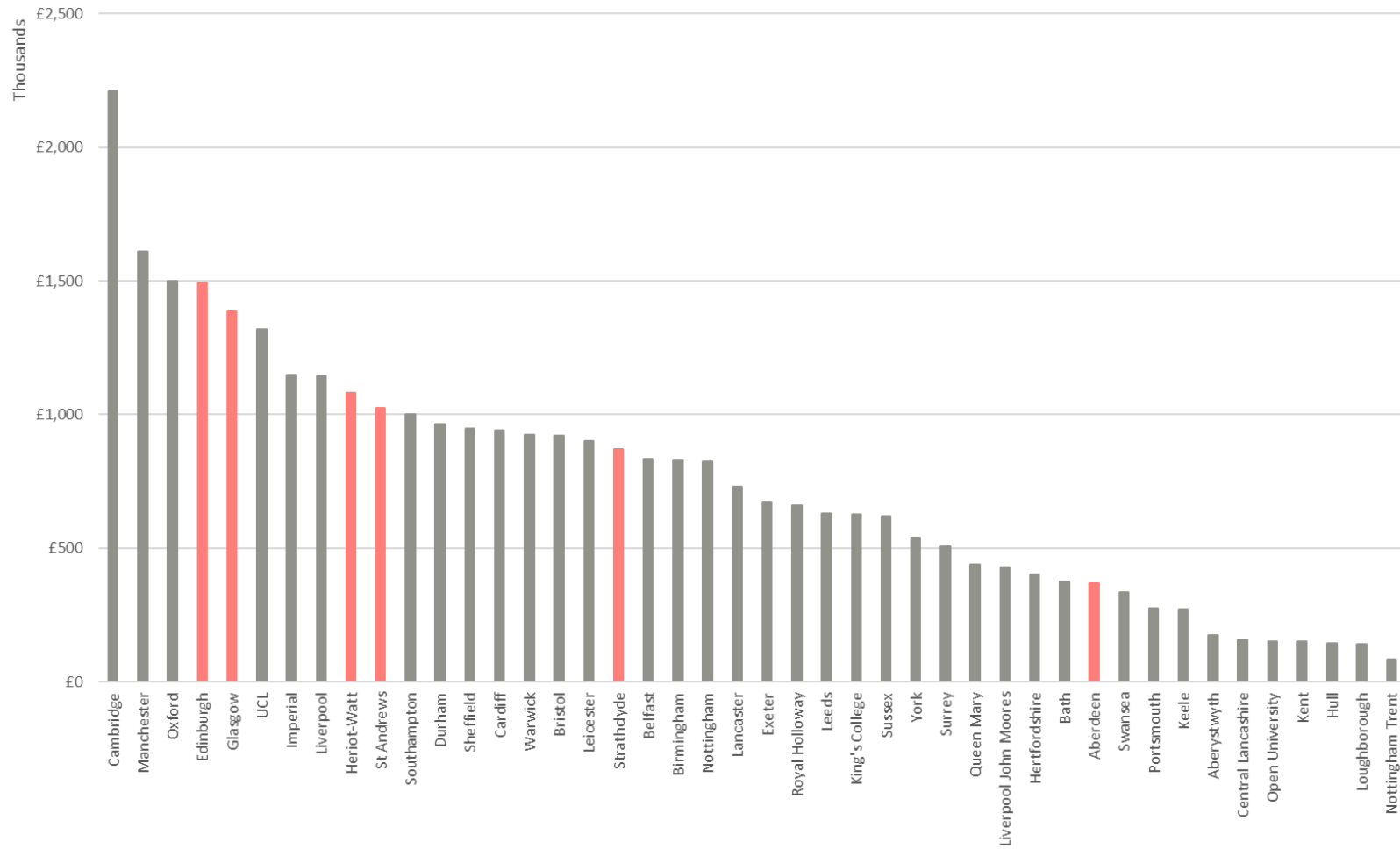
HESA Cost Centre 112 (Biosciences)

Pink = SULSA pool members



HESA Cost Centre 114 (Physics)

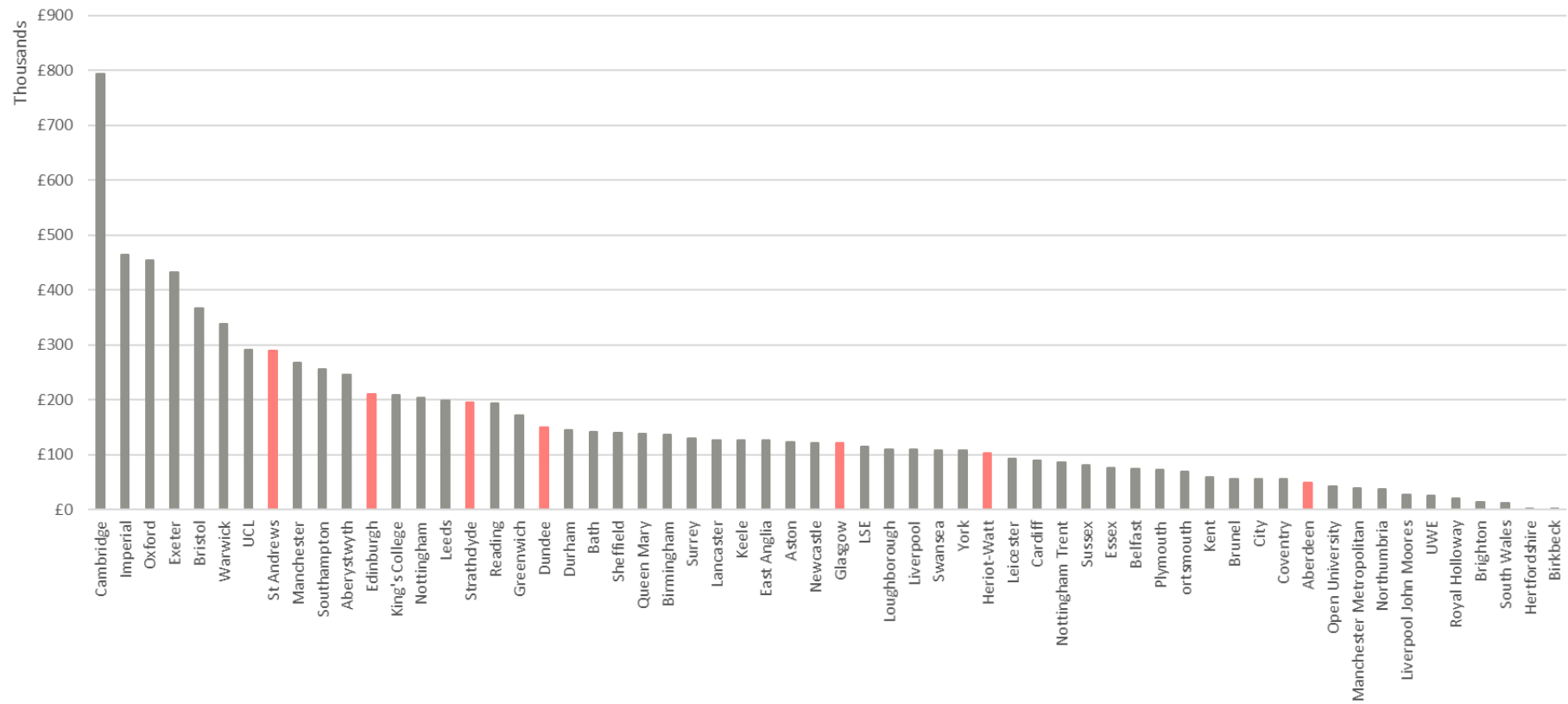
Pink = SUPA pool members



Non-pooled disciplinary areas

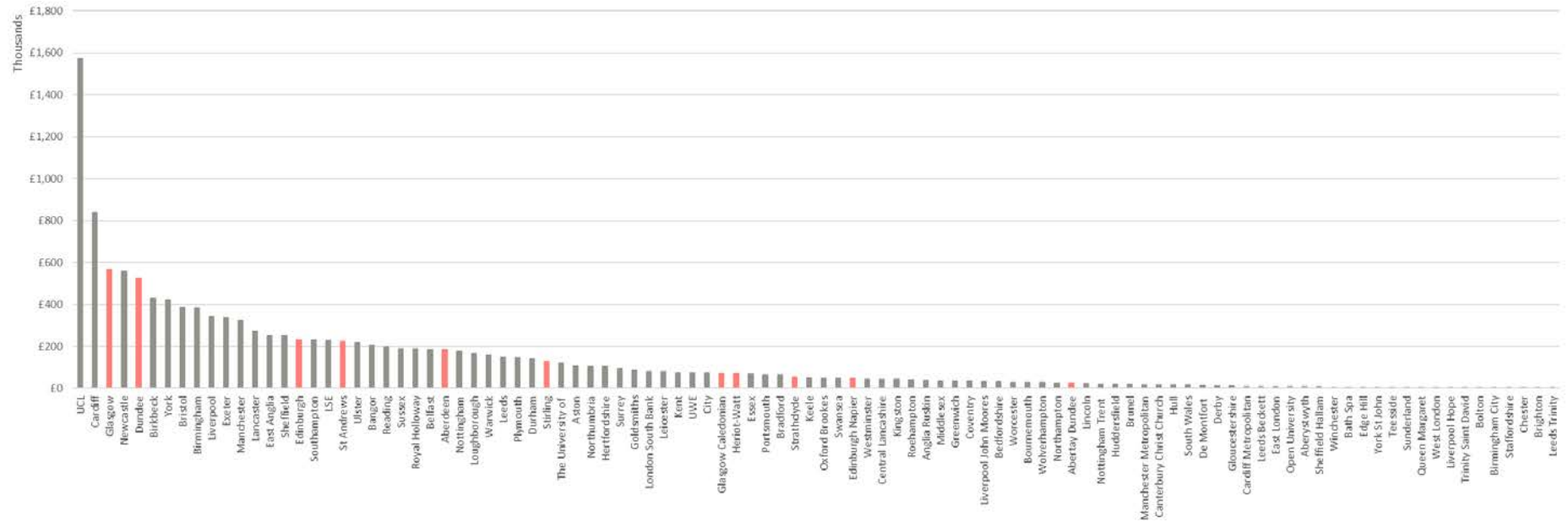
HESA Cost Centre 122 (Mathematics)

Pink = Scottish Institutions



HESA Cost Centre 104 (Psychology and Behavioural Sciences)

Pink = **Scottish** Institutions



Appendix E – Research doctoral degrees awarded (2007-09 vs. 2016-18) – broken down by UK region

'Research Pools'

JACS 3.0 Principal Subject Codes (F7) Science of aquatic & terrestrial environments, (F8) Physical geographical sciences, and (L7) Human & social geography

Region	No. PhDs (2007-09)	No. PhDs (2016-18)	Growth in No. PhDs	Market Share (2007-09)	Market Share (2016-18)
East Midlands	40	75	88%	4.6%	6.3%
East of England	105	115	10%	12.1%	9.7%
London	145	165	14%	16.7%	13.9%
North East	45	75	67%	5.2%	6.3%
North West	65	90	38%	7.5%	7.6%
Northern Ireland	10	15	50%	1.1%	1.3%
SAGES & MASTS	75	105	40%	8.6%	8.8%
South East	195	285	46%	22.4%	23.9%
South West	40	75	88%	4.6%	6.3%
Wales	30	30	0%	3.4%	2.5%
West Midlands	25	50	100%	2.9%	4.2%
Yorkshire and The Humber	95	110	16%	10.9%	9.2%

JACS 3.0 Principal Subject Code (F1) Chemistry

Region	No. PhDs (2007-09)	No. PhDs (2016-18)	Growth in No. PhDs	Market Share (2007-09)	Market Share (2016-18)
East Midlands	140	170	21%	7.9%	7.5%
East of England	120	170	42%	6.8%	7.5%
London	160	220	38%	9.0%	9.7%
North East	70	105	50%	3.9%	4.6%
North West	175	225	29%	9.9%	10.0%
Northern Ireland	40	40	0%	2.3%	1.8%
ScotCHEM	225	345	53%	12.7%	15.3%
South East	250	340	36%	14.1%	15.0%
South West	175	150	-14%	9.9%	6.6%
Wales	85	70	-18%	4.8%	3.1%
West Midlands	90	170	89%	5.1%	7.5%
Yorkshire and The Humber	245	255	4%	13.8%	11.3%

JACS 3.0 Principal Subject Codes (I1) Computer science, and (I2) Information systems

Region	No. PhDs (2007-09)	No. PhDs (2016-18)	Growth in No. PhDs	Market Share (2007-09)	Market Share (2016-18)
East Midlands	100	160	60%	6.8%	8.1%
East of England	145	140	-3%	9.8%	7.1%
London	235	365	55%	15.9%	18.6%
North East	60	75	25%	4.1%	3.8%
North West	200	200	0%	13.5%	10.2%
Northern Ireland	45	15	-67%	3.0%	0.8%
SICSA	200	220	10%	13.5%	11.2%
South East	190	340	79%	12.8%	17.3%
South West	30	75	150%	2.0%	3.8%
Wales	70	80	14%	4.7%	4.1%
West Midlands	65	125	92%	4.4%	6.4%
Yorkshire and The Humber	140	170	21%	9.5%	8.7%

JACS 3.0 Principal Subject Code (L1) Economics

Region	No. PhDs (2007-09)	No. PhDs (2016-18)	Growth in No. PhDs	Market Share (2007-09)	Market Share (2016-18)
East Midlands	70	80	14%	12.1%	11.0%
East of England	60	100	67%	10.3%	13.8%
London	110	125	14%	19.0%	17.2%
North East	15	10	-33%	2.6%	1.4%
North West	30	50	67%	5.2%	6.9%
SIRE	15	70	367%	2.6%	9.7%
South East	130	130	0%	22.4%	17.9%
South West	30	35	17%	5.2%	4.8%
Wales	5	10	100%	0.9%	1.4%
West Midlands	50	50	0%	8.6%	6.9%
Yorkshire and The Humber	65	65	0%	11.2%	9.0%

JACS 3.0 Principal Subject Codes (H1) General engineering, (H2) Civil engineering, (H3) Mechanical engineering, (H4) Aerospace engineering, (H5) Naval architecture, (H6) Electronic & electrical engineering, (H7) Production & manufacturing engineering, (H8) Chemical, process & energy engineering, (H9) Others in engineering

Region	No. PhDs (2007-09)	No. PhDs (2016-18)	Growth in No. PhDs	Market Share (2007-09)	Market Share (2016-18)
East Midlands	345	450	30%	8.7%	7.4%
East of England	535	605	13%	13.5%	9.9%
London	665	1110	67%	16.8%	18.2%
North East	155	245	58%	3.9%	4.0%
North West	375	480	28%	9.5%	7.9%
Northern Ireland	85	115	35%	2.1%	1.9%
South East	550	690	25%	13.9%	11.3%
South West	180	360	100%	4.5%	5.9%
SRPe & ETP	345	655	90%	8.7%	10.7%
Wales	105	240	129%	2.6%	3.9%
West Midlands	200	440	120%	5.0%	7.2%
Yorkshire and The Humber	425	715	68%	10.7%	11.7%

JACS 3.0 Principal Subject Codes (C1) Biology, (C2) Botany, (C3) Zoology, (C4) Genetics (C5) Microbiology, (C7) Molecular biology, biophysics & biochemistry, and (C9) Others in Biological Sciences

Region	No. PhDs (2007-09)	No. PhDs (2016-18)	Growth in No. PhDs	Market Share (2007-09)	Market Share (2016-18)
East Midlands	175	210	20%	5.7%	6.0%
East of England	440	530	20%	14.3%	15.0%
London	360	365	1%	11.7%	10.4%
North East	95	140	47%	3.1%	4.0%
North West	270	295	9%	8.8%	8.4%
Northern Ireland	50	60	20%	1.6%	1.7%
South East	490	515	5%	15.9%	14.6%
South West	180	240	33%	5.8%	6.8%
SULSA	465	605	30%	15.1%	17.2%
Wales	80	130	63%	2.6%	3.7%
West Midlands	200	135	-33%	6.5%	3.8%
Yorkshire and The Humber	275	285	4%	8.9%	8.1%

JACS 3.0 Principal Subject Codes (F3) Physics and (F5) Astronomy

Region	No. PhDs (2007-09)	No. PhDs (2016-18)	Growth in No. PhDs	Market Share (2007-09)	Market Share (2016-18)
East Midlands	80	100	25%	6.0%	4.9%
East of England	155	195	26%	11.6%	9.6%
London	240	415	73%	18.0%	20.3%
North East	45	70	56%	3.4%	3.4%
North West	120	200	67%	9.0%	9.8%
Northern Ireland	40	45	13%	3.0%	2.2%
South East	255	305	20%	19.1%	15.0%
South West	75	110	47%	5.6%	5.4%
SUPA	130	280	115%	9.7%	13.7%
Wales	25	45	80%	1.9%	2.2%
West Midlands	90	155	72%	6.7%	7.6%
Yorkshire and The Humber	80	120	50%	6.0%	5.9%

Non-pooled disciplinary area

JACS 3.0 Principal Subject Codes (G1) Mathematics, and (G3) Statistics

Region	No. PhDs (2007-09)	No. PhDs (2016-18)	Growth in No. PhDs	Market Share (2007-09)	Market Share (2016-18)
East Midlands	55	100	82%	7.2%	7.9%
East of England	80	95	19%	10.5%	7.5%
London	135	240	78%	17.6%	18.9%
North East	35	50	43%	4.6%	3.9%
North West	80	160	100%	10.5%	12.6%
Northern Ireland	5	5	0%	0.7%	0.4%
Scotland	85	110	29%	11.1%	8.7%
South East	170	265	56%	22.2%	20.9%
South West	55	90	64%	7.2%	7.1%
Wales	20	30	50%	2.6%	2.4%
West Midlands	45	125	178%	5.9%	9.8%