ScotCHEM

Everything that Matters

Submission to the Independent Review of the SFC's Research Pooling Initiative

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ScotCHEM and Pooling in Chemistry: A Brief Introduction

Chemical research lies at the heart of more than £250 billion in value-added *pa*, equal to 21% of UK GDP. It supports over 6 million UK jobs[1]. In Scotland, the chemicals sector is a multibillion-pound industry ranked second for exports. Chemistry underpins the Energy, Food and Drink, Healthcare, Digital Media and Communications sectors. It provides highly skilled professionals that enable these high-value industries to compete.

Against this background, research pooling has underpinned the spectacular progress of Scottish Chemistry. We established ScotCHEM in 2005 with a £23M investment from the SFC and the former Office of Science and Technology. The ScotCHEM umbrella structure encompasses two integrated university pairings. The pairings acknowledge the institutions' complementary research, as well as their proximity. Glasgow and Strathclyde together form WestCHEM. EaStCHEM brings together Edinburgh and St Andrews. These pairings are more deeply integrated than ScotCHEM as a whole. Unlike ScotCHEM, they have integrated research schools and make joint submissions to REF. The majority of first phase funding helped establish our two integrated research schools. The remainder supported ScotCHEM in ensuring that pooling's benefits reached researchers at Aberdeen, Dundee, and Heriot Watt.

EaStCHEM and WestCHEM continue but no longer receive direct SFC support. Pan-Scotland, ScotCHEM, activity was the only beneficiary of funding from the continuation phase. We support a community of more than 200 P.I.s, 280 postdocs and 750 PhD students. We have a close alliance with Chemical Sciences Scotland (CSS), the chemical industry leadership group.

Section 1: Initial Research Pooling Initiative

Q1a. What has been the impact of the initial research pooling initiative?

Has the pooling initiative met its objectives: to enable Scotland to compete effectively for funding, research staff and doctoral students both nationally and internationally; and provide a more attractive research environment? How can that be evidenced?

- A greater level of inter-institutional collaboration and impact.
- An increased quality, breadth and depth of research and training.
- More interactions between academia, industry and government. These include regular strategic meetings with Scottish Enterprise (SE), Skills Development Scotland (SDS) and the Knowledge Transfer Network (KTN).
- An improved ability to secure infrastructure funding. The recent award of the Scottish Centre for Highfield NMR is evidence of this. ScotCHEM and SULSA both supported the bid.
- The 2009 International Review of UK Chemistry[2] identified Research Pooling as a success and a model for sustaining globally competitive research in the UK.

[1] http://www.epsrc.ac.uk/SiteCollectionDocuments/Publications/reports/ChemistryImpact.pdf
[2] See http://www.epsrc.ac.uk/research/intrevs/2009ChemistryIR/Pages/default.aspx

- Pooling has helped Scotland to compete for funding, research staff and doctoral students. A comparison of the RAE2008 and the REF2014[3] shows that ScotCHEM schools secured more research income (£78M vs £83M). It is notable that our smaller members saw particular uplifts. This despite the 2008 financial crisis and uncertainty caused by recent referenda. The number of PI's in ScotCHEM rose from 159 to 197. We are currently training around 750 PhD Students, a historically high level.

- The quality and impact of our research have improved consistently since pooling. Again, comparing RAE and REF. All our members saw a rise in the proportions of papers ranked as 3 or 4 stars. Disappointingly, EaStCHEM saw its power ranking slip from first to second. However, all other members saw their power ranking improve.

- SE[4,5] reports into the strength of the Scottish chemical sciences paint an impressive picture. **Table Table** 1 summarises some statistics from the reports. In summary, not only are our researchers highly productive but increasingly so. They also increasingly collaborate internationally and with greater impact.

Period	**2000-05**	**2006-11**	**2011-15**
Mean compound growth in the number of publications / %	4.1*	5.9*	6.9**
International citation impact ranking	-	-	4
Field weighted citation impact ranking	11	10	5
Ranking in field-weighted citation impact factor when adjusted for the number of researchers.	1	1	1
Ranking in field-weighted citation impact factor when adjusted for BERD	1	1	1
Proportion of papers featuring an international co-author / %	40.5	49.9	59.0
Field-Weighted Citation Impact for internationally co-authored papers	1.41	1.63	1.73

Table 1 Selected data from footnotes 4 and 5. *calculated from all publications **calculated from internationally co-authored publications.

- Further, in 2010-2015;
  - Scotland ranked 4th in citation impact following Singapore, Switzerland and the Netherlands.
  - Scotland contributed 14% of the UK's publications.
  - Scottish citation impact was 16.55 *cf* 15.48 for the UK and 15.61 for the USA.
  - International collaboration continues to grow. Increasing proportions of publications have an international co-author. These international papers also have a greater impact.

[3] For ease of comparison, we have included only submissions under Chemistry. Chemical Engineering and the Dundee Drug Discovery Unit are not included in these figures.
[4] International Comparative Performance of the Scottish Research Base in Chemical Sciences, Elsevier, 2013
[5] http://www.evaluationsonline.org.uk/evaluations/Search.do?ui=basic&action=show&id=608

- ScotCHEM was the first pan-Scotland Research Pool to engage collectively and directly with industry through a partnership with Chemical Science Scotland (CSS). An important role for ScotCHEM has been to serve as a front door for industry. This is particularly true at the strategic level. Together ScotCHEM and CSS established 31 industry-focussed doctoral student projects[6]. ScotCHEM continues to work closely with CSS.

- A larger community of researchers has made possible training opportunities that would be difficult to justify for smaller groups. Both EaSt and WestCHEM run scientific writing masterclasses specifically for Chemists. EaStCHEM also runs an Early Career Researcher conference. These opportunities did not exist before pooling.

- ScotCHEM has served as a front door for Scottish chemistry internationally. Notably in our contribution to the Scotland - Hong Kong collaboration framework. Most recently, we supported a deputation of ScotCHEM researchers to Singapore's A*[7].

- Our prestigious colloquia series has been particularly successful in attracting internationally renowned speakers. Our large community of excellent researchers succeeds in attracting the best speakers.

Examples of the ways that pooling has impacted the relations between pooling partners and on how individual partners work with other external bodies.

- Pooling provides ready-made networks that can act as scaffolds for large interdisciplinary grant applications.

Evidence that the partnerships associated with pooling have had broader impacts on Scottish HEIs.

- The ScotCHEM facilities database maximises the utility of chemistry facilities in Scotland. It fosters internal and external collaboration. It helps to ensure that researchers encounter fewer blockages in their research.

Examples of other outcomes of research pooling, and how they have impacted on the Scottish research landscape.

- There is now an understanding that local collaboration helps us compete internationally.

Have pools made an impact on Scotland's reputation? What are the national (Scotland/UK) and international perceptions of pools?

- Pooling has raised the profile and reputation of Scotland nationally and internationally.

- ScotCHEM acts as a gateway to Scottish chemistry for the KTN and InnovateUK.

- The ScotCHEM CEO represents Scotland on the Royal Society of Chemistry (RSC) heads of school committee.

[6] http://www.rsc.org/AboutUs/News/PressReleases/2008/ScottishIndustryPhDs.asp
[7] An internationally renowned centre for translational research (https://www.a-star.edu.sg/).

- PEER/PECRE placements are an important vehicle that has enabled us to build our international profile.

What aspects of pooling have attracted most interest from outwith Scotland/ academia and have they impacted on developments elsewhere? Can you give examples of this?

- Since the initial pooling initiative, we have seen the emergence of pools in the rest of the UK e.g. N8[8], Midlands Innovation[9], GW4[10], SES[11] etc.
- The EPSRC Centres for Doctoral Training program mirrored the pools graduate schools. They recognise critical mass in a research area. They stress the importance of cohorts to the student experience.

What has happened that would not have happened without research pooling? Please give examples.

- Pooling brought closer collaboration between disparate institutions. In chemistry, pooling provided a platform for successful CDT applications such as CRITICAT and OPTIMA.

What has been the impact of pooling outside of the academic sector, on policy and industry? Can you provide examples of this?

- ScotCHEM's partnership with CSS was crucial in identifying Industrial Biotechnology as a key growth area. This ultimately led to the establishment of the IBioIC.

Have there been missed opportunities, where pooling could have had an impact but didn't?

- Our engagement with SME's has been less effective than it could have been. We target our limited resources at organisations with business development capacity (e.g. ETP, Interface). Our own capacity to search out collaborations with SMEs would be a huge advantage.

Q1b. What lessons can be learnt from the research pooling initiative?

What lessons can be learnt about making collaborations work effectively?

- Trust and transparency are essential in making a pool work. Each institution must see the value in its membership. Even when members do not agree openness and respect are important.
- Size and reputation can often be a source of friction. Our open and pragmatic approach allows us to overcome this friction to our mutual advantage.

Have particular pooling models been shown to work well/badly, in all cases/in specific contexts?

[8] https://www.n8research.org.uk/
[9] http://www.midlandsinnovation.org.uk/midlands-innovation.aspx
[10] http://gw4.ac.uk/
[11] https://www.ses.ac.uk/

- Our pooled research schools have been very successful. Please see the earlier comment on RAE and REF.

- The SPIRIT PhD program was very successful in establishing new industrial partnerships; supporting industry, and in training excellent new researchers.

Were particular elements of pooling more effective than others? From your perspective what evidence can you give regarding what worked well, or didn't? Why? You may wish to consider: academic posts; improved facilities and equipment; graduate schools and studentships.

- Investments in academic posts, improved facilities and equipment were crucial in underpinning increases in productivity and competitiveness.

- Our two research schools have been critical in ensuring sustainability beyond the end of core funding. They are a seedbed for new collaborations and initiatives.

- The ScotCHEM colloquia series are a success. They enable our researchers to collaborate with innovative companies and internationally renowned academics

- PEER PECRE funding has been essential. It establishes international collaborations. It provides excellent ECR training.

- We have been effective in working with the Scottish chemicals sector via CSS, particularly on a strategic level. Yet we need further support to be fully effective in reaching businesses in all sectors.

- It has been difficult to encourage our member's knowledge exchange offices to work together. Academics are quick to see the advantages of pooling. However, university employees have their own KPIs to meet.

Are there lessons to learn from the range of pools supported? Were the disciplines covered by pools the right ones? Some pools were focussed on discrete discipline areas while others were broader / interdisciplinary – are there lessons to be learned from the different models? Were there missed opportunities in other areas? What happened in those areas?

- It is important that underpinning disciplines have a vehicle to represent their interests. This ensures that Scotland continues to produce world-leading research and excellent scientists. This supports a fertile knowledge economy in which innovation can thrive.

- It was important that each pool was free to find its own form. This ensured that each community made the best decisions for its members.

- For the UK to achieve its aim of spending 2.4% GDP on R&D, advanced synthesis and materials with be essential. This is especially true for sustainable energy and materials. The approach will be interdisciplinary, but strong physical sciences will be a cornerstone. We have positioned ourselves well to exploit these opportunities.

- When establishing the ICs, SFC should have carefully considered the relationship to the research pools.

Are you aware of examples of location impacting on or limiting institutions' involvement in research pooling and/or of examples that overcame any limitation?

- When we discussed creating our research schools physical proximity was an important consideration. This meant that Aberdeen's involvement was not possible.

- Our series of online modules allows PhD students from all institution to take part in taught modules.

What lessons can SFC learn from the initiative on how we design/ implement/ manage projects?

- Continuity of funding is important in maintaining momentum. This is especially true of retaining staff.

- SFC could do more to spread best practice and coordinate activity between the pools and ICs.

Section 2: Pooling now and the future
During the continuation phase of research pooling ScotCHEM

Q2a. In the current research landscape, what is the perception of, and role for, the pools?

Has the changing landscape and funding environment affected evolution of the research pools? Do institutions remain committed to individual pools and the concept of pooling more widely?

- Our members remain committed to pooling. They understand that competition is international and that we must cooperate to compete.

- BREXIT has limited the abilities of our members to recruit. It has also hampered our efforts to create an international graduate school. There is little confidence that an EU funding application would be successful.

- Reduced funding in the continuation phase has meant we have been unable to advance on as many fronts as we desired. In particular, we were unable to appoint a business development manager. This restricts our ability to interact with SMEs and the ICs.

How does pooling fit with the current focus on interdisciplinarity and challenge led research? What is the current role of pools and how has that changed since the initial phase? Is the current model right? How do pools interact with other SFC investments such as Innovation Centres (ICs)?

- We have seen a trend toward more challenge-based and industry-led funding. Our external engagement events target areas on the frontiers of the chemical sciences. They bring together people from different disciplines and sectors. We have aligned them with current funding priorities from the Scottish and UK governments. So far,

they have included Energy[12] (with ETP) and Smart Sustainable Materials[13] (With IBioIC). They establish new collaborations in novel areas to win new external funding.

- With some exceptions, it has been difficult to work effectively with the ICs. Their industry led funding model means we must often react instead of lead.

- We have strong links to ETP. Their Energy Conversion and Storage theme has strong representation from our community. The ETP has provided an excellent link to industry, particularly via their studentship program.

- There is a perception that the central aim of pooling was to bolster the research base. That is, it was only about improving academic quality to compete internationally. Our role was never only about academic excellence. Our longstanding relationship with CSS is evidence of this.

- The role of pooling in the chemical sciences has changed. Diminished funding has reduced the impact of pooling on international competitiveness. The trend towards challenge funding has led us to be more proactive in external engagement.

- We see our role as both supporting academic excellence and reaching out to new sectors and disciplines. The ICs are a key conduit for this. They represent important and fast-growing sectors. Yet, we also underpin existing industries not represented by the ICs. These industries are an essential source of new science, products and processes.

- Our role includes:
  - Supporting international excellence in research and training. With a particular focus on ECRs.
  - Ensuring critical mass, dialogue and learning within our discipline.
  - Catalysing new interactions at the frontiers of the chemical sciences. These interactions cross-discipline and sectoral boundaries.
  - Supporting innovation and growth in areas beyond those targeted by ICs.

Q2b. Should research pools have a role continuing role in the Scottish research base?

Will the concept of research pooling remain relevant in the developing research landscape? How can/should the model evolve to fit that landscape?

- Pooling is important in ensuring critical mass and competitiveness in our discipline. Their loss would be a significant blow to our competitiveness.

- The pools should have greater support in reaching out to industry. We were unable to proceed with plans for a Business Development Manager.

[12] https://www.etp-scotland.ac.uk/NewsandEvents/Events/ETPEneryInnovationEmporium2018.aspx
[13] https://www.scotchem.ac.uk/ssmr/

- Industry-academia studentships are an importing way of building new relationships. They are particularly important in boosting the ability of SME's to innovate.

- Scotland has struggled in the recent round of EPSRC doctoral training centres. Investment in our graduate schools would enable us to compete more effectively in the future.

What happens when the five years continuation funding comes to an end?

There are three scenarios:

1. **No further funding.** We have committed ourselves to pooling. EaStCHEM and WestCHEM would continue as they are. ScotCHEM would continue in a reduced form. Many of our activities rest on modest seed funding and the goodwill of our researchers. Our online postgraduate training would stop. We could no longer promote or maintain our facilities database. Our colloquia series and subject groupings would continue in a reduced form. Our online activity would be far less active. Our strategic relationship with CSS would continue. Our proactive engagement with industry would stop. Any benefits of our enhanced critical mass would dissipate in time.
2. **Funding at a similar level**. We would maintain our current activities. A healthy, networked, community with a competitive edge in chemistry would continue in Scotland. Our resources are currently strained. Our postgraduate training program is strongly dependent on goodwill. The available person–power, limits the scale of our external engagement. There would be slow progress towards our strategic goals. Important strategic coordination, particularly for large funding calls, would continue.
3. **Increased funding**. With increased funding, comes increased benefits. We would like to collaborate more across industry-academia and sectoral boundaries. We would like to continue to improve graduate and ECR training. We would like to achieve the levels of PhD training provision found in CDTs. We would like to create an international graduate school. We maintain a list of shovel ready capital projects.

Section 3: Anything Else

- The current investment in pooling is excellent value for money. The loss of the pools would damage our competitiveness.