3
The future of higher education chemistry departments in the UK should be shaped by excellence and competitiveness in research and teaching

3.0
Vision

Over the next 10 years:

- **A coherent UK university research and innovation strategy is in place which is based on excellence and competiveness. UK chemistry departments have unique selling points.**
- **World-class undergraduate chemical sciences teaching attracts high numbers of the best students living in all areas of the UK as well as from around the world.**
- **The UK is a dynamic and successful *region* in the global arena. It attracts and keeps world-leading researchers, as well as international research and commercial investment.**

To achieve this, the following are needed:

Research

3.1
Research and Innovation in the UK

a. Clustering and partnerships emerge in a bottom-up way, according to the evolving strengths, resources and needs of its stakeholders.
b. Universities encourage partnerships that minimise bureaucracy, maximise excellence and competitive advantage, and also are nimble, flexible and dynamic.
c. An overarching organisation strategically manages the balance between numbers and models of traditional core chemistry departments, research institutes focused on grand challenges and Docotral Training Centres (DTCs).

3.2
The UK as a region

a. Government promotes the UK as one region instead of promoting its domestic regional structure. This attracts large investments from multinational companies.
b. World-leading UK researchers form international collaborations with world-leading scientists based on excellence rather than geographical considerations.
c. Government creates access to information of expertise, facilities and technology outside of the UK. This increases international collaborations for the benefit of UK researchers.
d. The UK is competitive in terms of salaries, research funding opportunities and structures and flexibility. This keeps world-leading researchers in the UK and attracts world-leading researchers from overseas.

3.3
A national strategy for research infrastructure

a. A strategy is developed and implemented by Research Councils UK (RCUK) and should involve key stakeholders from industry, universities, science parks, Government laboratories and other charity funders.
b. A GAP/SWOT analysis of what is required informs this national strategy for research infrastructure. This includes a record and understanding of the UK national facilities coupled with maps which are made widely available at national and international level.

c. The research infrastructure strategy focuses on three levels of facilities: large (e.g. Diamond, ISIS etc.); midrange (e.g. crystallography service, EPR service) and small (facilities that would be expected at every institute).

3.4
Funding priorities for research

a. Universities, Government and industry take a longer-term approach to research. The science community, funders and Governments define research priorities together in a way that gains buy-in from all stakeholders.
b. Universities identify UK-specific research strengths and the funding agencies exploit these to their full potential.
c. Government does more horizon scanning which encourages a change in focus of funding bodies; Universities and funding agencies adopt more of a 'look 10 years out, but act now' policy.
d. Research Councils improve financial incentives/grants for real multidisciplinary collaborative research. Funding structures are adapted to maximise these incentives.
e. RCUK committees have more industry representation to ensure there is a good balance of all types of research being funded.

3.5
A multidisciplinary approach

a. The RSC improves awareness of how chemistry can help to solve research problems/challenges traditionally rooted in other disciplines. Case studies and evidence are used by the chemical science community to showcase the value of chemistry.
b. The RSC creates well-defined visions for each of the chemistry sub-disciplines and how they interact with disciplines outside of chemistry.
c. Universities in the UK adopt a 'T-model'. Strong training builds world-class expertise in traditional core disciplines (chemistry, physics, biology etc), then robust collaboration occurs where the best innovation happens at the interfaces between strong core disciplines.
d. Funding agencies adopt a more joined up approach to funding structures. Grand challenges and disciplines are not solely 'owned' by individual research councils.
e. 'Fundamental' and 'applied' research cease to be considered as separate entities by the community. Fundamental research also helps to solve grand challenges even though the timescale to benefit is longer.
f. The Research Councils increase DTCs which become hotbeds for developing a collaborative culture among early career researchers.
g. Learned societies and professional bodies work more closely together which encourages better collaboration in the science community.

<u>Teaching and Training</u>

3.6
World-class undergraduate teaching

a. Universities provide undergraduate chemical sciences courses to students in all geographical areas. Given increases in student fees in certain regions, students are likely to increasingly opt to live at home.
b. Universities provide part-time undergraduate degrees, and the ability to transfer between full-time and part-time degrees in the UK.
c. University chemistry departments accommodate increases in numbers of students interested in traditional subjects due to better economic benefits.
d. Departments within the same university (for example chemistry, physics, material, engineering) or at nearby institutions pool teaching resources by sharing equipment and laboratory space, providing joint courses and providing research experiences for students and lecturers from institutions focussed on teaching.

e. The value of excellence in teaching staff at universities is raised by HEFC due to investment in a Teaching Excellence Framework that runs alongside the Research Excellence Framework.
f. Universities make teaching and assessment less modular (separate teaching of inorganic, organic, physical chemistry still occurs) focusing on a learning approach rather than a teaching approach.
g. University chemistry courses continue to assign a high priority to practical teaching.
h. Government provides tax incentives for companies who offer placements for undergraduate students.
i. Industry pays for the tuition fees of high calibre students.

3.7
PhD and postdoctoral training

a. Universities provide good quality PhD/postdoctoral training which develops technical skills, with a secondary emphasis on the development of innovative problem-solvers, leaders and decision makers. (e.g. through the Concordat). The ability to communicate across disciplines is also enhanced.
b. Universities provide PhD students and post doctorates with more development opportunities, outreach opportunities and careers advice.
c. Universities change the PhD model to enable improved access to PhD programmes through for example part-time attendance whilst working in industry.
d. Postdoctoral fellowships comprise of research and teaching in a university environment improving prospects to obtain a permanent lecturing post.