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## **Scottish Science Advisory Council (SSAC) Response to the Open Consultation on Science and Research: proposals for long-term capital investment**

The SSAC welcome the opportunity to feed into this BIS initiative following the House of Lords Select Committee report last year and have recently undertaken a parallel consultation across the Science and Engineering community in Scotland to determine views on current and future requirements for research infrastructure. The following SSAC response draws on the findings of this consultation.

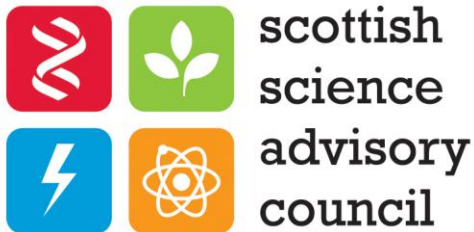
In recent years, although there have been some substantial and specific investments in research infrastructure, it has been some time since more general initiatives such as SRIF, and Research Council policy on expenditure on capital equipment has become more restrictive. The infrastructure base has consequently aged, whilst demand has increased. Hence, we very much welcome initiatives and policies that will promote development of a sustainable research infrastructure.

SSAC recognise that many researchers are entirely dependent on access to facilities, but at different scales often characteristic of their subject: international (e.g. for telescopes and particle accelerators); national, in Scotland and the rest of the UK (e.g. synchrotrons, neutron sources, some types of high-performance computing etc.); or at the level of individual institutions (e.g. analytical equipment such as mass spectrometers, X-ray diffraction etc.). Thus the tension between large, medium and small facilities is in some respects equivalent to a tension between different subjects. A key issue arising from the SSAC consultation was the unresolved question of how medium-scale institutional facilities and their running-costs should be paid for. Medium-scale facilities also include those in which individual items of equipment might cost only ~£0.1M, but where the facility requires a suite of such items at a total cost of several £M in order to be fully functional.

SSAC have noted that there is general satisfaction with existing access arrangements, tempered by growing anxieties of diminishing capacity (with some facilities already over-subscribed), ageing equipment, and difficulties in meeting running costs (including for staff). Hence there is a clear driver for infrastructure investment, but with recognition of the tension between capital investment and revenue expenditure; and a need to achieve better alignment of priorities for capital and revenue expenditure to ensure that running costs can be met. The optimum process of allocating resource between specific subject areas was seen to be peer review (which was often considered to be diminished in 'strategic' funding decisions for infrastructure) and hence, for universities, most appropriately handled by the Research Councils.

The SSAC consultation highlighted some good examples of equipment sharing, e.g. in some of the Scottish research pools, and between research institutes where there are close working relationships. However, it is evident that many researchers do not know which facilities might be accessible in other

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institutions, or how access might be obtained. Thus it would be worthwhile to establish a database of facilities, and potential for standard access arrangements.

Finally, the importance was recognised of allocating at least some infrastructure investment in support of research relevant to growth of the economy. At present, access by industrial users to facilities at least partly funded by public money is relatively limited, and a suitable access scheme would be especially helpful to smaller companies.

The following Annex A attempts to list in more detail our recommendations and conclusions to this work and our responses to a number of your more specific questions.

I hope you find this response helpful.

Yours sincerely

Professor Muffy Calder and Dr Chris Masters  
**Co-Chairs of the Scottish Science Advisory Council.**

*Q: What balance should we strike between meeting capital requirements at the individual research project level, relative to the need for large scale investments at national and international levels?*

### Capital Project Balance

It is important that capital equipment facilities are not established unless there is confidence that they can be operated effectively and used efficiently, thus requiring resources for staffing to operate the equipment, its maintenance and calibration, and running costs, with sufficient demand to achieve full usage. It does not necessarily follow that the equipment funding must be directly accompanied by additional resource to meet the other costs; however, it should be a requirement of equipment funding that there is robust explanation of how the additional costs will be met, which might include the possibility that some or all of the running costs would be met by the equipment grant itself.

It was noted that current initiatives for infrastructure development are usually ‘strategic’ in nature, with subject areas often defined highly specifically—and thus, in that sense, the ‘strategic’ approach is inconsistent with the Haldane principle, and therefore contrasts with the mechanisms by which the project funding required to actually make use of the infrastructure is derived. We therefore recommend that as far as possible, funding mechanisms for ‘infrastructure’ and ‘projects’ should be made as mutually consistent as possible, with the same criteria for support, and with planning horizons of similar duration; that would be more easily achieved if both were the responsibility of the same agency, e.g. the Research Councils.

### Large-scale national and international facilities

Some areas of research (e.g., particle physics, astronomy, earth observation, deep ocean observation and remote sensing etc.) are completely dependent on facilities too large to be the responsibility of single institutions. The requirement is not geographically specific. It is simply the case that groups in those fields cannot undertake research of competitive quality without access to world-class facilities. The allocation of resources between facilities of different scale and nature is essentially equivalent to an allocation between different general topics of research, but because prioritisation processes for ‘facilities’ and ‘projects’ are different, there is a real risk of inconsistencies and unintended consequences e.g. that facilities will be available, but without the resources to make use of them. We therefore recommend:

- (a) debate be instigated to develop processes to define relative priorities between fields requiring infrastructure of different character,
- (b) and hence to align resources for provision of facilities with those for access and running costs...
- (c) demonstrating consistency between priority and total resource provision, recognising the very different timescales involved in different fields.

*Q: How can we maximise collaboration, equipment sharing and access to industry to ensure we make the most of this investment?*

### **Sharing and access**

There are many situations in which it is essential for researchers to have access to facilities in their own institution. There are also some good examples of equipment-sharing across Scotland, e.g. in the Research Pools. However, there are also examples of unused capacity in facilities where sharing would improve efficiency. A significant inhibition is ignorance of what facilities are available, uncertainty and inconsistency of access arrangements, lack of skilled staff to support access by external users, and uncertainty over cost and other resource arrangements. We therefore recommend that:

- (a) a Scotland-wide database of facilities and access arrangements should be set-up and maintained.
- (b) consideration should be given to developing standard access arrangements, covering contractual and pricing details, in support of future infrastructure funding initiatives, and
- (c) adherence to standard access arrangements and levels of service should be a condition of funding by such initiatives.
- (d) policies should be developed to promote use of facilities by users from industry and business (and especially SMEs).

*Q: What factors should we consider when determining the research capital requirement of the higher education estate?*

### **Medium-scale institutional facilities**

Medium scale facilities are those that provide a service, within a single institution and primarily for internal use, where the total equipment costs within the facility would be typically up to £10M. A common example would be analytical equipment often found in chemistry departments, including NMR, X-ray diffraction, mass spectrometry etc. There has never been a clear consensus on how such facilities were to be sustained, e.g. between funding via Research Council project grants, the 'fEC' element of Funding Council grants, or initiatives such as SRIF. Policy changes have reduced the opportunity for supporting such facilities by Research Council grants; there have been no initiatives such as SRIF for some years; and universities have tended to use fEC support to increase capacity rather than maintain sustainability. We recommend that:

- (a) a consensus be developed on how medium-scale university facilities are to be sustained (both in terms of equipment and running costs, including staff),
- (b) including models for access arrangements;
- (c) in the short-term, an equipment initiative (perhaps similar to SRIF) should be introduced;
- (d) 'facilities' should be defined to include suites of equipment, where although individual items may be relatively inexpensive (e.g. ~£100k), the total assembly of equipment required to deliver the necessary service would cost ~several £M;
- (e) 'facilities' should also include software, computing hardware and associated costs;

(f) further debate is required on the tensioning between revenue (project) and capital (infrastructure/facilities) demands.

*Q: What should the criteria for prioritising projects look like?*

### **Wider engagement with the economy and societal needs**

We agree that it is appropriate to allocate resources with the objective of stimulating the economy and meeting other societal needs (defined here as gaining ‘capability’, and embracing issues expressed in a number of research council strategies), in balance with resources directed with the primary objective of gaining scientific understanding. We recommend that:

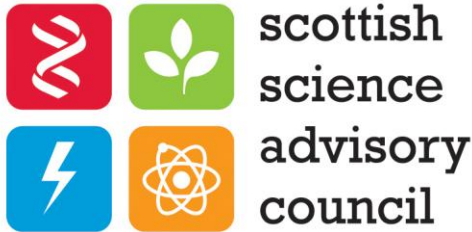
- (a) the processes used to tension resources between ‘understanding’ and ‘capability’ should not differ between ‘infrastructure’ and ‘projects’, recognising that currently, infrastructure support is often driven ‘strategically’ whereas project support is more frequently responsive and involves a greater element of peer review.
- (b) in our view policy initiatives that create mechanisms and structures for ‘capability’ support tend to be more effective than those that select highly specific topics (by analogy with the Haldane principle). Specific activities supported should be based on peer review involving all relevant stakeholder groups (including researchers and the potential or actual users of the research).
- (c) some elements of ‘capability’ support are not geographically-specific, but others (and especially those for SMEs) are definitely regional in character and appropriately so in support of industry clustering. A study and identification of relevant and actual or nascent Scottish industry clusters would form the basis for proposing specific infrastructure in support of needs of the economy and society generally.
- (d) access to facilities is particularly important for SMEs, who would like to know what is available in universities and research institutes, and what the access arrangements would be.

*Q: What should be the UK’s priorities for large scale capital investments in the national interest, including where appropriate collaborating in international projects?*

### **Specific Priorities**

The SSAC consultation was not comprehensive; however, the following issues and topics were identified:

- (a) the need to support the core research of the Research Institutes, universities and their research pools with a coherent strategy for medium-scale facilities at individual institutions, including general purpose analytical equipment;
- (b) provision of advanced imaging equipment for medical and materials applications;
- (c) support for information systems infrastructure; and
- (d) pilot-scale production facilities (especially for support for industry).
- (e) it is possible that for the medium-scale priorities (e.g. (a) and (b), and possibly (c) above), a pan-Scotland service could be provided from a single facility, if an appropriate arrangement for access and service level could be developed, and we recommend that wider debate be initiated regarding the



feasibility of establishing as a generally-available service, pan-Scotland centres for medium-scale facilities, e.g. for analysis or imaging.

(f) further enhancement of the integrated Scottish land-based research facilities to provide a UK-wide facility with high strategic relevance to address challenges in food, water and energy security and enable integrated experimental land-based science on scales ranging from molecules, microcosms, plot, field, farm and land systems, catchments and landscapes.

(g) the opportunity to develop virtual facilities to pool resources and research capabilities around societally relevant challenges (e.g., as in Centres of Expertise developed by the Scottish Government).

This list would suggest that the following projects listed within the consultation document (1. *those related to Big Data*, 4.6 *Capabilities in Next Generation Imaging Technologies*, 4.7 *Mid-range National Analytical Facilities*) would be among the desirable priorities although, as noted above, the SSAC consultation was not comprehensive and should not be taken as representative of a Scotland-wide view. SSAC has encouraged institutions across Scotland to respond to the BIS consultation separately.

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