

Response to Consultation from Glasgow Science Centre (GSC)

GSC welcomes the Science & Innovation Strategy for Scotland Consultation Paper and is pleased to respond.

As the largest centre for science communication in Scotland GSC has a large number of stakeholders, partners and collaborators all of whom are essential for the success of GSC operations and provide key input and support for our actions. However, all comments made in this response are those of GSC alone and although some of these other organisations may be referred it should not be construed that their views are the same as those of GSC.

Our main comments are contained in themes 5 & 6 and the majority of these cross between these 2 themes but also apply in support of all other themes given the wide application of outcomes from themes 5 & 6.

Background

GSC is one of the four Science Centres within the Scottish Science Centres Network (SSCN). All of those centres are exemplars of good science communication taking complex scientific concepts and distilling them into understandable and relevant information for the general public and schools audiences.

The network of science centres is an excellent resource in support of government aims & objectives in respect of science, science education and public engagement reaching approximately 700,000 individuals per annum. Each of the four centres has its own set of resources with related objectives and actions but all operate within the common framework of the SSCN Strategy published in 2005.

Glasgow Science Centre:

- raises awareness of science & technology developments and associated issues affecting society,
- provides enrichment experiences in support of formal education in school, college and university programmes,
- develops & implement new and effective learning & teaching in support of contemporary sciences and their applications and implementations,
- engages & motivate interest in science & technology by all sectors of society,
- helps develop public understanding of science & technology matters and encourage intelligent debate, analysis and choice,
- takes actions that are complementary to and supportive of mainstream education and lifelong learning policies and programmes,
- engages interest in STEM topics in early years and throughout life,
- demonstrates the relevance of Science / Technology in social, economic, environmental and political contexts,

- catalyses new actions to encourage science & technology as career choices and to help in making all individuals contributors to Smart Successful Scotland,
- coordinates actions within SSCN and with 3rd party service providers to avoid duplication and maintain high standards of science communication activities.

GSC also has an economic / social mission but as a matter of principle all science centres should.

One of the key strengths of Science Centres is as a conduit for information dissemination and diffusion. The model of engagement with school children and members of the public makes us unique in being barrier free and appealing to all ages, social backgrounds and educational levels; a key requirement for any actions intended to change perceptions of science in society.

To develop a sustainable science nation requires a dramatic cultural change in Scotland. This cannot be achieved overnight and requires a generational impact - much as we have seen in the last 10 -15 years regarding green issues. As such, themes 5 and 6 must be central to the objectives of the strategy. Without informing and stimulating the minds of our children we are destined to reinforce the negative stereotypes of the current generation (with continued falling numbers of teachers, scientists and associated disciplines and activities).

By promoting the day to day benefits of science and the positive impact it can have on our lives (but in a challenging and engaging way), science centres can be complementary to traditional methods of promotion and also support other major government initiatives such as the promotion of healthy lifestyle.

If science is to be regarded as a mainstream topic, it cannot be considered in isolation. The impact and advantage of science and scientific thinking is that it inter-relates with all other subjects. No facets of everyday life are unaffected. Themes 5 and 6 within this consultation are critical to the success of the strategy since their impacts have direct and collateral effects in all theme areas and indeed in all of societal development.

The SSCN provides a unique and well placed conduit to mass communication, engagement and support for science and innovation that is already the envy of many European nations but we recognise there is much more that can be done and must be done to maximise the benefits of that capacity for Scotland. We look forward to providing full support for the new Science & Innovation Strategy for Scotland.

THEME 1: MAINTAINING AND DEVELOPING THE EXCELLENCE OF THE SCIENCE RESEARCH BASE

1. Do you agree with the long term aspirations listed at the end of this theme?

Yes. However, there must be more cross-sectoral activities within the research base. Future science developments are unlikely to remain within current sectoral and discipline boundaries.

2. Do you agree with the short to medium term action points listed at the end of this theme?

Yes, with the same comments as above.

3. What do you consider are the two or three most important or pressing science and innovation policy issues under this theme that need to be addressed, and how should the Executive address them?

4. How should activity under this theme be developed to have most impact on supporting environmental sustainability?

5. How should activity under this theme be developed to have most impact on improving the quality of life of the people of Scotland?

6. How should activity under this theme be developed to have most impact on encouraging innovation?

7. How should activity under this theme be developed to have most impact on improving connections and synergies between the science research base in Scotland and other sectors, both within Scotland at a UK level and internationally?

8. Which developments or investments under this theme could generate the best return for the people of Scotland, and why?

9. Which major areas of achievement or excellence under this theme should be promoted by the Executive and its partner organisations?

10. Which performance measures under this theme should be introduced to track Scotland's progress as a "science nation"? What would be appropriate targets?

Additional Comments.

THEME 2: ENHANCING INTERNATIONAL CONNECTIONS AND CAPTURING OVERSEAS INVESTMENT

1. Do you agree with the long term aspirations listed at the end of this theme?

No. The statement here identifies some of the things that may define a 'science nation' and these may be necessary but they are not sufficient. If we restrict ourselves to this view then we will find other countries taking a more inclusive view of the innovation economy gain advantage. In respect of research and development we must embrace 'Open Innovation' and ensure our definition of innovation goes beyond science and technology so that we have an offer that is both attractive and effective for partners.

2. Do you agree with the short to medium term action points listed at the end of this theme?

Yes, if we are using 'Open Innovation' as a vehicle to bring substantial shifts in global R&D within our scope. The developments in China and India are particularly relevant here. We will not be able to compete directly with the massive level of human resources they are bringing into play but we can offer other customer and service oriented aspects of our capacity as well as globally significant research abilities.

3. What do you consider are the two or three most important or pressing science and innovation policy issues under this theme that need to be addressed, and how should the Executive address them?

4. How should activity under this theme be developed to have most impact on supporting environmental sustainability?

5. How should activity under this theme be developed to have most impact on improving the quality of life of the people of Scotland?

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7. How should activity under this theme be developed to have most impact on improving connections and synergies between the science research base in Scotland and other sectors, both within Scotland at a UK level and internationally?

8. Which developments or investments under this theme could generate the best return for the people of Scotland, and why?

9. Which major areas of achievement or excellence under this theme should be promoted by the Executive and its partner organisations?

10. Which performance measures under this theme should be introduced to track Scotland's progress as a "science nation"? What would be appropriate targets?

Additional Comments.

THEME 3: INTENSIFYING KNOWLEDGE EXCHANGE BETWEEN ACADEMIA AND BUSINESS

1. Do you agree with the long term aspirations listed at the end of this theme?

Yes, provided that we are measuring the correct things. The traditional measures of innovation do not fit well with current and future needs. In practice much of the exchange that business needs is not associated with science but is very much about innovation. We must redefine innovation if we are to measure the right things and take the right actions.

2. Do you agree with the short to medium term action points listed at the end of this theme?

Yes, as first steps but realignment as noted above is necessary.

3. What do you consider are the two or three most important or pressing science and innovation policy issues under this theme that need to be addressed, and how should the Executive address them?

4. How should activity under this theme be developed to have most impact on supporting environmental sustainability?

5. How should activity under this theme be developed to have most impact on improving the quality of life of the people of Scotland?

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8. Which developments or investments under this theme could generate the best return for the people of Scotland, and why?

9. Which major areas of achievement or excellence under this theme should be promoted by the Executive and its partner organisations?

10. Which performance measures under this theme should be introduced to track Scotland's progress as a "science nation"? What would be appropriate targets?

Additional Comments.

THEME 4: EXPANDING BUSINESS INNOVATION

1. Do you agree with the long term aspirations listed at the end of this theme?

No, they look too much like a manufacturing economy model. These actions may be appropriate if they are within a framework appropriate to the knowledge/innovation economy. That demands a much more inclusive approach and is not limited to science and technology.

2. Do you agree with the short to medium term action points listed at the end of this theme?

No, the pipeline model suggested is outmoded and does not recognise the key differences between a manufacturing economy and a knowledge-based one. Innovations in the knowledge economy rarely arise directly from the science and technology base alone or from the basic research. Although exploiting technologies major new developments with substantial commercial success such as Amazon, eBay

and YouTube arose from innovations in existing markets (Amazon), creation of new markets (eBay) or social networking (YouTube). Scotland can be the source of such developments but ONLY if we can raise our thinking above the historical economic models and create the environment in which a knowledge/innovation society can develop. At the micro-level some actions may remain the same at least in the short term, but the macro model and policies must be very different. As an example, ITIs are too narrow in scope to be entirely consistent with the type of economy we must be aiming to develop. We must encourage genuinely cross-cutting developments that move beyond traditional business sector or classification boundaries.

3. What do you consider are the two or three most important or pressing science and innovation policy issues under this theme that need to be addressed, and how should the Executive address them?

4. How should activity under this theme be developed to have most impact on supporting environmental sustainability?

5. How should activity under this theme be developed to have most impact on improving the quality of life of the people of Scotland?

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8. Which developments or investments under this theme could generate the best return for the people of Scotland, and why?

9. Which major areas of achievement or excellence under this theme should be promoted by the Executive and its partner organisations?

10. Which performance measures under this theme should be introduced to track Scotland's progress as a "science nation"? What would be appropriate targets?

Additional Comments.

THEME 5: MODERNISING SCIENCE EDUCATION AND PROMOTING SCIENCE CAREERS

1. Do you agree with the long term aspirations listed at the end of this theme?

Yes, but they suggest a traditional 'pipeline' view of education and careers that was appropriate for the industrial economy of the past but not best suited for the innovation economy of the future. A 'science nation' requires full population engagement in science matters from early childhood. It is a cultural matter and demands a complete re-think of how we value, support learning in, discuss and debate science and technology. In the Victorian period there was a popular interest in the 'wonder of science' that pervaded daily life. We seem to have lost any sense of wonder and excitement even when Nobel Prize winning work is discussed. The pervasive use of advanced science and technology applications such as mobile telephones, digital games and internet technologies has no doubt had an effect in setting expectations at a very high level, but that is precisely why we must react to the very different expectations and behaviours of our 'digital population'. Extension of education experience beyond the classroom must become routine and go even further than implied in the HMIe report 'Improving Achievement in Science'. That report also acknowledges the difficulties for teachers in maintaining currency with the 'exponential growth of scientific knowledge and associated investigative techniques'. It is now expected in most professions that due to the rate of development most of what is learned during an undergraduate career will have a useful life of only 3 to 10 years so far as day to day requirements of the profession are concerned. In science and technology professions the lower end of that range applies therefore it is unreasonable to expect that teachers who of necessity are out of the mainstream of their science disciplines can on their own represent contemporary principles and practices fully and effectively. The NESTA 'Real Science' Report published in November 2005 also highlighted the need for contemporary science in the classroom and much greater use of 'science enquiry learning' as appropriate for 21st century needs. In the HMIe report referenced above the question raised is: 'For the 70% of pupils who choose not to continue their study of biology, chemistry or physics in s3/s4 how well are you preparing them for the science they will experience as citizens of the 21st century?'. Are we equipping them for creativity and innovation as routine elements of their personal and professional lives? Taking the available evidence into consideration suggests radical actions that provide sustainable opportunities for enrichment of science experiences in schools within a model that is fully supportive of teachers is essential. This will require extensive use of specialist practitioners and resources from outside the schools on a frequent basis throughout the school career of all pupils. This can be combined with career development for science researchers and

collaborative programmes with informal science education providers and science centres. If the curriculum moves at the appropriate pace to keep track of contemporary science and technology then it may not be feasible to provide matching facilities in all schools: another good reason for building enrichment of experience with partners external to the school who have the scale of operations to justify rapid turnover of equipment and other resources but more importantly maintain a continuous supply of specialists who can bring contemporary creative and innovative approaches to all the learning experiences of pupils and the teaching practices in the classroom. A helpful quote from 'The 10 Habits of Mass Innovation' by Charles Leadbetter is: "Creativity and innovation are not diversions from the main tasks of education: they must be the main task of education if the UK is to prosper. Information is everywhere; creativity is not".

2. Do you agree with the short to medium term action points listed at the end of this theme?

Yes, with similar qualifications as above. The mass population must be fully supported if we are to create the basis for an innovative society. Scientists and technologists do not work only in science and technology businesses and they do bring creative and innovative thinking to any task they are involved in. Therefore, any analysis of supply and demand must factor in the need for creativity and innovation in general and not just the specific as suggested. It must also be acknowledged that innovation is not just a science and technology matter. Many of the most valuable innovations arise in service industries that have no direct or immediate association with science. We must ensure that broad base of innovation is addressed and avoid falling into an outmoded view of how and where innovation affects our economic and societal wellbeing.

Teacher CPD requires particular care. It is easy to make unreasonable demands of teachers in the rapidly changing world we now live in so comprehensive but easily assimilated support must be available. This requires a single source of information but a wide range of providers of CPD. Through SSERC develop the idea of a 'Science Learning Centre' in Scotland that looks to bring together the LEAs, TEIs, Universities, LTS, science centres and the institutions to provide co-ordinated, sustainable CPD programmes for all primary and secondary science teachers. Science in society should be supported in CPD for all teachers since the impacts of science are all pervading and the issues arising should be factored in to all subject areas. Much of the subject separation that is still prevalent in schools is somewhat unhelpful when contemporary business and society needs are considered so we must take steps to integrate science thinking across the whole school curriculum and teaching practices.

The 'Science Learning Centre' should be a virtual centre. Avoid spending money in the first instance on capital works but concentrate rather on getting the infrastructure of the partnership working. The resources available in the Science Centres, SSERC new building and other main partners are adequate in the first instance until a clearer picture emerges.

In part of National STEM develop a 'Scottish Science Learning' forum bringing together the key players in Teacher CPD - LEA, TEI, HEI, FE, Careers Scotland, LTS, SSERC, institutions and science centres.

3. What do you consider are the two or three most important or pressing science and innovation policy issues under this theme that need to be addressed, and how should the Executive address them?

Scotland as a 'science nation'. Mass engagement in science is a prerequisite and the Executive must make this a top priority for early action. There are already good platforms in place with the science centres and the informal science education providers but close coordination is necessary. Those key players in communication of science must also leverage other existing networks and recognise that this is a lifelong learning issue. Networks such as those of learndirect scotland and Communities Scotland can be effective partners for science communication that supports mainstream schools science through collateral impacts on parents and children in the community. We must encourage a culture of science and innovation and bring back the 'wonder of science' to everyday lives.

Take-up of science. This should not be limited to encouraging specialist careers in science but should also embrace the value and effectiveness of a scientific training for any 21st century career. General business degrees are seen as a universal entry for careers in most types of business yet the skills developed in such programmes are much less appropriate for the demands of business in the innovation economy than those of science degrees.

Science as a career. All engagement in science learning activity is in its essence supporting the idea of science as a career. By opening up young peoples minds to the wonders of science, to the breaking down of misconception in the minds of their parents, science centres and others are developing the atmosphere that is conducive to continued progression through school / college / university / employment in science. Science Centres are about lifelong learning and as such develop, support, facilitate and deliver activities for groups from early years, through families and formal education, young adults, adults and the 'silver' generation.

Science centres should work in stronger partnership with Science & Technology Matters and Careers Scotland. This is already happening at GSC but this type of partnership should be strengthened further.

Specific activity undertaken at GSC such as 'Advanced Techniques in DNA Technology' for Advanced Higher Biology Students, 'Who Wants to be a Scientist?' programme for S1 / S2 and the 'Pixel This!' experience for S3 - S5 pupils should be further supported and disseminated.

In addition, the development of careers within science centres needs to be recognised. We need to recognise the professionalism of science communicators and value and encourage the skills they will bring to the mix and also the development that occurs with staff working for periods in the science centre environment. Science centres are unique learning environments for staff as well as visitors.

Primary actions recommended are:

- Develop 'Science Careers Ladder' programme for young adults to work in science centres and other informal learning environments.
- Develop strategic relationship between science centres and Science & Technology Matters Programme.
- Support dissemination of best practice in science communication activity that supports general career choice and enhancement opportunities for teachers at all levels.

4. How should activity under this theme be developed to have most impact on supporting environmental sustainability?

If the primary actions to develop a 'science nation' are followed then a natural consequence will be that issues such as environmental sustainability will be taken up as mass interests and actions driven forward on an informed basis. A natural disposition for science enquiry in the general population will drive national interests forward but may also create very robust challenges to unsupported claims arising from politically motivated sources.

5. How should activity under this theme be developed to have most impact on improving the quality of life of the people of Scotland?

Developing science communication as an attractive, entertaining, regular pastime for parents, grand-parents and children. A visit to a science centre should be seen as equally attractive and rewarding as a visit to the cinema. Active pastimes are usually rated as better for quality of life than passive ones. If we can create more active participation in science related experiences for the family and the individual then we can enable creativity and innovation by the family that will be seen to be of high value and very desirable. Science education in the school should relate well with family and community interests and build synergies that bond lifestyle and education activities. (The GSC/learndirect scotland family learning project 'Mission to Mars' is a good example of models that are effective.)

6. How should activity under this theme be developed to have most impact on encouraging innovation?

Building collaborative network support for teachers and schools that ensure contemporary science is always represented effectively and associated with the school but not necessarily located totally within the school. Very few business and particularly science and technology business operate in isolation. The rate of change and range of specialisms in most application areas is such that even very large companies cannot resource development projects on their own. Schools education should both recognize this and apply similar models of collaboration with the wide range of expertise available. This has the key advantage of using techniques in mainstream education that align well with 21st century business practice and draw on the natural tendency to collaborative teamwork that is prevalent in the 'digital

natives' who now make up our schools population. The teacher as facilitator is crucial here and the focus is very much on learning rather than teaching.

'Innovation by the masses, not just for them; that must be our national purpose'.
(Charles Leadbetter)

7. How should activity under this theme be developed to have most impact on improving connections and synergies between the science research base in Scotland and other sectors, both within Scotland at a UK level and internationally?

Adopt an 'Open Innovation' approach and make it a clear public policy. Scotland has a good history of collaboration and openness across sectors and internationally. Given the rapid increase in volume, quality and effectiveness of research in countries like China and India we must leverage maximum benefits from our internal efforts in all sectors but also leverage the benefits of research taking place in other countries. Open Innovation will become a key enabler of economic success and Scotland has a unique opportunity to become the country of choice for those wishing to exploit Open Innovation either here or in other markets.

8. Which developments or investments under this theme could generate the best return for the people of Scotland, and why?

Enhancement and extension of education programmes through science centres. These need to be both in the science centres and in the schools using science centres outreach. Other providers of informal education programmes can and should be integrated with these actions. The key reason for focus on the science centres is that they already have established physical presence with logistics, capacity and general support facilities for both inreach and outreach. In addition science centres have existing mass market penetration with established traffic patterns to their sites by schools and families. If engagement with science issues is to become a routine matter for the whole population then we must exploit the iconic places that relate to science and are recognised as such by the population. Quality of service and consistency of support are essential for medium and long-term success and can be ensured by using organisations that already depend upon these factors for their current success. The main overheads are already absorbed by the science centres so the education developments are 'scale-up' options rather than new start. Therefore, faster response and more cost-effective operations can be assured.

9. Which major areas of achievement or excellence under this theme should be promoted by the Executive and its partner organisations?

The Curriculum for Excellence framework should be promoted and adopted widely. It provides a first-class basis for planning and developing all matters associated with science education at all levels and science in society in all its forms. Key partners should be able to demonstrate their support for the principles by their actions and it may be helpful for the Executive to consider the inclusion of

requirement to demonstrate support for the framework in funding applications and recurrent grant funding reviews.

10. Which performance measures under this theme should be introduced to track Scotland's progress as a "science nation"? What would be appropriate targets?

The real measures of progress are complex and will only be meaningful after a number of years of activity. The Executive should consider a baseline evaluation to ensure that a robust framework exists against which progress can be charted. OECD measures are used for most international comparisons and therefore must be central to this. However, short term measures of a simple form are needed to gauge early progress. Early indicators of progress will be based on the numbers of individuals engaged in new actions but perhaps the proportion of the whole population or age-group population would be a better measure given the significant demographic changes taking place over the next few years. Some emphasis should be given to progress measures for early years education since ongoing progress will be dependent on success there.

In OECD comparisons the UK rates poorly against key competitor countries in Europe in the proportion of our population with intermediate skills. This should be a priority area for action and progress measurement since mass innovation throughout the population will come from success here rather than the high performance of specialists in particular disciplines.

Recent research suggests that it is more important to measure what people do rather than what they study since it is the practical outcomes of high human capital that generates the high societal and financial returns we are seeking. The Executive should consider inclusion of some elements of this type that are much more appropriate for the knowledge economy in a progress measurement matrix.

Additional Comments.

'We need to extend the definition of innovation beyond technology and R&D to include investment, the arts, culture, and all forms of innovation and creativity.'
(Richard Florida in The Creative Compact)

THEME 6: INCREASING PUBLIC ENGAGEMENT WITH SCIENCE

1. Do you agree with the long term aspirations listed at the end of this theme?

Yes. The Science Centres provide a national platform for delivery on all of these aspirations. The population penetration of the SSCN is in excess of 700,000 individuals at this time. This provides a powerful platform for extension of engagement with that significant proportion of the Scottish population and for expansion of coverage more widely through the population. Established traffic patterns and operating partnerships make this a unique basis in Europe for science communication and we should exploit that fully.

2. Do you agree with the short to medium term action points listed at the end of this theme?

Yes. Although the SSCN strategy is only a year old it does require an update to reflect the maturity of thought and action already apparent and to take account of new developments and priorities in associated areas. The part that outreach has to play is a particular area of importance in meeting the aspirations of this and other themes and a main element within the revised strategy should address that comprehensively. Building on existing proven partnership successes should be an immediate priority since substantial scale-up of outcomes can be generated quickly.

3. What do you consider are the two or three most important or pressing science and innovation policy issues under this theme that need to be addressed, and how should the Executive address them?

Promoting better coordination

Undoubtedly better co-ordination of informal science learning providers is required.

Teachers are unaware of the resources that are available to them or of the benefits they could bring (the developing Curriculum for Excellence suggests there will be increasing opportunities for informal science learning providers to provide direct support to pupil learning or through Teacher CPD)

Informal science learning is competing with Xscape, football coaching and many other popular pastimes for attention. Better co-ordination of activities will allow better development of partnerships, leading to synergy and greater impact that can meet the competitive challenge for people's time.

SETPoints have the potential to provide this co-ordination. By changing from their current role (depending on which SETPoint you look at) as providers of science learning they would be better concentrating on becoming the 'one stop shop'. By adopting a strong brand they should look to promote the benefits of the informal science learning network to teachers and facilitate their participation in activity. In parallel, the informal network should look to develop a quality mark that ensures consistently high quality engagement is provided by all. Building a brand for science communication that guarantees quality of experience and service is an essential of we are to become a 'science nation'.

Scotland is well placed within Europe to become leader in terms of the way informal science learning contributes to the development of a science nation. The existence of SSCN is unique in Europe in bringing together 4 iconic centres with excellent resources and high quality services targeted on the science in society agenda. Aligning the informal providers with this network will create a powerful combination of resources and activities with truly national coverage.

How should this activity be developed?

- Re-define role of SETpoint to better reflect original ideals
- Put SETPoint contracts up for competitive tender.

- Develop a National STEM group to bring together the key players in Scotland.
- Develop a science 'brand' so that informal science learning is a part of the mix (not an add on - A Curriculum for Excellence supports the increasing roll of providers from outside formal education).
- Develop a robust quality assurance scheme for informal science education providers - see the learndirect scotland pledge to learners and learning centre branding guidelines.
- Align these activities with the virtual Science Learning Centre referred above.

Encourage Dialogue between scientists and the public

Science Centres are uniquely placed to facilitate the link between formal education, the public and scientists on a scale that will make a significant impact and be sustainable. This type of engagement occurs elsewhere but only science centres have the capacity such that the links can be developed in a sustainable and cost effective manner.

This type of scientist engagement can take many forms:

- Meet the scientist programmes
- Public lectures
- Contributing to the development of programmes through dissemination of knowledge
- Development of exhibitions
- Participation in debates
- Development of web resources
- Contributing to Teacher CPD

Science centres raison d'être is to engage learners in science learning and therefore they are equipped to provide the structure that is required to reach out and engage audiences.

For example, GSC is an iconic building that sets the tone, is well situated in terms of travel and provides a conducive atmosphere for engagement to take place. Add to this the dedicated professional delivery staff, a pr/marketing team geared to raise awareness of science learning activities to many audiences and it is clear to see why science centres are excellent forums/facilitators of sustainable and effective engagement between society and scientists.

How should this activity be developed?

- Scottish Universities in partnership with SSCN should become 'Beacons for Public Engagement' (See Research Council UK call for proposals - <http://www.rcuk.ac.uk>). This will provide the framework / support mechanism to develop and co-ordinate the engagement of scientists and the science centres.

- The role the Science Centres will play in this area should be recognised in the service funding provision of science centres.

Take forward the four-year Scottish Science Centre Network Strategy. By developing long-term sustainable funding programmes through the development of a service provision model that recognises outputs and outcomes the short to medium term action points will continue to be met and developed further. In addition, as outlined above the science centres have a major role to play in the development of a more co-ordinated approach to the provision of science learning activity in Scotland.

How should this activity be developed?

- Re-visit and update the Scottish Science Centres Network Strategy document.
- Develop joint SSCN joint targets and measures.
- Develop a long-term sustainable funding programme aligned with development of a service provision model.
- Provide free access and transport to all schools pupils.
- Recognise roll of science centres as hubs for activity and provide the correct funding model that allows access to the facilities to organisations with supporting visions and missions to ensure synergy.
- Ensure capacity is developed and maintained in science learning teams within centres.

4. How should activity under this theme be developed to have most impact on supporting environmental sustainability?

Some of the main activities in the general science communication should be targeted on environmental impact. GSC currently has the only Climate Change Theatre in the UK, a model that is now being copied elsewhere but it does give a natural platform for further dialogue on environmental issues. Recent community projects with Glasgow City Council on recycling are examples of science in action in support of environmental sustainability which gain popular support.

5. How should activity under this theme be developed to have most impact on improving the quality of life of the people of Scotland?

Developing science communication as an attractive, entertaining, regular pastime for parents, grand-parents and children. A visit to a science centre should be seen as equally attractive and rewarding as a visit to the cinema. Active pastimes are usually rated as better for quality of life than passive ones. If we can create more active participation in science related experiences for the family and the individual then we can enable creativity and innovation by the family that will be seen to be of high value and very desirable. Science education in the school should relate well with family and community interests and build synergies that bond lifestyle and education activities. (The GSC/learn direct scotland family learning project 'Mission to Mars' is a good example of models that are effective.)

Science festivals, community science days, science workshops in local learning centres all form parts of communities outreach. There should be a cohesive plan of communities outreach that ensures broad based coverage is available of high and consistent standards. At this time GSC has a communities engagement programme and a communities liaison manager resulting in over 10,000 individuals being reached each year. This was the first of only 3 such initiatives in the UK and is now being copied by other science centres. This model should be established and supported across all 4 science centres in Scotland.

6. How should activity under this theme be developed to have most impact on encouraging innovation?

Link science communications with science actions. Create local opportunities for 'hands on' engagement with science and technology. Develop working partnerships between science centres and local community learning and social centres. Combine the outreach of science centres and other informal learning providers with community programmes to popularize science enquiry, debate and discussion. This will help us broaden the base of innovation by encouraging creativity, problem-solving, collaboration and resourcefulness - the essential skills for innovation.

Support family learning projects that can build continuity of interest and action. (e.g. the GSC/learnirect scotland project 'Mission to Mars'.)

Recognise and promote such actions as key lifelong learning issues. Given the rapidly aging population we must take these skills to older members of society as well as the young.

7. How should activity under this theme be developed to have most impact on improving connections and synergies between the science research base in Scotland and other sectors, both within Scotland at a UK level and internationally?

Develop an action line through the Scottish Funding Council for Open Innovation. Make this a high priority objective for funded institutions and link the level of support to external partnerships. Use existing science communication networks to extend this principle to local industries and communities.

8. Which developments or investments under this theme could generate the best return for the people of Scotland, and why?

Take forward the Scottish Science Centres Network Strategy.

There is an established mass communication capacity already in place with all main overheads already covered. Scale-up and extension of services will be very cost-effective and exploit the strong reservoir of proven skills to full effect. SSCN can provide national coverage with iconic centres providing focus for activities and places for families, individuals, schools, colleges and universities to use as resource and support facilities.

Develop Quality Standards and Branding for Science Communication

Science communication is a confusing market at this time. A wide choice of services should be available but only if they meet appropriate standards and can be relied upon. Public funding should only be available to support known quality providers offering programmes that meet curriculum requirements in schools or specific policy objectives for the wider population. The example of building a brand for lifelong learning through learndirect scotland is an excellent one and offers a template for achieving the same for science communication. A 'science nation' should have a recognized brand for science in society.

Encourage Dialogue between scientists and the public

It is widely acknowledged that public perceptions of science are far from the reality. We must act quickly to start breaking down these misconceptions and to help scientist find sustainable ways of engaging with the public. This programme must link closely with the 2 above to maximise coverage and rate of progress. The Scottish Funding Council and the Research Councils must also play their part in supporting effective dissemination and diffusion.

9. Which major areas of achievement or excellence under this theme should be promoted by the Executive and its partner organisations?

Recent HMIe review of science centres highlighted the excellence in science communications skills and training for these skills. We should build on this by supporting wide dissemination of these science communications skills to the teaching profession but also to associated professionals in lifelong learning, communities support and careers services. The main issues highlighted in this theme al relate to our ability to communicate effectively and widely. Developing our human capital in such communication will benefit all other actions.

10. Which performance measures under this theme should be introduced to track Scotland's progress as a "science nation"? What would be appropriate targets?

Simple measures of engagement are appropriate for early stage progress measurement. These relate to numbers of individuals or proportion of target population reached through the defined actions. The overall objective of becoming a 'science nation' means that nothing less than 100% penetration of the population should be the target.

Additional Comments.

'Our aim should be to become a society of adaptors, contributors, participants and designers, with people having their say, making contributions (often in small ways) to add to the accumulation of ideas and innovation. Participation and contribution should be the watchwords of such a society rather than consumerism.' (Charles Leadbetter in 10 Habits of Mass Innovation)

THEME 7: DEVELOPING BETTER USE OF SCIENCE BY GOVERNMENT

1. Do you agree with the long term aspirations listed at the end of this theme?

Yes. As mentioned elsewhere the need for cross-cutting is high and the presence of scientific skills should be considered for all areas of government.

2. Do you agree with the short to medium term action points listed at the end of this theme?

Yes. The SSCN could act as a helpful resource for community level action and review.

3. What do you consider are the two or three most important or pressing science and innovation policy issues under this theme that need to be addressed, and how should the Executive address them?

4. How should activity under this theme be developed to have most impact on supporting environmental sustainability?

5. How should activity under this theme be developed to have most impact on improving the quality of life of the people of Scotland?

6. How should activity under this theme be developed to have most impact on encouraging innovation?

7. How should activity under this theme be developed to have most impact on improving connections and synergies between the science research base in Scotland and other sectors, both within Scotland at a UK level and internationally?

8. Which developments or investments under this theme could generate the best return for the people of Scotland, and why?

9. Which major areas of achievement or excellence under this theme should be promoted by the Executive and its partner organisations?

10. Which performance measures under this theme should be introduced to track Scotland's progress as a "science nation"? What would be appropriate targets?

Additional Comments.

