The Scottish Government

Scotland's Science Centres – Impacts and Future Interventions

Education and Training

social research

SCOTLAND'S SCIENCE CENTRES - IMPACTS AND FUTURE INTERVENTIONS

Halcrow Group Limited

Scottish Government Social Research
2007

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LIST OF ACRONYMS

ASTC - Association of Science Technology Centres
CPD - Continuing Professional Development
DfES - Department for Education and Skills
ECSITE-UK – UK Network of Science Centres and Museums
EISF - Edinburgh International Science Festival
ERDF - European Regional Development Fund
FEDS - Framework for Economic Development in Scotland
GSC - Glasgow Science Centre
HIE - Highlands and Islands Enterprise
HMIE – HM Inspectorate of Education
NEC - National Entitlement Card
NEET - Not in Education, Employment or Training
NMSI - National Museum of Science and Industry
ODE - Our Dynamic Earth
ODPM - Office of the Deputy Prime Minister
RD&D – Research, Design and Development
SATRO - Science and Technology Regional Organisation
SEED - Scottish Executive Education Department
SEERAD – Scottish Executive Environment and Rural Affairs Department
SEETLLD – Scottish Executive Enterprise, Transport and Lifelong Learning Department
SSAC - Scottish Science Advisory Committee
SSCN - Scottish Science Centres Network
SSERC - Scottish Schools Equipment Research Centre
STEM – Science, Technology, Engineering and Mathematics
VfM - Value for Money

CONTENTS

EXECUTIVE SUMMARY

1. In September 2006, Halcrow was appointed by the then Scottish Executive to undertake a study of Scotland's four science centres to inform future policy and delivery of the Scottish Science Centres Network (SSCN). The main purpose of this study, as specified in the brief, has been to inform policy, delivery and future commitments to the science centres.

2. The SSCN was established in 2005 to promote greater collaboration and networking between Scotland's four main science centres and other key stakeholders within industry, education and the wider community. The four main science centres include:

- Our Dynamic Earth, Edinburgh
- Sensation, Dundee
- Glasgow Science Centre
- Satrosphere Science Centre, Aberdeen

3. The total funding that has been allocated to the SSCN over the three years from 2004/2005 to 2006/2007 has amounted to £10.4m. Over 70% of this expenditure related to revenue support, and the remainder relating to capital expenditure (18%) and education related projects (11%).

4. In order to fulfil the requirements of this commission, a wide-ranging programme of consultations with the science centres and wider stakeholders within academia, industry, professional bodies and elsewhere in the public sector has been undertaken. This was complemented by extensive desk research and a survey of visitors at a number of science centres and museums, which has provided useful evidence of the impacts of potential future interventions.

5. The consultations did underline that there remains a broad range of views regarding the role of the science centres and the extent to which they should extend their role beyond a perceived core function, which was focused on their contribution to engaging children, primarily of primary school age in science and technology. Contributing to the 3-18 Science Curriculum is widely accepted by the vast majority of stakeholders as a central and core function of the science centres. While a number of examples of best practice were highlighted in the consultations, the SSCN was still considered to be in the early stages of development with a much greater emphasis being given to areas for improvement. A key area will be the identification and dissemination of best practice arising from the independent review of education provision undertaken by the HMIE.

6. One of the main objectives of this study was the development of a set of performance objectives, and it is recommended that these should be used to measure the future performance of the science centres. The two key performance objectives focus on increasing the number of visitors from all ages and backgrounds in Scotland and are supplemented by a set of six sub-objectives, with a focus on quality and collaboration. This review concludes that an outcome based approach to funding be adopted by the Scottish Government. It is also recommended that the share of funding for each science centre should be directly linked to performance against the key performance objectives.

7. The impact of a number of potential future policy interventions have been investigated, including:

- Universal free entry
- Half price entry
- Free entry for under 18s
- Free entry for school groups
- Half price entry for school groups
- Free transport for school groups

8. Evidence from the two science museums in London and Manchester and the findings from our survey of visitors have been used to provide estimates of the impact of free admission and other charging regimes on the number of visits to the four Scottish science centres.

9. On the basis of the analysis, universal free entry would result in the biggest impact on visitor numbers, resulting in around 1.2m additional visits to the four science centres per annum and requiring an overall increase in public grant estimated at just over £2.5m. This equates to £2.14 for every additional visitor to the science centres. Out of all of the proposed options, free admission for under-18s would be the most cost effective, with an estimated payment of just 49p required for each of the 260,000 additional visits.

10. In terms of the three potential interventions focused on school groups, the analysis suggests that free transport for schools would generate the greatest increase in visits, amounting to 276,000 additional visits per annum. Overall, it is estimated that this option would require an increased public grant of more than £2.5m, significantly more than the other options for school visits.

11. The implementation of free entry for under-18s could be implemented as part of a staged approach to universal free entry. It is likely, nevertheless, that further more detailed work would be required to assess the potential costs and benefits before progressing further with the implementation of these policy interventions.

1 INTRODUCTION

1.1 Background

1.1.1 The Scottish Science Centres Network (SSCN) was established in 2005 to promote greater collaboration and networking between Scotland's four main science centres and other key stakeholders within industry, education and the wider community. The four main science centres include:

- Our Dynamic Earth, Edinburgh
- Sensation, Dundee
- Glasgow Science Centre
- Satrosphere Science Centre, Aberdeen

1.1.2 In September 2006, Halcrow was appointed by the then Scottish Executive to undertake a study of Scotland's four science centres to inform future policy and delivery of the SSCN. The main purpose of this study, as specified in the brief, has been to inform policy, delivery and future commitments to the science centres. The main objectives of the study have been as follows:

- Identify and, where possible, quantify suitable performance objectives for the four science centres
- Review the impacts of the science centres and the performance to date against these identified objectives
- Identify current areas of best practice in the science centres
- Assess the effectiveness of explicit linkages and complementarity between the science centres and the wider STEM engagement sector
- Assess the options for future interventions which may be most appropriate in meeting the identified objectives and deriving the maximum benefit
- Assess the options for future funding and sustainability of each of the potential interventions

1.2 Methodology

1.2.1 The proposed methodology to undertake this study was contained in the proposal submitted by Halcrow to the then Scottish Executive in September 2006. An inception meeting was held on the 26th September 2006, which confirmed the objectives of the project, the proposed method and the programme for individual stages of the commission. An inception meeting report was produced by Halcrow and agreed with the client, which provided further clarification regarding study objectives and methodology. Regular progress meetings were arranged between Halcrow and the client team to report on progress to date and discuss next steps.

1.2.2 A number of key tasks were identified in the proposal including:

1. Policy and context review
2. Stakeholder consultations
3. Development of performance objectives
4. User survey
5. Appraisal of interventions

1.2.3 The extensive programme of consultations with the science centres and wider stakeholders within academia, industry, professional bodies and elsewhere in the public sector have formed a key part of this study. This has ensured that the process has been fully transparent while also allowing the views of those affected by the strategy to feed into the investigation and analysis. This has been complemented by a survey of visitors at a number of science centres and museums, which has provided useful evidence of the impacts of potential future interventions.

1.3 Structure of the report

1.3.1 This report presents the findings from the study. Following this introductory chapter, it is divided into several chapters.

- Chapter 2 reports on the policy and context review
- Chapter 3 assesses the contribution of the Scottish Science Centre Network to the Science Strategy for Scotland
- Chapter 4 examines areas of best practice and the effectiveness of linkages within the wider STEM engagement sector
- Chapter 5 reviews the Scottish Science Centre Network Strategy, identifies suitable performance objectives and discusses performance against these objectives
- Chapter 6 assesses the options for future interventions including an assessment of funding options and future sustainability.
- Chapter 7 provides a summary of findings and conclusions from the study

1.3.2 Further details of the research programme can be found in the appendices to this report. Annex I provides details of the organisations that were consulted as part of the programme of stakeholder consultations and Annex II provides details of the visitor survey undertaken at a number of science centres and museums. Annex III provides details of the spreadsheet model which was developed to assess the impacts of a number of future interventions.

2 POLICY AND CONTEXT REVIEW

2.1 Introduction

2.1.1 This chapter of the report places the development of the Scottish Science Centres Network within a policy and economic context. It focuses primarily on a review of national economic development and science strategies and the role of science centres in the context of the science, technology, engineering and mathematics (STEM) sector.

2.1.2 The "science centre movement" developed in North America during the 1960s and 1970s. The "Exploratorium" model from San Francisco developed a new type of attraction in which children explored in a highly interactive environment with a large range of stand alone exhibits, which were very hands-on. This was very different from a museum environment, which focused more on presenting artefacts of significance to society.

2.1.3 Glasgow Science Centre (GSC) is the largest of the four science centres and was developed as part of a major regeneration project at Pacific Quay. The project received significant funding from the Millennium Commission as well as support from the European Regional Development Fund (ERDF), Scottish Enterprise Glasgow and Glasgow City Council. The centre has been fully operational since 2001 and the complex contains a Science Mall (including interactive galleries, planetarium and interactive theatre), as well as an IMAX cinema and a 100m tower with viewing gallery.

2.1.4 Our Dynamic Earth (ODE) in Edinburgh was the centrepiece of a major urban regeneration plan in Holyrood and received considerable capital funding from the Millennium Commission, as well as support from Scottish Enterprise Edinburgh & Lothian and City of Edinburgh Council. The centre is focused on the Earth Sciences and explains the processes and evolution of life on Earth. The centre is different from a conventional science centre in that the exhibition follows a linear structure, which tells a story from the beginning of time. The centre opened in 1999 and has been successful in generating a significant proportion of its revenue from corporate hospitality to support its core mission in science communication.

2.1.5 Sensation in Dundee was opened in 2000 and was part funded by the Millennium Commission, with further capital funding secured from the Gannochy Trust, the Wellcome Trust, Scottish Enterprise Tayside and Dundee City Council. The centre focuses on the theme of the life sciences and is located on a site adjacent to the Dundee Contemporary Arts centre.

2.1.6 Satrosphere in Aberdeen was the first science centre in Scotland and first opened in 1989. It was developed by the predecessor to SETPOINT Scotland North, the Science and Technology Regional Organisation (SATRO) based in Aberdeen, to provide a

physical centre to inspire interest in science and technology among young people. The centre is now located at "the Tramsheds", adjacent to major leisure facilities at the Beach in Aberdeen.

2.2 Background

2.2.1 The Scottish Science Advisory Committee (SSAC) was established in 2002 to provide a source of independent advice to Scottish Government Ministers on strategic scientific issues. One of the main recommendations arising from the report "Science Matters: Making the right connections for Scotland"[1] was to encourage the development of enhanced networking across both formal and informal science education.

2.2.2 The science centres were reported as a valuable aspect of informal science education. However, it was highlighted that "even greater value could be had through the centres working more closely together with each other, with schools and local authorities, with the professional bodies, and with further education colleges, higher education institutions and research institutes to present key aspects of science to school pupils."

2.2.3 One of the recommendations of the report stated "The Scottish Executive should continue to address the issues of short-term viability and the longer term sustainability of Scotland's science festivals and science centres such that these constitute a national network that fulfils identified educational and cultural roles."

2.2.4 Subsequent to the SSAC report, further work was undertaken to review the operations of the science centres with a view to considering their future performance. A strategy for the Scottish Science Centres Network was launched in December 2005, which provides a framework for the development of the centres including strategic milestones and deliverables.

2.3 Strategic context

2.3.1 At a strategic level the development of the future policy of the four science centres is articulated within the Scottish Science Centre Network 2005-2009 Strategy, which sits within the objectives of A Science Strategy for Scotland, A Smart Successful Scotland and the Framework for Economic Development in Scotland which all wish to encourage growth and productivity improvements in key sectors of the economy.

2.3.2 Growing the economy is commonly recognised as the Scottish Government's top priority. This is reflected in the Government's *Framework for Economic Development in Scotland* (FEDS) which sets out the vision: *"To raise the quality of life of the*

[1] "Science Matters: making the right connections for Scotland" First Report of the Scottish Science Advisory Committee, January 2004.

Scottish People through increasing the economic opportunities for all on a socially and environmentally sustainable basis."

2.3.3 The Scottish Government's *Smart Successful Scotland* expands on many of the priorities set out in FEDS and outlines the Enterprise Strategy and strategic direction to the Enterprise Networks including entrepreneurial dynamism, skills, innovation and research and development.

2.3.4 By working together under the auspices of the science strategy, the range of science and society delivery agents, with the four science centres counted principally among those, can make an important contribution to achieving these objectives. By introducing Scotland's children and young people to science, and the wonders of science, it is hoped that this can inspire future generations of scientists, technologists, engineers and mathematicians, help promote a knowledge economy and improved long term economic performance.

2.3.5 The first national *Science Strategy for Scotland* was launched in 2001 and a Progress Report detailing how the strategy has developed was published at the start of 2006 The strategy is currently being updated and a revised strategy will be published later in 2007. There are expected to be limited changes in the overall strategic direction, but it will contain an increased emphasis on innovation and will be known as a "*Science and Innovation Strategy for Scotland*". The increasing profile of innovation as a key theme within public strategy documents was also reflected in the revised *Smart Successful Scotland* strategy, which was updated in 2004.

2.4 Long term objectives of the Science Strategy for Scotland

2.4.1 There are five key long term objectives within the Science Strategy for Scotland. These are:

1. Maintaining and connecting the science base
2. Exploiting science to grow the economy and benefit society
3. Improving science education and promoting science careers
4. Promoting awareness and appreciation of science across society
5. Developing better use of science and scientific advice by Government

2.4.2 While there are expected to be only limited changes in the overall strategic direction, it is expected that science communication and engagement will have a more central role across the various strands of the Strategy.

2.4.3 Using the present long term objectives as a starting point, the Scottish network of science centres has the potential to make the greatest contribution to objectives three and four of the national strategy relating to science education, science careers and raising awareness of science across society. In addition, a greater level of networking between the science centres and other organisations within the scientific community

would also ensure that they were able to make a moderate contribution to objectives one and two.

2.4.4 The following section reviews the alignment of the Scottish Science Centre Network to each of these long term objectives and their related long term aspirations, which is the overarching government strategy to which the science centres will contribute.

1. Maintaining and connecting the science base

2.4.5 Of the four long term aspirations detailed under this objective, the most relevant aspiration for the science centres is

- "Continue to promote Scotland as a "science nation": a world-class location for science and research and development, with productive international education and research links in both existing and new markets".

2.4.6 This long term aspiration underlines the development of international linkages for the science centres and their capacity to contribute to the development of Scotland as a science nation. This aspiration is highlighted in the strategy for the SSCN which states that "ultimately, the network aims to create a four site Centre of Excellence enhancing Scotland's reputation as a pro-science nation".

2. Exploiting science to grow the economy and benefit society

2.4.7 Of the two long term aspirations detailed under this objective, the most relevant aspiration for the science centres is

- "Place a continued emphasis on the value of commercialising research, and promote a culture that fosters knowledge transfer from the science base"

2.4.8 This long term aspiration underlines the potential role of the science centres in facilitating the dissemination of scientific knowledge as well as the profiling of new products and processes which have been developed in Scotland. This potential role will be explored further as part of this study in chapter three.

3. Improving science education and promoting science careers

2.4.9 Of the eight long term aspirations detailed under this objective, the most relevant aspirations for the science centres are:

- In conjunction with a broad range of formal and informal science education providers, including our Science Centres, inspire young people to consider the achievement of science, the place of science in society and the possibility of a future science career
- Ensure a good supply of science and mathematics teachers and provide the means to keep their skills and knowledge up to date

2.4.10 The strategy contains specific short to medium term action points referring to the role of the science centres in terms of science education and science careers. It states that funding has been provided for an education programme in the four Science Centres, and that the unique position of the science centres will be used in a much more cohesive fashion to communicate the attractiveness of a science career to an increasingly diverse audience.

2.4.11 There is no specific reference to the role of the science centres in relation to Continuing Professional Development (CPD) for teachers of science and mathematics within the Science Strategy for Scotland. The Strategy states that it will support the programme of teacher CPD being organised by the Scottish Schools Equipment Research Centre (SSERC), and the programme of Teacher Fellowships through the Royal Society of Edinburgh. There has been some feasibility work undertaken regarding the potential to deliver CPD through the network of science centres. The potential role of the science centres in relation to CPD will be discussed later in chapter three.

4.Promoting awareness and appreciation of science across society

2.4.12 All of the four long term aspirations detailed under this objective are relevant for the science centres. These include:

- Promote understanding, appreciation and engagement with science by all levels of society through informal science education
- Promote better co-ordination of informal science learning and community access activities
- Encourage dialogue between scientists and the public on science issues
- Link in to Science and Society activity at a UK and European level

2.4.13 The strategy contains specific short to medium term action points referring to the role of the science centres in terms of science education and the dissemination of scientific research. It states that the programme of informal science education should complement, enhance and be consistent with developments in Science Curriculum 3-18. It also underlines the need for the further development of linkages with other science and society delivery partners as well as further and higher education institutions and industry.

2.5 Summary

2.5.1 Overall, around £600m of public expenditure was invested in science related activities in Scotland in 2005/2006[2], of which investment in the four science centres

[2] "A Science Strategy for Scotland 2001: Progress Report" Scottish Executive, February 2006.

represented less than 0.5% of this figure. While this is a very small proportion of the overall science budget, the review of the potential contribution of the Scottish science centres to the Science Strategy for Scotland underlines that they have the potential to make a significant contribution to the overall aims and objectives of the strategy.

2.5.2 The science centres are developing as key players in science communication and have the skills and facilities to make a unique contribution to the emerging Science Curriculum 3-18. They are accessible venues attracting a footfall of around 0.5m people every year, which provides them with a unique platform to engage with a wide cross section of society, and provide other stakeholders within the science community a unique resource to engage with the general public.

3 CONTRIBUTION TO THE SCIENCE STRATEGY FOR SCOTLAND

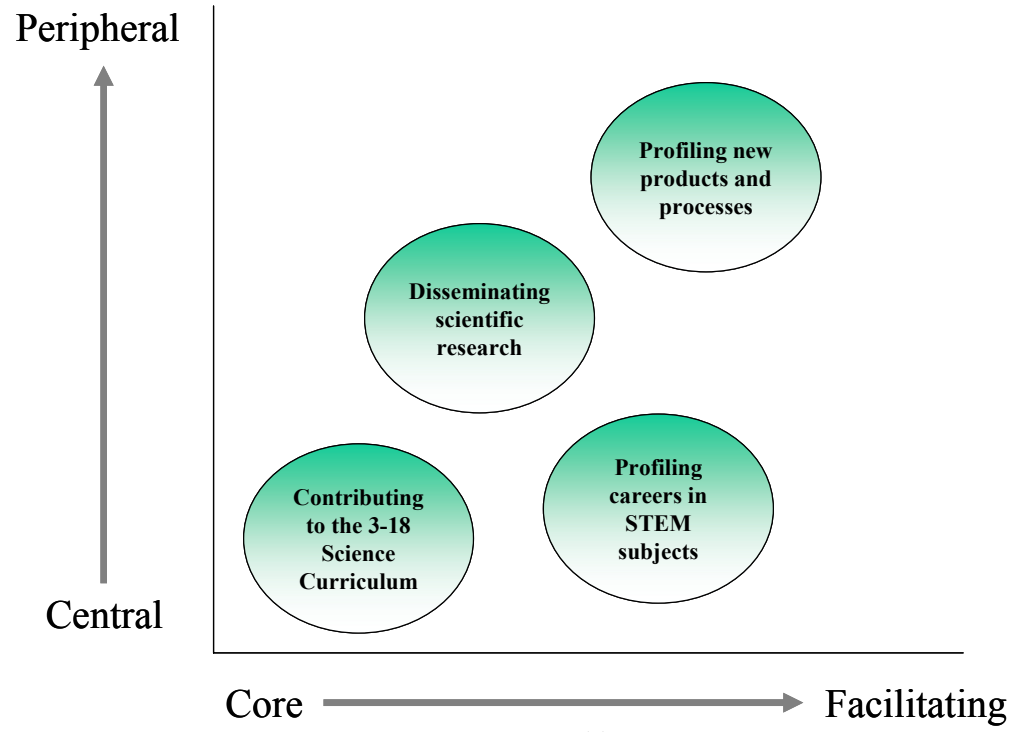
3.1 Introduction

3.1.1 This section of the report assesses the contribution of the Scottish Science Centre Network to the Science Strategy for Scotland. There are four key themes emerging from the Science Strategy where the science centres are well placed to make a unique and worthwhile contribution to the Science Strategy for Scotland. These correspond to the four network policy areas articulated in the SSCN strategy and include:

- Contributing to the 3-18 Science Curriculum
- Profiling careers in Science, Technology, Engineering and Mathematics
- Disseminating scientific research and discussing relevance and application in society
- Showcasing new products and processes discussing relevance and application in society

3.1.2 The science centres and wider stakeholders were asked the extent to which these functions were central to the role of the science centres and whether the centres were the lead agency or acted more to facilitate the work of other organisations. The consultations did underline that there remains a broad range of views regarding the role of the science centres and the extent to which they should extend their role beyond a perceived core function, which was focused on their contribution to engaging children, primarily of primary school age in science and technology. Figure 3.1 below provides a broad summation of these views.

Figure 3.1: Perceived Role and Functions of the Scottish Science Centre Network



3.2 Contribution to the Science Curriculum 3-18

3.2.1 This is widely accepted by the vast majority of stakeholders as a central and core function of the science centres. Ensuring that the science centres are used in a way that maximises their potential contribution to the 3-18 science curriculum is a core theme for the future development of the Scottish Science Centre Network. The educational role of the centres has developed such that there is potential for the network to play a much more central role in the delivery of the science curriculum, a more formalised and integrated function with regard to the delivery of learning outcomes.

3.2.2 Scotland has always had a distinctive approach to the education of its citizens which has placed greater emphasis on first principles and a unified approach to knowledge. This is reflected in the ongoing development of *A Curriculum for Excellence*, which will be introduced in Scotland from 2008 onwards. The overriding themes (or 'capacities') of A Curriculum for Excellence are:

- successful learners
- confident individuals
- responsible citizens
- effective contributors

3.2.3 The central thrust of the revised curriculum in science will be to reduce the emphasis on specific detailed knowledge and focus more on fundamental underlying principles and the "big ideas" of science. This process of de-cluttering the content of the curriculum will provide an opportunity to engage pupils in science education in more diverse and innovative ways. The focus on broad learning outcomes means that the curriculum will become less prescriptive and will place less emphasis on how these outcomes are achieved. This provides an unprecedented opportunity for the science centres to demonstrate how they are able to provide a unique resource to support the learning outcomes of the science curriculum.

3.2.4 A Curriculum for Excellence is likely to demand substantial change for all educators in learning and teaching approaches which brings their methods and practices much closer to those which have been employed by science centres. The new curriculum is likely to have greater encouragement to develop out of school visits and curriculum enrichment through offsite learning. This suggests there will be greater potential for the science centres to meet these learning outcomes, but it will be up to schools and educational authorities how these outcomes are achieved. It was underlined by the then Scottish Executive Education Department (SEED) that currently the science centres are considered to be only one of a number of resources that could be used to support these outcomes.

3.2.5 A Curriculum for Excellence will place a greater level of autonomy on individual teachers to meet the learning outcomes and may require a greater emphasis on CPD. There will be generic CPD courses which will be developed which will be funded by

SEED. However, there is not currently any commitment by SEED to any specific revenue funding to support the type of CPD which would be delivered by the science centres.

3.2.6 There was a feeling among many stakeholders that the provision of CPD for science teaching lacked a co-ordinating body to support CPD delivery. The capacity of local education authorities had been reduced with most no longer retaining the post of science advisor, and the capacity to deliver within the Teaching Education Institutes has also been reduced. The response in England and Wales has been the introduction of regional Science Learning Centres which have been developed through a partnership between the Department for Education and Skills (DfES) and the Wellcome Trust. The National Science Learning Centre in York had been envisaged to cater for the whole of the UK, although given the differing educational structure in Scotland, and the travelling distance involved for teachers, the role of the centre in this regard has been limited.

3.2.7 The Scottish Schools Equipment Research Centre (SSERC) has developed a key role to develop learning resources for teacher CPD, supported through the Science Strategy for Scotland, and will deliver CPD on site at its new premises in Rosyth. There are no plans within SEED to follow the development in the rest of the UK for a central Science Learning Centre for Scotland, nor to replicate the model of regional centres. It was reported by many consultees that the Science Learning Centre approach in England was unlikely to work in Scotland as this structure would not allow for sufficient interface with communities, in order to set delivery within a local context

3.2.8 Most stakeholders believed that a different approach was required in Scotland in order to ensure successful delivery. The preferred model would be some central facilitating and supporting function to be available with local delivery mechanisms. It is interesting to note that some stakeholders within the further and higher education sectors that had not previously thought of the science centres in that capacity recognised their potential valuable role in this regard. Overall, there was a strong feeling among many of the stakeholders that the science centres had the potential to play a much more central role in the delivery of CPD for science education, both at a primary and secondary level.

3.3 Profiling careers in Science, Technology, Engineering and Mathematics

3.3.1 Although this was generally perceived to be a central function of the science centres by all consultees, their role was more in terms of facilitating the work of other agencies. It was emphasised by a range of stakeholders that there is a great deal of activity that has been developed in relation to profiling careers in the STEM sector, but that it would benefit from greater co-ordination in order to maximise impact at a national level.

3.3.2 The Science Strategy for Scotland does make several references to the importance of profiling science careers within the science centres. Although the Assessment of Achievement in Science survey suggests that performance in science subjects between S3 and S6 has been relatively strong[3], there has been a decline in uptake of science subjects Chemistry, Biology and Physics at Higher level between 1993 and 2001. The science centres are not lead agencies in the profiling of careers but have been working with agencies such as Careers Scotland in delivering a number of initiatives in relation to the profiling and promotion of careers in science.

3.3.3 The recent report published by the Scottish Government on the supply of and demand for science graduates in Scotland[4] suggests that the future prospects for science related careers in Scotland are very positive, with employment projected to grow faster over the next decade than for non-science occupations. While this could suggest potential for future skill shortages, there are signs that the supply of science graduates is responding well, with an average rise of around 6% every year in Scottish entrants to first degree science courses between 2000 and 2004. Over the same period Scottish entrants to non-science first degree courses was relatively static. Key growth areas have been in medicine, biological science and mathematics, while more applied subjects such as forensics, archaeology, geology, microbiology and psychology have also experienced significant increases.

3.4 Disseminating scientific research

3.4.1 This was perceived to be a more peripheral role for the science centres by a large number of stakeholders which would be focused on facilitating the requirements of other organisations, particularly within the higher education sector and research institutes. The growing profile of science communication underlines the growing emphasis on the role and responsibility of scientists to communicate with wider society regarding their work. Research Councils are placing an increasingly pro-active emphasis on the requirement for science communication and the need for scientists to engage more fully with the public.

3.4.2 Research recently undertaken by the Royal Society on the factors affecting science communication by scientists and engineers[5] reported that while the level of science communication has increased over the past five years, with around three quarters of

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[3] "Assessment of Achievement Programme: Sixth Survey of Science 2003", Scottish Executive Education Department

[4] "Supply of, and Demand for Science Graduates in Scotland: a review of available data" Report by the Scottish Executive, the Scottish Funding Council and Future Skills Scotland, February 2007.

[5] "Science Communication: Survey of factors affecting communication by scientists and engineers" Royal Society, 2006

scientists now undertaking at least one public engagement activity in the past 12 months, there was a need for greater guidance and encouragement to ensure effective dialogue and debate.

3.4.3 Over 70% of scientists stated that making it easier to organise a public event would be an incentive to encouraging engagement. The role of professional science communicators was central to this. Mentors, technical help and direct support from science communicators were cited as important to develop the supportive infrastructure which was required in order for a more substantive engagement to develop. They were also thought to be important in organising events and inviting scientists to take part.

3.4.4 This underlines the central role of science communicators in supporting public engagement. The science centres in Scotland are a unique resource with regard to science communication, providing a series of venues which attract around 0.5m visitors a year with a focus on communicating science to the non-specialist public. In this sense, the science centres can be seen as an interface between the general public and the scientific community, which provides them with a unique position in terms of science communication.

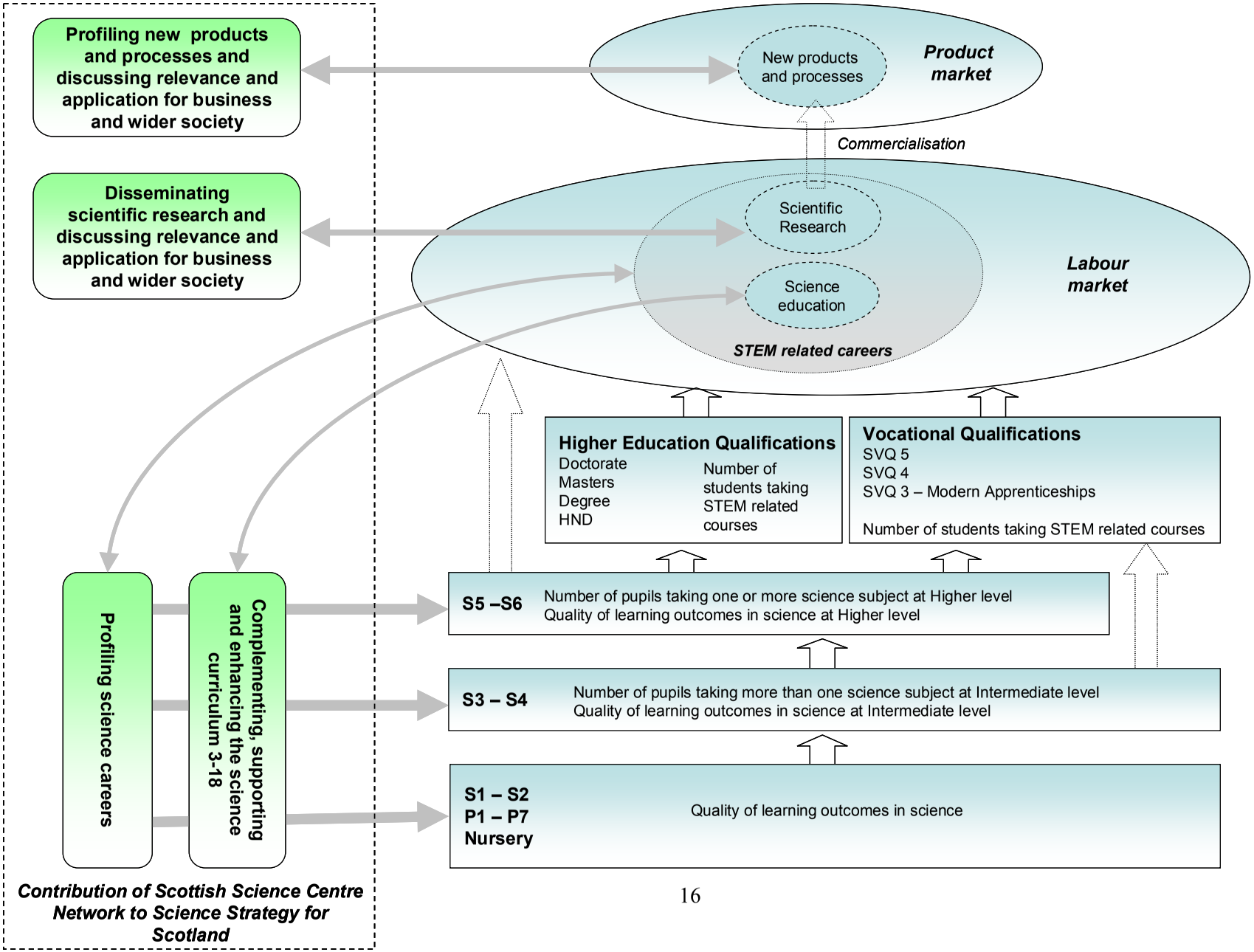
3.5 Profiling new products and processes

3.5.1 This was perceived to be the most peripheral of all the roles discussed by the majority of stakeholders, and the role was very much facilitating rather than pro-active development. The SSCN Strategy places a strong emphasis on value of the science centres as a platform for profiling new products and processes by developing further linkages with industry. However, without more practical consideration regarding the means through which these linkages can be fostered and further developed, this function is likely to remain underdeveloped.

3.5.2 It was recognised that there is potential for the science centres to play a much more active role in hosting exhibitions of new products and processes developed or being developed in Scotland. This would provide a means of showcasing Scotland's contribution to global economic development, and a means of demonstrating to young people the clear linkages between a career in science and technology and making a valuable contribution to improving the quality of people's lives through new product and process development. It was noted by several stakeholders that Scotland would benefit from celebrating more its recent achievements in science and technology. This profiling could be used to attract venture capital to these Scottish companies, as well as generate additional sales and attract higher levels of publicity.

3.5.3 The developing roles of the science centres are shown diagrammatically on the following page. It provides a conceptual framework, which can be used to demonstrate how the science centres are able to contribute to the Science Strategy for Scotland and lead to supply side improvements in labour and product markets.

Figure 3.2: Contribution of the Scottish Science Centre Network to Science Strategy for Scotland



3.6 Summary

3.6.1 Figure 3.2 illustrates that the potential contribution to nursery, primary and secondary education is through two main means, namely:

- Complementing, enhancing and supporting delivery of the 3-18 Science Curriculum
- Profiling careers in Science, Technology, Engineering and Mathematics (STEM)

3.6.2 At the core of this is the contribution to the general science curriculum for nursery, primary and S1 and S2. This is currently the core market for the science centres and underlines their ability to provide a universal approach to science education for all pupils.

3.6.3 The science centres are also well placed to deliver CPD for primary school teachers and there are examples of best practice about how this can be best integrated, which will be discussed later in this report. It is evident that the further development of CPD for primary school teachers as well as those in secondary education is an area which requires further consideration, in terms of how this is delivered.

3.6.4 Figure 3.2 emphasises that delivering on the Science Curriculum 3-18 will be dependent on greater two-way linkages between the science centres and the science education community, in particular more strategic relationships with local education authorities and with SSERC.

3.6.5 The Assessment of Achievement in Science[6] undertaken in 2003 suggests that there is relatively strong performance from P1 to P4 in pupil science learning and in separate sciences from S3 to S6. The key area in need of significant improvement in achievement was from P5 to S2. The age group from P5 to S2 is a key market for the science centres and so this could be a strategic priority to further target this age group. The S2 age group is also a critical stage when future subject choices are made and whether one or two sciences are studied in S3 and S4.

3.6.6 One of the core functions of the science centres therefore could be considered to relate to contributing to higher levels of achievement in science learning for all pupils up to S2 and encouraging a higher proportion to take two science subjects in S3. This underlines the role of science centres in engaging pupils in science in a way which cannot readily be achieved in a classroom environment. It is clear these learning outcomes will be influenced by many factors in addition to a visit to a science centre. Nevertheless, demonstrating a link between levels of achievement in science

[6] Assessment of Achievement Programme: Sixth Survey of Science 2003, Scottish Executive Education Department

education and visits to a science centre is important in underlining their value within the science curriculum.

3.6.7 Figure 3.2 demonstrates that the science centres can further develop their role in science communication by engaging with both the labour and product markets to:

- Profile new products and processes and discussing relevance and application for business and wider society
- Disseminate scientific research and discussing relevance and application for business and wider society

3.6.8 While these roles are perceived by many stakeholders to be more peripheral to the core function of the science centres (although they are of equal importance within the SSCN strategy), the further enhancement of these relationships with the labour and product markets through enhanced linkages with the higher education sector and industry, provide a means of further developing the core science communication function for the centres and underlining the value of science in society.

4 BEST PRACTICE AND EFFECTIVENESS OF LINKAGES

4.1 Introduction

4.1.1 This section begins with an examination of best practice within the SSCN and elsewhere. The extensive programme of consultations with the Scottish science centres, other science centres across the UK and wider stakeholders, highlighted a number of issues relating to the development and dissemination of best practice, which are reported in this section. The section then continues with an assessment of the effectiveness of linkages within the wider STEM engagement sector, which was explored in the consultations with the science centres as well as with wider stakeholders.

4.2 Review of Best Practice

4.2.1 Given that the Strategy was launched just over one year ago in December 2005, it was still believed to be in a developmental phase. While a number of areas of best practice were identified, there were also a significant number of areas where there was potential for improvement.

4.2.2 One of the main means through which best practice has been identified and will be disseminated is the recent HMIE inspection, which sought to identify best practice in the educational provision across the four science centres

4.2.3 The initial conclusions of the inspection underlined that the centres employ a young and enthusiastic group of science communicators that are committed to improving science education. This is a very positive asset within the centres which could be exploited further to optimise delivery of key outcomes. In terms of where the science centres add value to the curriculum: they have resources and facilities which are not available elsewhere; their learning and teaching approaches are different to that which can be secured elsewhere; the communicators have well developed presentation skills; and they have developed techniques to capture the attention of pupils and know how to interact with their audience. This is an area where teachers can learn how to present science to pupils.

4.2.4 Nevertheless, the onus remains on the SSCN to demonstrate clear linkages between the school visit to the science centre and the school curriculum, and how this learning is developed before and after the visit has taken place. There is currently no systematic or consistent approach in terms of how a visit to a science centre is integrated within the school science curriculum. The tendency for visits to be concentrated at the end of term underlines that visits to the science centres are in many cases considered as more of an end of term treat rather than an important part of science learning. This means that the science centres are competing as one of many options for a potential school trip rather than being considered to be an integral part of the science curriculum.

4.2.5 Many consultees underlined the importance of an ongoing relationship between the pupils and the science centres through the development of curriculum relevant materials to be used before and after the visit. Any interaction should be linked in through preparatory work for the visit, and follow up work after the visit, to set it in context and understand how it fits in to the curriculum. This already happens to some extent, through some pilot projects in some of the centres but could be developed further across the network. It was highlighted that there is a need for more materials to be developed for this type of interaction, but once they have been developed, they could be rolled out to be used elsewhere

4.2.6 In terms of the greatest added value that the science centres can bring to the post S2 curriculum, the development of expertise at Advanced Higher level is an area where the centres have the potential to act as a focus of expertise, bringing in experts from industry, higher education and research institutes and combining this with in-house expertise and facilities. It is cost effective to concentrate some types of facilities for education provision in the centres and bring pupils to the centres from across Scotland. This can be integrated with the delivery of CPD for the science teachers at the same time. An example of this is the development of DNA workshops at Glasgow Science Centre. This project involves collaboration with a number of partners and provides both tuition at Advanced Higher level and CPD for teachers.

4.2.7 It was underlined by a number of stakeholders that if the network is going to make a more significant contribution to the 3-18 Science Curriculum, there needs to be a clear view on the means through which the network can deliver for the whole of Scotland. This would require further consideration to resource requirements, particularly the scale and nature of touring facilities and complementarity with existing provision currently on offer. There was a need to understand how existing exhibits can best be recycled into outreach activities, with an awareness of this at the design stage of new exhibits, in terms of how they could be modified for touring use, rather than creating new exhibits for outreach.

4.2.8 It was universally accepted that there is a need for better co-ordination of outreach activity across the whole of the STEM sector to ensure that those activities that are delivered are reliable, appropriate and worthwhile. Some consultees reported that there is some outreach where delivery is not of a standard which is acceptable, and this needs to be looked at to ensure that there is better quality assurance in place. It was underlined that there are significant negative impacts of a poor outreach experience both for pupils and for the value placed on science communication.

4.2.9 The economic implications of this observation are worth considering further. If there is a lack of awareness of the quality of science communication activities, then higher quality products are less likely to be supplied as their level of quality cannot be distinguished from lower quality alternatives. This results in “adverse selection” where the schools end up choosing a lower quality product resulting in a lower level of benefit, than in a situation of full information where the quality is known beforehand.

4.2.10 The solution, which would support market adjustment, is to ensure that some quality procedures are developed with regard to all science communication activities. In the first instance, this could relate to a systematic requirement for quality monitoring to be undertaken so that user satisfaction levels could be appropriately assessed. A more extensive requirement would be related to the development of a quality standard branding, which ensured that all deliverers of science communication adhered to a recognised quality procedure and standard.

4.2.11 It was underlined that the science centres have a unique platform with regard to science communication. Nevertheless, there was also the view that there is not the breadth of experience for the science centres to become significantly more involved in the delivery of CPD for teachers and it was questionable whether they had the expertise. There was also a credibility issue with regard to delivery. HMIE stated that the GSC was the only centre to have sufficient credibility at present to deliver CPD at secondary level. GSC has the benefit of being able to draw upon a number of staff qualified at post graduate and post doctorate level involved in science communication, whereas this is not the case in the other three centres.

4.2.12 The consultations also identified a need to profile scientists in the local area so school children can understand the relevance and application of science within the local community. The language and presentation needs to be relevant to the age group to which this is being presented. This has been developed by a number of the centres, and there have been a range of co-ordinated initiatives involving the science centres and Careers Scotland, in terms of promoting STEM related careers. Much more could be done, however, to link the work of the Science and Engineers Ambassadors programme, which is administered by the four SETPOINTs in Scotland, to that of the science centres.

4.2.13 The key programme through which Careers Scotland is engaging in this sector is "Science and Technology Matters for Scotland". This is the name for a wide range of activities that are being undertaken with primary and secondary school groups to encourage greater involvement in science and technology. The programme is being delivered in 11 local authority areas and has attracted ESF funding. It seeks to engage with primary and secondary schools, establishing and exploiting local industry links and also with businesses and has included workshops and events as well as CPD for school careers advisors.

4.2.14 Other programmes include "Tomorrows Inventors", which is a project to encourage school children to think about inventions with competitions. The "Scottish Space School" is the most high profile initiative which has a number of children spending time in the US at NASA as well as summer schools operated at Glasgow and Strathclyde Universities. "Make it in Scotland" is another initiative that aims to attract S2 cohorts to consider a career in manufacturing. The science centres have been used for a variety of purposes in relation to the programmes that are run by Careers Scotland.

4.2.15 A number of these initiatives developed through Careers Scotland have been highly regarded as examples of best practice. Given the re-organisation of Careers Scotland and the possible re-focussing of activities towards other priorities, such as the NEET group (not in employment, education, or training), consideration needs to be given to the most appropriate delivery mechanisms for these initiatives, to ensure that the momentum built up in relation to STEM activities is not lost.

4.2.16 There are a number of interesting initiatives which have already been developed in this area such as "Meet the scientist" where the science centre becomes a forum for researchers to engage in dialogue with the general public. This approach, where science learning is developed in a more informal context, acknowledging the increasing emphasis on a two way discussion rather than a top-down approach is an important shift in how science learning is delivered.

4.2.17 All of the science centres have been developing growing links with higher education institutions in their areas, with several having representation on their Board of Trustees. The commitment to dissemination is increasing, which has involved an exploration of the most appropriate means of dissemination. Science centres are a very appropriate conduit as they are already centres of high footfall of the general public with a focus on science. They have expertise and a growing credibility in science communication and can work with universities to ensure that the research is disseminated in an appropriate form. They would be aware of how to present and package the research in the most effective manner.

4.2.18 Initiatives such as Meet the Scientist are models that work well on an events based level, but some of the centres, particularly GSC and Sensation were keen to develop more process led initiatives which are more about a continual stream of dissemination, bringing a greater continuity to the process. GSC is interested in developing interpretation boards and use of AV to present and showcase research, while Sensation is researching the feasibility of developing a knowledge transfer gallery.

4.2.19 In terms of best practice identified at other science centres across the UK, Techniquest highlighted an innovative programme relating to the delivery of CPD to teachers in North Wales. The CPD was integrated with the development of specific exhibits developed by Techniquest, called the Maths Challenge Kit. These kits would then be used in the classroom by the teachers themselves. The delivery in areas such as North West Wales has been successful due to an awareness of the need to work closely with local organisations, and ensure that the resources developed were clearly linked with key stages within the school curriculum.

4.2.20 Curriculum lesson plans were developed to ensure that the kits could be well integrated within the curriculum. The kits increase the resources that can be used to support learning of key concepts in mathematics, as these resources are generally not available in schools. By centralising this resource in the science centre and integrating it with CPD delivered to groups of teachers locally, it allows the resource

to be used in many locations with teachers increasing capacity to deliver learning and successfully engaging with pupils. Techniquest is now looking to develop a "Forces Challenge Kit" which will enhance the capacity of teachers to teach key concepts with regard to the physical sciences.

4.2.21 W5 in Belfast underlined the need to integrate the concept of *creativity* in all of the exhibits, programmes and workshops that are developed by the centres. There was a need to ensure that science was presented in a way which demonstrated linkages with the arts and explored the role of science in everyday life. For example, W5 is in the process of developing a programme focused on home economics and linking with celebrity chefs to look at the issue of healthy eating. This is an issue which touches on chemistry and human biology in a way which links science with fundamental and interesting aspects of everyday life.

4.3 Assessment of networking activity and sectoral linkages

4.3.1 The current level of linkages between the centres as well as with academia, industry and other organisations with the science communication community was explored in the consultations with the science centres as well as with wider stakeholders.

4.3.2 One of the key themes highlighted by a wide range of consultees was the diverse nature of the science centres in terms of differences in operational scale, management culture and scientific focus. The heterogeneous nature of the network was seen to be a key strength, and there was little desire for the centres to become more standardised and homogenous. The key objective common to all of the centres was science communication. Increasing the profile and role of the network with regard to A Curriculum for Excellence and developing science engagement with wider society were the key themes common to all four centres.

4.3.3 There was significantly less residual potential for collaboration among the centres in more commercial aspects of the business such as catering, hospitality and facilities management, due to the differing scale and nature of operations. Where there were demonstrable benefits such as economies of scale regarding retail purchases, these had already been implemented, with clear benefits in terms of consolidation of supplier relationships and better availability and price of products, particularly for the smaller centres.

4.3.4 In terms of networking with wider stakeholders, one of the key requirements here was to develop much closer links with the local education authorities as the principal players in ensuring that the science centres were aligning themselves with how A Curriculum for Excellence was to be delivered in each local authority area. SSERC, given their membership consists of the 32 local authorities in Scotland, may have a role to play here as broker to the establishment of such partnerships.

4.3.5 Developing links with schools directly was less effective and it was stated by a number of stakeholders including HMIE and SEED that it would be better

concentrating resources on developing strategic linkages with local authorities. This was lacking in all of the centres, with the exception of GSC, which has developed strategic linkages with Glasgow City Council in particular. The others do have links with local authorities, although at a less strategic level within the local education authorities.

4.3.6 It was highlighted that there was a need for the centres to be better informed about the developments within A Curriculum for Excellence and how they would be able to contribute to the key outcomes. This required linkages such as secondments with schools through shadowing delivery, in order that the centre staff are much better able to understand the context in which their education contribution (such as a visit to a science centre and outreach and workshops) is set.

4.3.7 The relationship between the SETPOINTs and the SSCN is of critical importance. The linkages between these two networks needed to be developed further as there would be significant benefits from more co-ordination and collaboration. It was underlined by Satrosphere, which had been established by the forerunner to SETPOINT Scotland North, the Science and Technology Regional Organisation (SATRO), that the previous funding regime had been a barrier to closer joint working. Satrosphere had generally struggled to be financially viable, and so there was reluctance on the part of the SETPOINT to get more closely involved in the organisation due to the potential exposure to financial risk. There was also potential competition for funding which limited joint working.

4.3.8 The financial support from the Scottish Government has allowed much closer joint working to take place, and SETPOINT Scotland North is now working much more closely with Satrosphere, as well as with Sensation in Dundee, through joint outreach and other science communication activities. Techfest, the science and technology festival organised through the SETPOINT now makes much greater use of Satrosphere as a venue rather than being focused exclusively within the universities. This has widened the appeal of the festival within the community as Satrosphere is seen to be a well established community resource.

4.3.9 The issue of closer working with the SETPOINTs was underlined by a wide range of consultees. There was strong support for the co-location of the SETPOINTs in the science centres, to underline their role as a key locus of science communication activities. The two SETPOINTs in Glasgow are in the process of merging, and a number of stakeholders thought that this was an ideal opportunity to examine co-location within GSC.

4.3.10 ECSITE-UK is the national body of science and technology centres in the UK, which is affiliated with the European network of science centres, and is the main UK forum for networking for science centres. All of the Scottish Science Centres are members of ECSITE UK alongside eight other organisations in Scotland. These 12 organisations attract over 2.3m visits every year, 20% of which is accounted for by the four science centres.

4.3.11 The twelve Scottish members of ECSITE-UK include:

- Glasgow Science Centre
- Hunterian Museum, Glasgow
- Almond Valley Heritage Centre, Livingston
- Edinburgh International Science Festival
- National Museum of Scotland, Edinburgh
- Our Dynamic Earth, Edinburgh
- Royal Botanic Garden, Edinburgh
- Royal Observatory Visitor Centre, Edinburgh
- Water of Leith Visitor Centre, Edinburgh
- Scottish Seabird Centre, North Berwick
- Sensation, Dundee
- Satrosphere, Aberdeen

4.3.12 The two organisations with the biggest footfall are the National Museum of Scotland and the Royal Botanic Gardens, both in Edinburgh. These two attractions account for nearly 1.5m visits per year. The National Museum of Scotland has increasingly developed its role with the presentation of science and technology within the museum and in 2006, was the most significant venue for the Edinburgh International Science Festival (EISF). It has the largest collection of science and technology artefacts outside the Science Museum in London, although a lot of this is not yet on display.

4.3.13 The museum has developed a number of permanent science galleries in the past three years. Communicate was opened in 2003, which profiles the development of communications and in 2006, the Connect gallery was opened which showcases key science and technology objects, including Dolly the sheep and a Renewable Devices wind turbine. It has plans to considerably expand its involvement in science and technology through the development of more floor space to be allocated to permanent science and technology displays. For example, a collection looking at the development of broadband in the Highlands and Islands and its impact on people's lives is something which is currently being developed.

4.3.14 The Royal Botanic Gardens is currently in the process of developing a £15m gateway project, which will develop a visitor interpretation site at the entrance to the Gardens at Inverleith. The visitor centre will support greater links and partnership between research organisations funded by the Scottish Government and offer live links to leading scientists around the world.

4.3.15 There are a wide range of examples of bilateral networking between the SSCN and other Scottish members of ECSITE. For example, GSC has worked with the Royal Observatory regarding it planetarium, while the Royal Museum has developed links with ODE and contributed to geological exhibits at the centre through the lending of rock samples. Outreach collaboration has developed between ODE and the Scottish Seabird Centre, while EISF is working more closely with GSC regarding the delivery of workshops.

4.3.16 The tying in of a range of locations for developing themed events is one issue which is increasingly important to ensure co-ordination of effort and maximise impact with the public. The example was given of the "Discover Antarctica Festival", which was led by the British Antarctic Survey. Each venue hosted its own events and exhibitions which were financed internally but there was joint marketing financed centrally. This worked well and that central hook, into which others can feed, is important, with a central fund to co-ordinate and manage and develop joint marketing.

4.3.17 Some stakeholders both within and out with the Scottish Government stated that there was potential for greater alignment of activity in science related centres to contribute to Scottish Government campaigns in areas such as sustainable development and health. This could be best co-ordinated through the Office of the Chief Scientific Advisor, which provides a "cross-portfolio" focus for science across other Departments with an interest in science, such as SEED, SEERAD and SEETLLD.

4.3.18 There is potential for greater networking across the UK and further linkages with other science centres to share best practice. For example, Techniquest in Cardiff provides an interesting comparator to the delivery of science communication activities in Scotland. It has a long standing relationship with the National Assembly for Wales, and has recently negotiated a contract to deliver school outreach activity across the principality. There are similarities to Scotland in terms of the need to deliver in more remote communities where accessibility issues are more significant. Techniquest has developed a worldwide reputation in the area of *regionalisation* due to its extensive experience of delivering science communication activities within more peripheral and isolated communities across Wales. It has developed four satellite sites across the country. All of the sites contain exhibits developed by Techniquest, and some of the sites are staffed by Techniquest personnel, some are unmanned.

4.4 Summary

4.4.1 While a number of examples of best practice were highlighted in the consultations, the SSCN was still considered to be in the early stages of development with a much greater emphasis being given to areas for improvement. A key area will be the identification and dissemination of best practice arising form the independent review of education provision undertaken by HMIE.

4.4.2 While greater collaboration and sharing of best practice was developing in relation to the science centres' education provision and contribution to the science communication agenda, there was no evidence of best practice being identified and disseminated in relation to the more commercial aspects of the businesses such as catering, hospitality and facilities management. The differing scale and nature of operations between the science centres limits the potential for greater collaboration in these areas.

4.4.3 The relationship between the SETPOINTs and the SSCN is of critical importance and the linkages between these two networks needed to be developed much further. In

terms of greater networking with science centres outside Scotland, the development of a “Celtic Fringe” Network was strongly supported by both Techniquest in Cardiff and W5 in Belfast as well as the science centres in Scotland.

5 DEVELOPMENT OF PERFORMANCE OBJECTIVES

5.1 Introduction

5.1.1 This section of the report reviews the Scottish Science Centre Network Strategy, identifies suitable performance objectives and discusses performance against these stated objectives. The chapter describes the process undertaken in developing the set of performance objectives, and sets them within the context of a performance measurement framework demonstrating the logical flow from inputs, to activities and outputs, which then contribute to the specified outcomes of the strategy. The performance objectives are then discussed in turn and are used to asses past and current performance of the SSCN.

5.2 Development of performance objectives

5.2.1 Performance objectives generally focus on what is to be achieved rather than the means of achievement. This means that they will be focused more on outputs and outcomes, rather than inputs and activities. A definition of inputs, activities, outputs and outcomes is given below, based on "The 3Rs Guidance"[7] produced by the Office of the Deputy Prime Minister (ODPM).

- **Inputs** are the financial, in kind contributions and time resources used to fund the initiative
- **Activities** are the direct products or services provided or funded by the initiative
- **Outputs** are the intermediate effects of a project's actions. They represent the mechanism by which inputs and activities yield their intended outcomes
- **Outcomes** are the influence the initiative has on the various domains within the dimensions of environment, social and economic – quality of life conditions

5.2.2 This is an objective-led approach, which ensures that there is a clear focus on the outputs and outcomes to be achieved through funding and how funding can be allocated in a way which best meets these objectives. Therefore, ensuring that there are clear objectives is important in ensuring that funding is well focused and targeted.

5.2.3 The launch of the SSCN strategy underlines two of the key themes which need to be reflected across all of the performance objectives for the science centres. First the adjective "Scottish" emphasises that the network is Scotland wide. With public funding now being provided from the Scottish Government, the objectives of the

[7] "Assessing the Impacts of Spatial Interventions; Regeneration, Renewal and Regional Development", Office of the Deputy Prime Minister, May 2004

science centres need to reflect national rather than just local or regional priorities. Secondly, the term "Network", which means "a group of people who exchange information, contacts and experience for professional or social purposes", underlines the requirement for much greater collaboration and sharing of resources and best practice.

5.2.4 The SSCN strategy lists nearly forty *strategic milestones* which are to be delivered between 2005 and 2009. These relate primarily to **activities** to be undertaken by the network over the duration of the strategy. The strategy also includes nearly thirty *key deliverable **outputs*** which are to be achieved as a result of the activities undertaken within the strategy.

5.2.5 However, the strategy does not contain any specific performance objectives against which the success of the strategy can be measured. It was therefore necessary to develop performance objective for the strategy and then measure performance against these objectives. This has involved a synthesis of published strategies and has been developed through an iterative process including face to face consultations with the management of the four science centres and the Scottish Government.

5.2.6 The SSCN strategy has been reviewed in order to assess the nature of objectives contained within the strategy. Key phrases within the strategy have been summarised and collated within table 4.1.

Table 5.1: Summary of key phrases with the SSCN Strategy

What behavioural change does the strategy want to encourage in the science centres?
-provide more cohesive approach to science education
-complement the formal provision in schools and further and higher education
-more robust business planning
-drive up commercial performance
-consistent cost management
-optimising the commercial potential of exhibitions and events, retail operations, cafes and corporate hospitality
What activities are the science centres encouraged to undertake?
-joint education initiatives
-meetings to share best practice
-work more closely with other science and society initiatives
-show the science behind the latest headlines
-engage with the general public through debates and special events
-regularly refreshed, shared exhibitions and experiences
-forge beneficial partnerships with centres outside Scotland

-combined marketing initiatives

-showcasing Scotland's proud history of innovation and invention

-show contemporary science in everyday life

-highlighting Scotland's pro-science outlook

What are the nature of outputs?

-quality experience

-delivering across Scotland

-more collaboration and less competition

-strive to be world class

What are the anticipated outputs?

-more visitors of all ages and backgrounds from throughout Scotland

-turning our children and young people on to science

-inspiring future generations of scientists

-helping to achieve greater public involvement in the debate about the place of science in society

What are the high level outcomes?

-effect change in public attitudes to science

5.2.7 The summary above highlights that the key high level outcome referred to in the strategy is "effect change in public attitudes to science". This can be understood as the strategic objective of the funding delivered by the Science and Society Team within the Scottish Government. It should also be noted that while the science centres are one of the principal means through which this objective can be achieved, there could also be other means used in order to meet this objective such as through other science and society initiatives and venues.

5.2.8 In developing performance objectives, it is necessary to ensure that all objectives developed are SMART. SMART criteria provide a framework against which the effectiveness of the objectives can be assessed. The five criteria are as follows:

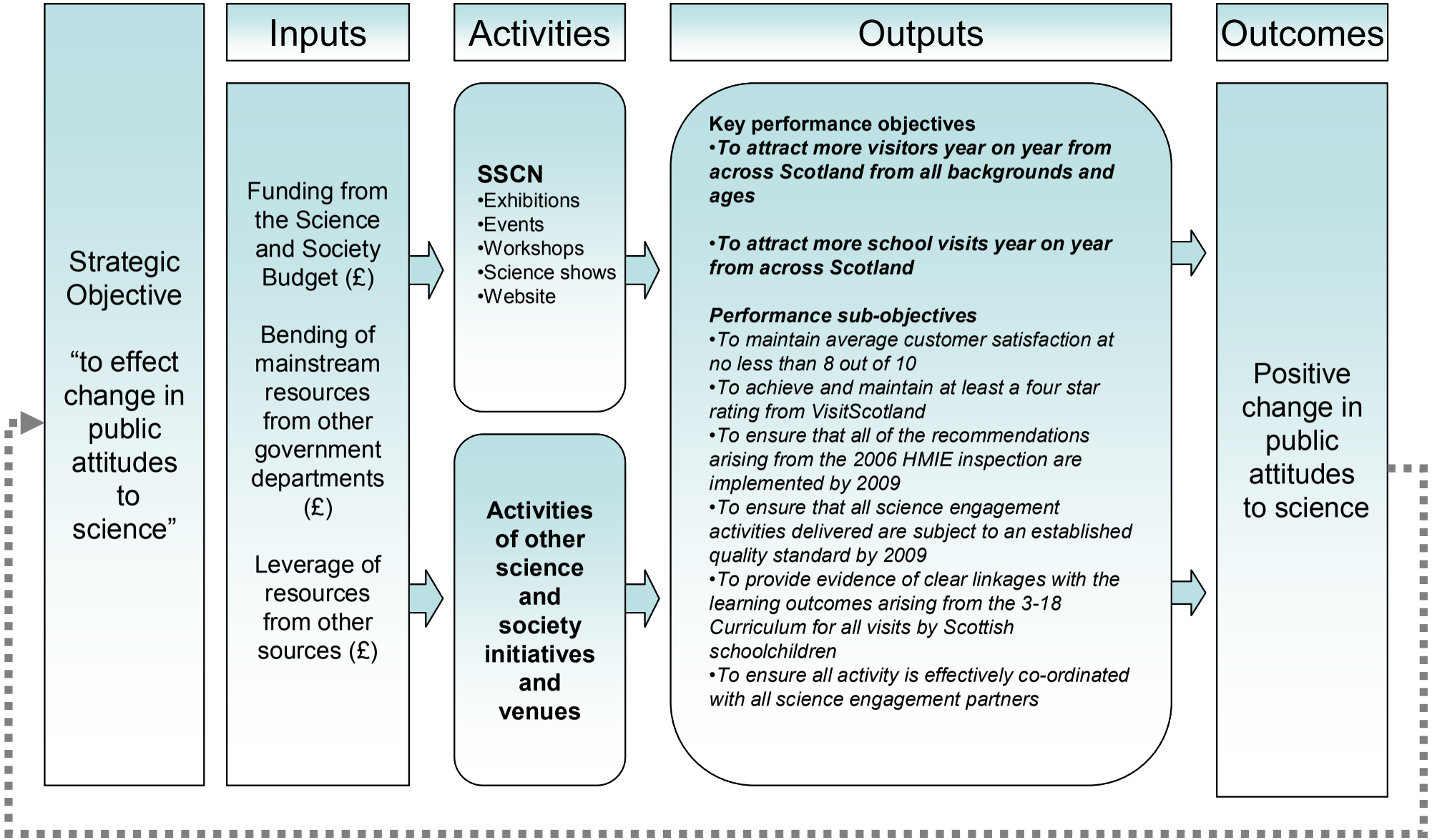
- **Specific** – is there a description of a precise or specific behaviour/outcome which is linked to a rate, number, percentage or frequency?
- **Measurable** – is there a reliable system in place to measure progress towards the achievement of the objective?
- **Achievable** – with a reasonable amount of effort and application, can the objective be achieved?
- **Relevant** – can the people with whom the objective is set, make an impact on the situation. Do they have the necessary knowledge, authority and skill?
- **Time-based** – is there a finish and a start date clearly stated and defined?

5.2.9 Overall, the main purpose of developing SMART performance objectives is to ensure that the progress towards the successful implementation of the SSCN strategy can be clearly measured. Ongoing monitoring of performance objectives ensures that where stated objectives are not being met, corrective action can be taken and projects modified, engendering a culture of learning and continuous improvement.

5.2.10 The performance objectives for the science centres focus on the anticipated outputs as well as taking account of the nature of outputs. As well as two key performance objectives which relate to maximising the number of visitors to the four science centres, a further set of six sub-objectives are also included which relate to the nature of outputs produced by the SSCN. Key issues here are *quality experience, strive to be world class* and *more collaboration and less competition*.

5.2.11 A conceptual framework illustrating the logical flow from the strategic objective through to outputs and outcomes, and outlining the nature of performance objectives is detailed in figure 5.1 below.

Figure 5.1: Strategic Performance Management Framework for Science and Society



5.3 Assessment against performance objectives

5.3.1 In order to determine the level of success in achieving performance objectives, some idea of where the science centres are starting from needs to be established, that is, the baseline needs to be measured. For the purposes of this analysis, the baseline can be taken as the year 2005/2006, which is the first year for the four year Scottish Science Centre Network strategy, which was launched in December 2005. Data has been derived from the corporate and business plans of the four science centres and other financial and management information obtained from the Scottish Government and the science centres themselves.

5.3.2 Once the baseline has been established, then it is necessary to undertake regular monitoring in order to establish progress from the baseline situation and assess the extent to which outcomes have been achieved. Recommendations are provided regarding the monitoring activity that should be undertaken in order to provide a more cohesive framework in which the performance of the science centres can be assessed.

5.3.3 It is interesting to note one of the key anticipated outputs of the strategy is "more visitors of all ages and backgrounds from across Scotland". Indeed, the Ministerial Foreword to the strategy states that "Being accessible to people of all ages and backgrounds throughout Scotland will be the key to the centre's long term future". Therefore to attract more visitors from throughout Scotland from all backgrounds and ages this objective has been selected as a key performance objective for the science centres and is set out in the table below.

5.3.4 In order to assess the socio-economic and geographical profile of visitors, allowing the background and origin of visitors to be monitored, it would be beneficial for full postcode data to be collected for all visitors. All science centres now have cash registers which are able to collect postcode information, although the data is not currently collected in a systematic way including the full postcode. To ensure that evidence is collected to measure the future performance of science centres against this objective it is recommended that facilities are put in place to allow the collection of suitable and relevant data.

Performance Objective	"To attract more visitors year on year from across Scotland from all backgrounds and ages"		
	Number of public visitors (excluding school groups), 2005/2006		
	All visitors	% from Scotland	Scottish visitors
Glasgow Science Centre (Science Mall)	184,826	77%	142,316
Our Dynamic Earth	144,734	46%	66,578
Sensation	50,459	*90% (est)*	*45,413 (est)*
Satrosphere	33,537	*95% (est)*	*31,860 (est)*
All science centres	**413,556**		**286,167**

Source: Scottish Government

5.3.5 Ensuring a higher number of school children coming to the centres is a key performance objective for the network. Visits up to S2 generally account for the vast majority of visits to centres and are less constrained by logistical issues in the schools. For example, this amounts to over 80% of visits at GSC and is likely to be even higher at the other centres. There would be benefits in developing a more sophisticated management information system to be used by all four science centres, to co-ordinate the process of targeting schools and ensuring that each centre was aware of which schools and year groups had made a visit to each of the centres.

Performance Objective	"To attract more school visits year on year from across Scotland"
	Number of onsite school visits, 2005/2006
Glasgow Science Centre (Science Mall)	56,301
Our Dynamic Earth	27,072
Sensation	10,036
Satrosphere	8,883
All science centres	**102,292**

Source: Scottish Government

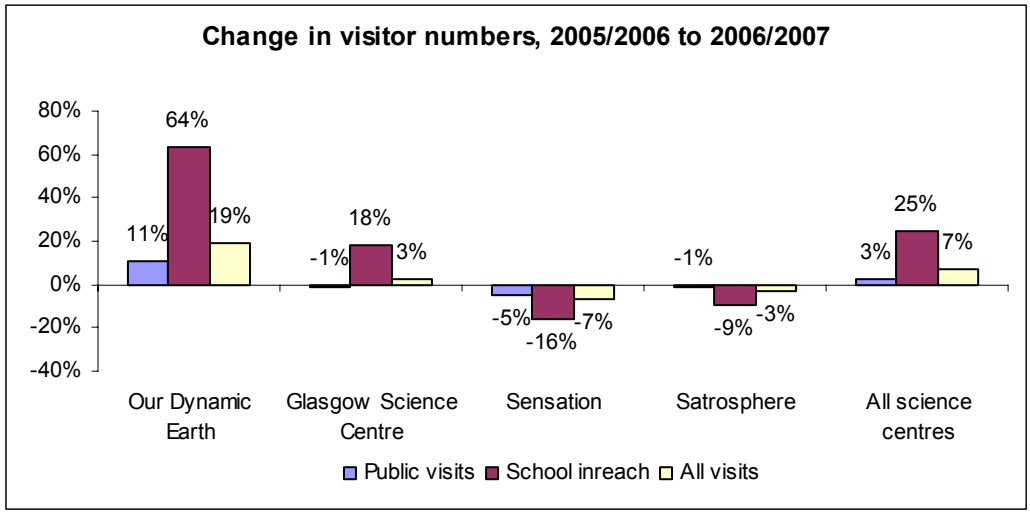
5.3.6 From the baseline position in 2005/2006, progress will be measured against these key performance objectives to assess the success of the strategy.

5.3.7 The figures for 2006/2007 indicate that there has been an overall rise in visitor numbers across the network of 7%, with public visitors rising by 3% and school

inreach by 25% (Figure 4.2). The most significant rise is at ODE, where school inreach has risen by nearly two thirds over the past year, while public visitors have risen by over 10%. GSC has experience an overall rise in total visits by 3%, although this includes a fall of 1% in public visitors. The re-opening of the Kelvingrove Museum after a major programme refurbishment is reported by GSC as a factor in the drop in visitors during 2006.

5.3.8 Both Satrosphere and Sensation have experienced a drop in the number of both public and school visits, amounting to 3% and 7% respectively. Overall, these figures suggest that while ODE is meeting the key performance objectives relating to increasing visitor numbers, these are not being met by GSC in terms of public visits and Sensation and Satrosphere in relation to all visitors.

Figure 4.2: Change in visitor numbers, 05/06 to 06/07



Source: Scottish Government

5.3.9 There is little benefit to be gained attracting more visitors through the door, if this corresponds with a deterioration in the quality of the visitor experience. Therefore, a performance objective relating to customer satisfaction is proposed to ensure that the quality of the visitor experience is maintained against rising expectations. This is important to make sure the measure used is consistent across all the centres and that this can be measured over time. The measures used across the centres are currently not consistent, and it is recommended that this be addressed in order to ensure future comparisons across the network.

Performance Objective	"To maintain average customer satisfaction at no less than 8 out of 10 for all visits"
	Value 2005/2006
Glasgow Science Centre	8.2
Our Dynamic Earth	(not available in this form)
Sensation	(not available in this form)
Satrosphere	(not available in this form)

Source: GSC

5.3.10 Another quality objective would be for the science centres to maintain at least a four star rating from VisitScotland by 2009. All of the science centres currently meet this objective by achieving quality assurance grading from VisitScotland, which is equivalent to an "excellent rating". Sensation is committed to achieving five star status by 2008, which is equivalent to "world class" rating.

Performance Objective	To achieve and maintain at least a four star rating from VisitScotland by 2009
	Status 2005/2006
Glasgow Science Centre	Five stars
Our Dynamic Earth	Five stars
Sensation	Four stars
Satrosphere	Four stars

Source: Scottish Science Centres

5.3.11 The evaluation of the science centres undertaken by the HMIE will be published in 2007. This review will identify best practice, highlight key areas for improvement and provide a set of recommendations for each of the centres. There will be a follow up after one year to assess progress, and this should form a key part of the future strategy of the SSCN. Therefore an additional quality performance objective has been developed as follows:

- **"To ensure that all of the recommendations arising from the 2006 HMIE inspection are implemented by 2009"**

5.3.12 Establishing quality standards for all science communication activities is a key issue for the development and future credibility of the SSCN as well as other deliverers of science communication. There is an issue of market failure where adverse selection can occur if there is not a clear view of the quality of the activities delivered. In these circumstances, a lower quality product will tend to be supplied to the market due to a lack of information regarding quality. This needs to be addressed through the

development of established quality standards and procedures, and potentially the development of a quality science communication brand. Therefore a qualitative performance objective has been developed as follows:

- **"To ensure that all science engagement activities delivered by the SSCN are subject to an established quality standard by 2009"**

5.3.13 There is a clear requirement to ensure that all the activities delivered by the network for school groups are of a high quality and well integrated with the emerging Science curriculum 3-18. The scores below have been based on a review of literature produced by the science centres and the extent to which these demonstrate clear links with the Science curriculum. Given the development of A Curriculum for Excellence, current educational programmes will need to be developed to ensure these linkages are maintained with learning outcomes.

Performance Objective	**"To provide evidence of clear linkages with the learning outcomes arising from the 3-18 Curriculum for all visits by Scottish schoolchildren to the SSCN**
	Status 2005/2006
Glasgow Science Centre	Demonstrates linkages with science curriculum for all science shows and workshops based on 5-14 Curriculum learning outcomes
Our Dynamic Earth	Demonstrates linkages with science curriculum for all workshops based on 5-14 Curriculum learning outcomes
Sensation	Demonstrates linkages with science curriculum for all workshops based on 3-18 Curriculum learning outcomes
Satrosphere	Demonstrates linkages with science curriculum for some workshops and science shows based on 5-14 curriculum learning outcomes

5.3.14 The issue of co-ordination with other agencies involved in the delivery of science education, particularly the universities and SETPOINTs will be important to ensure a more cohesive structure within the sector. With the establishment of a SETPOINT in the Highlands and Islands from April 2007, with the contract being hosted by Highlands and Islands Enterprise (HIE), this provides an opportunity for STEM provision in the region to be given an enhanced impetus and focus. The intention is for HIE, the SETPOINT, key industrial partners and the University of the Highlands and Islands to form a strategic "STEM partnership" forum similar to that which currently exists on Tayside to lend strategic direction to delivery. The effectiveness of the proposed structure will be enhanced if key strategic partnerships are established from the outset between this new structure and the science centres, and that best practice models from the rest of the sector are examined carefully.

Performance Objective	"to ensure all activity is effectively co-ordinated with other science engagement partner organisations".
	Status 2005/2006
Glasgow Science Centre	Partnership approach developed to outreach with four West Coast universities through Science Circus. Engaging with a number of partners such as Learndirect Scotland to deliver community outreach. Potential for greater co-ordination with other deliverers within universities and SETPOINTs
Our Dynamic Earth	Limited outreach activity, delivered jointly with Scottish Seabird Centre. EISF is main outreach provider in South East through Generation Science. Potential for greater co-ordination with other deliverers within universities and SETPOINTs. Some outreach is delivered though University of Edinburgh but this would benefit from better co-ordination and co-operation with other providers
Sensation	Outreach partnership has developed with Satrosphere and SETPOINT Scotland North but there remains potential for greater co-ordination with other deliverers within universities, particularly on Tayside
Satrosphere	Outreach partnership has developed with Sensation and SETPOINT Scotland North and with local industry, but there remains potential for greater co-ordination with other industrial delivery agents that operate in the region, and the Aberdeen universities

5.4 Summary

5.4.1 This section of the report has identified suitable performance objectives and discussed the performance of the SSCN against these stated objectives. The two key performance objectives focus on increasing the number of visitors from all ages and backgrounds in Scotland and are supplemented by a set of six sub-objectives, with a focus on quality and collaboration. The chapter has set these objectives within the context of a performance measurement framework demonstrating the logical flow from inputs, to activities and outputs, which then contribute to the specified outcomes of the strategy.

6 OPTIONS FOR FUTURE INTERVENTIONS

6.1 Introduction

6.1.1 The previous chapter proposed and discussed a number of performance objectives for the science centres, with the key objectives being identified as:

- To attract more visitors year-on-year from across Scotland from all backgrounds and ages
- To attract more school visits from across Scotland

6.1.2 Additional objectives focussing on issues such as quality assurance, integration with the 3-18 curriculum and promoting co-ordination with other agencies were also proposed. These are:

- To maintain average customer satisfaction at no less than 8 out of 10 for all visits
- To achieve and maintain at least a four star rating from VisitScotland by 2009
- To ensure that all of the recommendations arising from the 2006 HMIE inspection are implemented by 2009
- To ensure that all science communication activities delivered by the SSCN are subject to an established quality standard by 2009
- To provide evidence of clear linkages with the learning outcomes arising from the 3-18 Curriculum for all visits by Scottish schoolchildren to the SSCN
- To ensure all outreach activity is effectively co-ordinated with other science engagement partner organisations

6.1.3 The aim of this chapter is to investigate a number of potential interventions in terms of pricing structures that could help to achieve these objectives. The pricing options assessed in terms of future interventions include:

- Universal free entry
- Half price entry
- Free entry for under 18s
- Free entry for school groups
- Half price entry for school groups
- Free transport for school groups

6.1.4 The chapter begins by exploring briefly the impact of universal free entry at other institutions. This is followed by the views received from stakeholders on possible future interventions. The impact on visitor numbers, income and costs is then quantified and analysed before discussing the economic benefits associated with the options. The performance of the various interventions is then measured against the key objectives.

6.1.5 Before exploring these issues in detail, it is important to explain that a number of interviews were carried out and visitors were asked what they considered to be the most important measure to encourage a greater number of people to visit the science centres, based on the marketing mix Price, Product, Promotion and Place. Further details are explained in Annex II, but it is important to highlight the results indicate that the most important measure to encourage people to visit the science centres was price (42%).

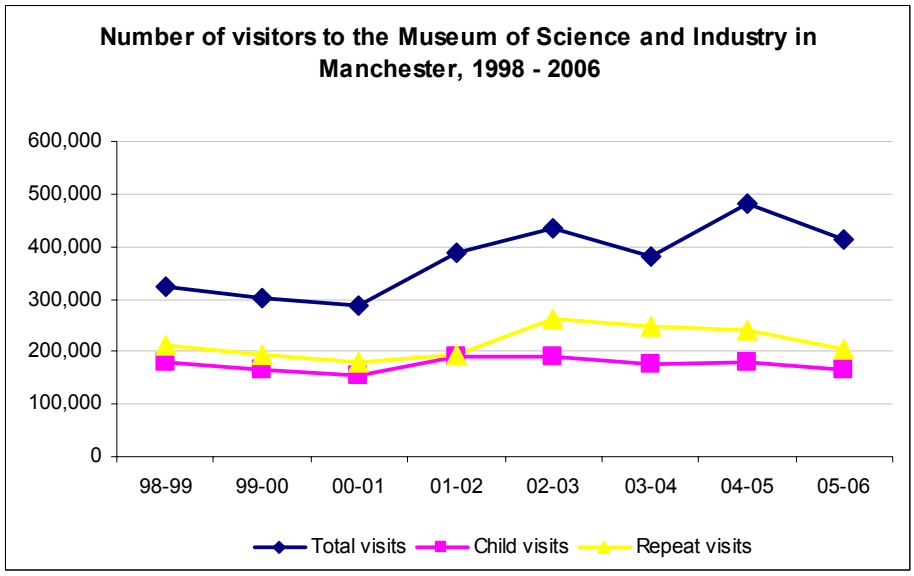
6.2 Evidence on impact of universal free entry

6.2.1 Universal free entry was introduced at all of the UK's National Museums and Galleries in December 2001. This reversed a policy of paid entry which was introduced in many of these institutions during the late 1980s. The policy of free admission was first extended to under 18s in April 1999, and further extended to the over 60s one year later in April 2000.

6.2.2 The impact of free admission has been hailed as a significant success with visitor admissions increasing by a total of 69% in the first year, and by a total of 83% over the five years since charges were removed in 2001[8]. In terms of the two science museums, the Museum of Science & Industry in Manchester and the National Museum of Science and Industry (NMSI), the number of visitors increased by over 50% between 2000/2001 and 2002/2003, equivalent to an additional 1.6m visits. The NMSI consists of the Science Museum in London, National Media Museum in Bradford and the National Railway Museum in York. Out of all these attractions, the Science Museum in London experienced the most significant increase, with visitor numbers doubling over the first year of free admission, equivalent to 1.3m additional visits.

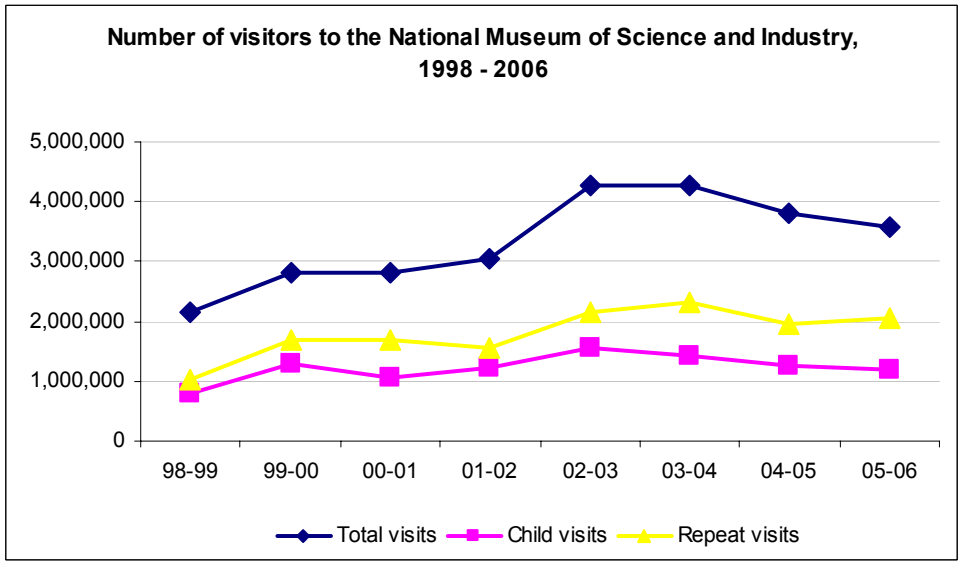
[8] "Tessa Jowell hails inspirational 29 million extra visits to national museums since admission charges scrapped five years ago" Department for Culture, Media and Sport Press Release, December 2006

Figure 6.1: Number of visitors to the Museum of Science and Industry in Manchester, 1998 - 2006



Source: UK Department for Culture, Media and Sport

Figure 6.2: Number of visitors to the National Museum of Science and Industry, 1998 - 2006



Source: UK Department for Culture, Media and Sport

6.2.3 Evidence from these two centres[9] suggests that the profile of visitors has not changed significantly with socio-demographic origin relatively similar before and after the introduction of free admission. Nevertheless, the significant rise in visitor numbers means that they are attracting more visitors from all ages and socio-economic backgrounds. The NMSI states that "in broadening our audiences – attracting a greater proportion of visitors from ethnic/cultural minorities and priority socio-economic groups – a more proactive approach is desirable"

6.2.4 While overall secondary spend in shops and cafes had increased, this was at a lower rate than the overall increase in visitors so that spend per visitor had fallen. Overall, there was evidence that "the advent of free admissions appears to have encouraged significantly more people to make return visits". This had contributed to a change in the pattern of visits with the dwell time decreasing per visit alongside an increasing frequency of visit. According to our survey, one third of visitors stated that their average length of stay at the Scottish science centres would be reduced with the introduction of free entry. The findings suggest that an average visit to ODE would reduce by 13%, equivalent to 13 minutes and average visits to GSC by 21% (35 minutes).

6.2.5 In terms of other key issues to consider with regard to the introduction of free admission, it was highlighted by NMSI that there was a need for additional resources to accommodate increased visitor numbers, including a number of revenue costs such as wear and tear on buildings, security, maintenance and conservation of collections, front of house services and manpower resources. This is also a very important consideration for the science centres as the marginal cost associated with increasing footfall is likely to be even higher for a science centre compared to a museum given the highly interactive and hands-on nature of the exhibits. It was also highlighted by the NMSI that the increased visitor numbers also resulted in congestion at peak periods, which required further capital investment in the fabric of the building.

6.3 Stakeholder views on future interventions

6.3.1 Overall, there was relatively limited support within the science centres as well as with wider stakeholders regarding the implementation of universal free entry. There was reluctance within the science centres as this had implications for exposure to financial risk. They would be less in control of generating revenue and as a result such a development could compromise their independent status. The level of support for free entry to under 18s was much higher, with a general feeling that it would be desirable for this to be introduced within the science centres.

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[9] "National Museums and Galleries: Funding and Free Admission" First Report of Session 2002-03, House of Commons Culture, Media and Sport Committee.

6.3.2 There was particularly strong support for the development of a more systematic and structured support for transport to and from the science centres for school groups. It was reported that there has been a significant rise in the cost of bus travel for school groups, which has made it increasingly difficult for out of school trips to be made. Health and safety, insurance and fuel costs factors have all contributed to this. Several stakeholders highlighted that this was a much wider issue than just for the science centres and it has been raised in the Scottish Government's Cultural Strategy regarding the potential development of subsidised travel for school trips to cultural destinations. It was suggested that a joint Scottish Government strategy would allow for greater economies of scale with regard to the development of a contract to deliver transport for school trips. It was also highlighted that a more long term commitment to a transport scheme could generate greater leverage from private sector sources.

6.3.3 A limited amount of private sector sponsorship of school transport has been generated through the SSCN, which currently benefits from a relatively small allocation of funds to support school trips to the science centres. With a longer term commitment, there is more scope to extend the commitment of the private sector partner.

6.3.4 The development of free entry for school trips to the science centres was though to be very important, although slightly less a priority compared to subsidised transport. It was reported that schools were more willing to pay for the cost of entry to the science centre, and the transport issue was the main barrier to making greater use of the centres (this is supported by survey evidence which will be discussed later in this section). If a school visit to the science centre becomes an integral part of the science curriculum, there will need to be consideration of whether this is funded centrally or through the education authorities and schools. There may be a case for a re-allocation of discretionary budgets to be focused specifically on supporting visits to the science centres, if this type of out of school visit becomes a priority measure for the Scottish Government.

6.4 Quantifying impact of future interventions

6.4.1 Evidence from the impact of free admission on the two science museums and the findings from our survey of visitors have been used to provide estimates of the impact of free admission and other charging regimes on the number of visits to the four Scottish science centres.

6.4.2 Interviews were undertaken at the GSC and ODE as well as at the National Museum of Scotland and Kelvingrove Museum to assess the potential impact of various pricing options on the propensity to visit a science centre. Respondents were asked at the four locations, the number of visits they had made to each of the science centres in the past two years and how this would have changed based on alternative payment scenarios.

6.4.3 The analysis undertaken as part of this study should be treated as a preliminary appraisal of options, which provides an indication of the relative performance of a

number of potential interventions. While the sample size upon which these results are based is comparatively small, the model, methodology and analysis are felt to be robust. A larger sample size, with a more extensive programme of interviews undertaken at different times of the year, would provide more statistically significant results. Such a programme has not been possible at this stage due to cost constraints, though a larger survey could be considered in the future

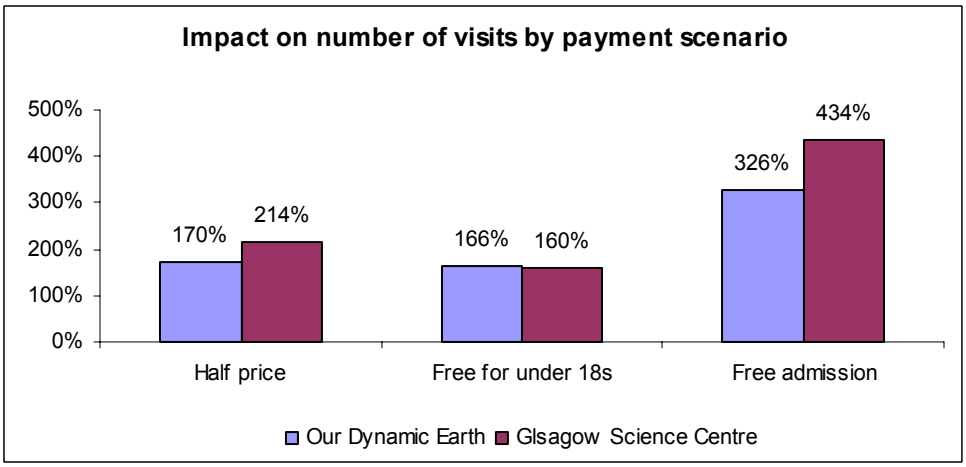
6.4.4 The analysis has assumed that there would not be any capacity constraints associated with the increase in visitors, in terms of the visitor attraction itself, as well as catering, retail and parking facilities. While it is felt that this is a valid assumption, this could be examined in greater detail in order to assess any potential capacity constraints within the network, which would constrain the potential increase in visitor numbers and secondary revenue.

6.4.5 In addition, the analysis has not assessed any potential tax implications of the move towards free entry as well as any potential loss in Gift Aid. The science centres highlighted that if they were re-assessed as VAT exempt due to the removal of entry fees, this could result in substantial clawback of VAT previously recovered relating to capital expenditure, as well as losing the ability to recover VAT on operating costs. Glasgow Science Centre reported that claw back on capital expenditure would amount to £8m, if it were re-assessed as VAT exempt. These tax implications are only an issue in relation to the move towards universal free entry, rather than the other pricing options. Therefore, there is a need for greater consideration of the possible mechanism used to deliver free entry in order to mitigate any potential negative tax implications arising from this policy. For example, the use of a more subtle delivery mechanism for free entry via the National Entitlement Card (rather than free entry for all visitors) could be one means of ensuring that the science centres were still considered as paid visitor attractions, mitigating the risk that they would become VAT exempt. This should also be considered further.

6.4.6 The survey suggested that a reduction of 50% of the admission price for all visitors would lead to an increase of 70% in the number of trips to ODE, and would more than double (114%) the number of trips to the GSC (Figure 6.3). With free entry for under 18s the number of visits would be 66% higher at ODE and 60% higher at Glasgow Science Centre.

6.4.7 The responses from the survey of visitors suggest that the impact of universal free entry would be even more significant with the number of trips at ODE increasing by over three times, and trips to GSC over four times. These figures suggest that the impact of a shift to universal free entry would be higher than the equivalent impact within the national museums which introduced universal free entry in 2001.

Figure 6.3: Impact on number of visits by payment scenario



6.4.8 Repeat visitors who had already been more than once to ODE over the past two years generated the majority of the additional visits as a result of the three alternative payment scenarios (Table 6.1). In terms of generating new visits from people that had not previously been to ODE, around a quarter of new visits would be from this source for both free and half price admission.

Table 6.1: % share of additional visits by visitor type at ODE

Visitor type	Half price	Free for under 18s	Free admission
First visit	15%	14%	20%
Repeat visitors	62%	69%	55%
Never visited	24%	17%	25%
Total	**100%**	**100%**	**100%**

6.4.9 The findings from the survey suggest that those respondents that had never previously been to GSC would generate a much higher proportion of new visits compared to ODE (Table 6.2). This group accounted for 36-37% of new visits for the free and half price scenarios, which increased to 45% for free admission for under 18s.

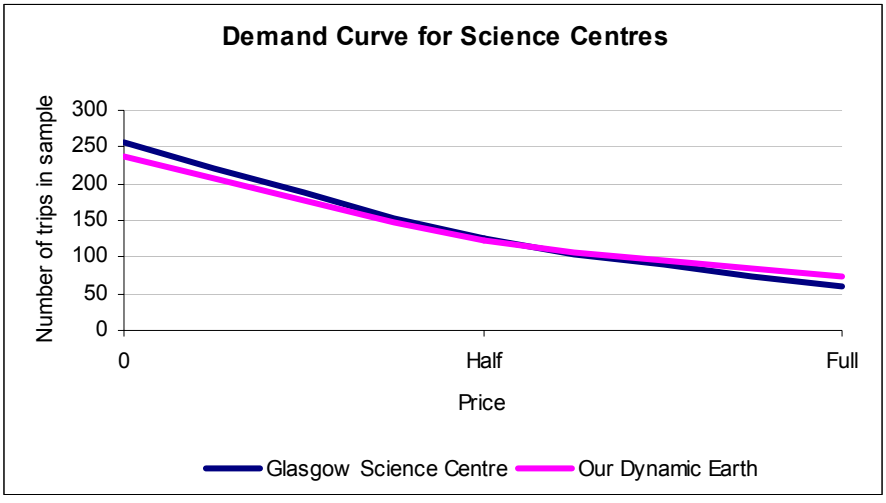
Table 6.2: % share of additional visits by visitor type at GSC

Visitor type	Half price	Free for under 18s	Free admission
First visit	20%	30%	29%
Repeat visitors	31%	25%	35%
Never visited	49%	45%	36%
Total	**100%**	**100%**	**100%**

6.4.10 These findings suggest that the market for visits to GSC is more price sensitive than the market for ODE. This means that a lowering of price will have a greater impact on the number of visits at GSC than at ODE. The fact that GSC is adjacent to a number of socially deprived areas and attracts a lower proportion of tourist visits compared to ODE would tend to support this finding. It also underlines that the centres have a different market profile, and changes in the charging regime will have different impacts at different locations.

6.4.11 The demand curves for ODE and GSC are illustrated in figure 6.4. This shows the number of trips that would be generated within the sample over the past two years based on three charging regimes, full price, half price and free admission. The demand curve for ODE is flatter than that of GSC underlining that the number of trips is less responsive to changes in price and indicating a lower level of price elasticity of demand.

Figure 6.4: Demand curve for visits to science centres

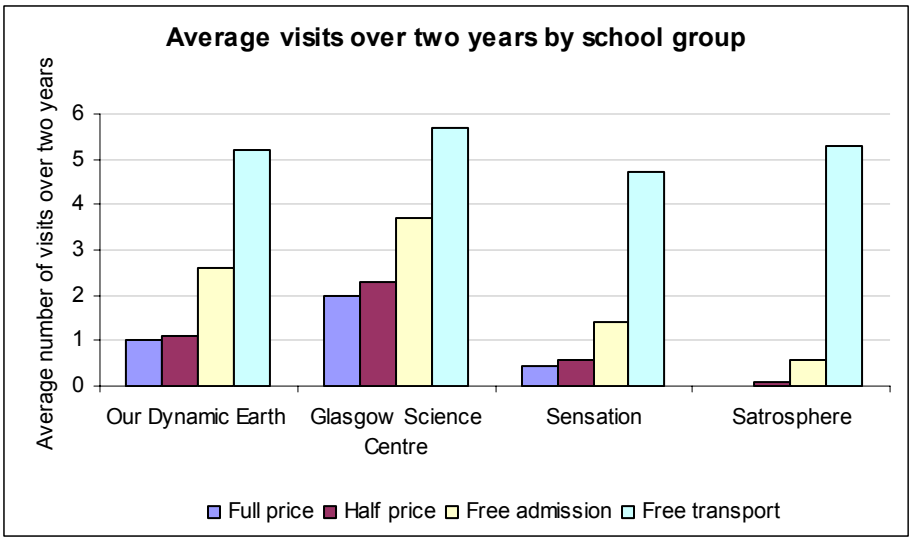


6.4.12 A total of seven school groups were included in the sample, which provides some indication of the impact of school visits of different charging scenarios. Five groups had visited Glasgow Science Centre, two had visited ODE and one had visited Sensation. Across the seven schools the average number of visits over the past two

years was around one at ODE and two at GSC. The impact of half price admission was very small, while there was a moderate impact arising from free admission (Figure 6.5).

6.4.13 The greatest impact for school groups arose with the introduction of free transport to the science centres, with the average visits over the past two years increasing to around five for all four science centres. It is interesting to note how free transport would result in significant rise in visits to Sensation and Satrosphere, from the school groups, who were much less likely to visit these centres under the other three payment scenarios.

Figure 6.5: Average visits over two years by school group



6.4.14 By extrapolating the data gathered in the surveys it has been possible to estimate the impact on visitor numbers, income and costs across the science centre network and a summary of the potential impacts of the various future interventions are set out in the table below. More details of the assumptions and data underpinning the model are outlined in Annex III, which also contains details of the potential impacts on each of the four science centres.

Table 6.3: Summary of impacts of future interventions

	Universal free entry	Half price admission	Free admission under 18s	Free admission for schools	Half price admission for schools	Free transport for schools
Increase in visitors (000s) per annum	1,180	389	259	138	20	276
Change in admission income (£000s)	-£1,739	-£56	£23	-£379	-£150	£1,073
Change in retail and café income (£000s)	£1,708	£560	£388	£0	£0	£0
Change in parking income (£000s)	£454	£147	£110	£0	£0	£0
Change in gross income (£000s)	£423	£651	£521	-£379	-£150	£1,073
Compensation for increased operating costs (£000s)	£2,949	£972	£647	£691	£102	£1,382
Payment for transport costs (£000s)	£0	£0	£0	£0	£0	£2,244
Total compensation required (£000s)	£2,527	£322	£126	£1,070	£251	£2,553
Payment per additional visit	**£2.14**	**£0.83**	**£0.49**	**£7.74**	**£12.37**	**£9.24**

Source: Halcrow and Scottish Government

6.4.15 On the basis of the analysis, universal free entry would result in the biggest impact on visitor numbers, resulting in an estimated 1.2m additional visits to the four science centres. While this would result in a loss of admission income, this would to a large extent be compensated for by an increase in secondary income from retail, café, and car parking. However, there could be a substantial increase in operating costs due to the increase in visitors, and so the overall increase in public grant is estimated at just over 2.5m[10]. This equates to £2.14 for every additional visitor to the science centres.

6.4.16 The analysis suggests that free admission for under 18s was the only payment scenario where there would be an increase in total admission income compared to the status quo. The results from the survey suggest that a charging regime where there were no admission charges for under 18s would basically be revenue neutral for both GSC and ODE, as the reduction in income would be fully compensated for by new visits by paying adults. Overall, revenue is estimated to rise by 1% at both centres under this scenario. However, in order to ensure that there was no loss in admission income, it is likely that the move to free admission for under 18s would need to be

[10] The estimated cost increase is based on a figure of £2.50 for each additional visitor. If the increase in operating costs per visitor was lower than this then the compensation figure would decline across each of the options.

accompanied by a significant level of publicity to raise awareness of this new policy amongst the general public.

6.4.17 On the basis of the analysis, the introduction of half price admission would lead to a rise in admission income at GSC, while admission income would fall at the other three centres. The analysis suggests GSC would benefit from a rise in admission income due to an elastic price elasticity of demand, whereby the percentage increase in demand would be higher than the percentage fall in price. Of all the proposed options, the survey findings suggest that free admission for under 18s would be the most cost effective, with an estimated payment of just 49p required for each additional visit.

6.4.18 In terms of the three potential interventions focused on school groups, the analysis suggests that free transport for schools would generate the greatest increase in visits, amounting to 276,000 additional visits per annum. This option generated the most significant increase in admission income for the science centres, given that they benefit from increased demand without any lowering of admission prices. Overall, it is estimated that this option would require an increased public grant of more than £2.5m, significantly more than the other options for school visits. Overall, the option for half price admission for school groups performs the least well in terms of cost effectiveness. This is because the fall in admission price only leads to a very small increase in school visits, but this fall in income would need to be compensated for by an increase in public financial support.

6.4.19 So far in this section, each of the options has been considered in terms of the additional financial cost that would be involved, due to an increase in visitor numbers, in terms of public sector support. It is recognised however that each of these policies could generate other benefits, in economic and social terms, that need to be weighed against the costs. While it is not proposed to carry out a full cost benefit analysis exercise here, there is a need however to assess whether the benefits to society as a whole associated with a particular intervention are likely to outweigh the costs.

6.4.20 The underlying rationale for government intervention in the form of policies, programmes or projects can be justified through two principal means, namely economic efficiency and/or equity considerations.

6.4.21 The rationale for intervention based on economic efficiency is associated with the concept of market failure whereby the market mechanism alone is not able to deliver an outcome which is optimal. The main justification underlining the rationale for government intervention in the science centres is the existence of positive externalities. These result when there are wider benefits which accrue which are not directly priced into the market. In terms of educational outcomes in science and technology, this relates to the benefits to the wider economy of a high quality and productive labour market, and the contribution of science and technology as key drivers of long-term economic growth.

6.4.22 It is clear that improving long-term economic growth and economic prosperity is dependent on improving technical progress within the economy. Endogenous growth theory provides the theoretical foundations for government intervention to improve the level of technical progress. The key driver is the accumulation of knowledge and developing an economy with a strong focus on Research, Design and Development (RD&D). Therefore this underlines the importance of science and technology as the key driver of long-term economic growth.

6.4.23 The question is therefore whether the long-term benefits to the economy generated by the increase in visitors to the science centres for each intervention is sufficient to outweigh the additional funds to the public sector. Breaking this down into specific linkages, raises the question of whether there is clear evidence that visiting a science centre leads to greater interest in science. Does an interest in science then lead to individuals taking more science subjects at school and then to schoolchildren choosing to take a science related degree at university? In addition, do graduates subsequently take up a career in the science and technology sector, contributing to greater productive capacity in the Scottish workforce? These causal relationships, between visiting a science centre and benefits feeding through to the economy, are difficult to prove.

6.4.24 If one does assume however that there is a positive correlation between visiting the science centres and long-term economic performance, then the option that generates the greatest number of visitors is clearly universal free entry. The analysis suggests that this would result in a 300% increase in the number of visitors across the network. The downside of this option is that it would lead to an additional funding requirement of £2.5m per annum.

6.4.25 The lowest cost option, in terms of additional public subsidy, is to allow free entry for under 18s. The analysis suggests that this option would result in an increase in costs of around £0.125m per annum, while at the same time increasing visitor number by 65%. If the linkages between an increase in the number of visitors and economic performance discussed above are correct then this intervention would offer a low-cost option to achieve this.

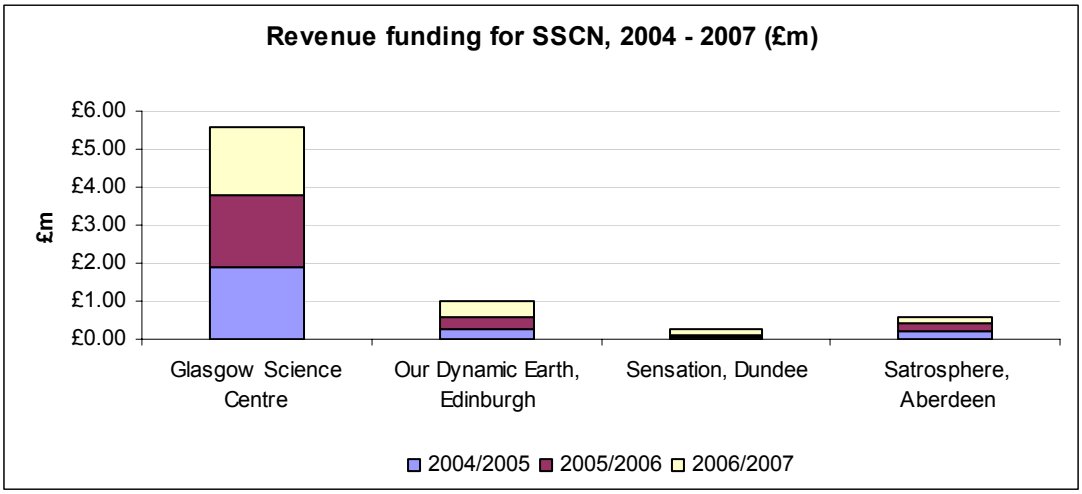
6.4.26 An alternative would be to adopt a staged approach, as introduced by the National Museum of Science and Industry. This could involve an initial decision to allow free entry for under 18s and then universal free entry at a later date.

6.5 Sustainability of future funding

6.5.1 The original business cases for each of the science centres in Scotland indicated that they would generate sufficient revenues to cover their costs and would be financially viable. It has become increasingly apparent however from their inception that the science centres will require on-going financial support, likely to be from central government, if they are to continue to operate. The commitment of the Scottish Government to provide capital and revenue funding for the four Scottish science centres has secured their longer term viability and ensured that they were much better placed to develop their mission in science communication.

6.5.2 The total funding that has been allocated to the SSCN over the three years from 2004/2005 to 2006/2007 has amounted to £10.4m. Over 70% of this expenditure related to revenue support, and the remainder related to capital expenditure (18%) and education related projects (11%). Over the three years, three quarters of the revenue funding support was provided to GSC, amounting to nearly £5.6m with only 4% to Sensation in Dundee (£263k) (Figure 6.6).

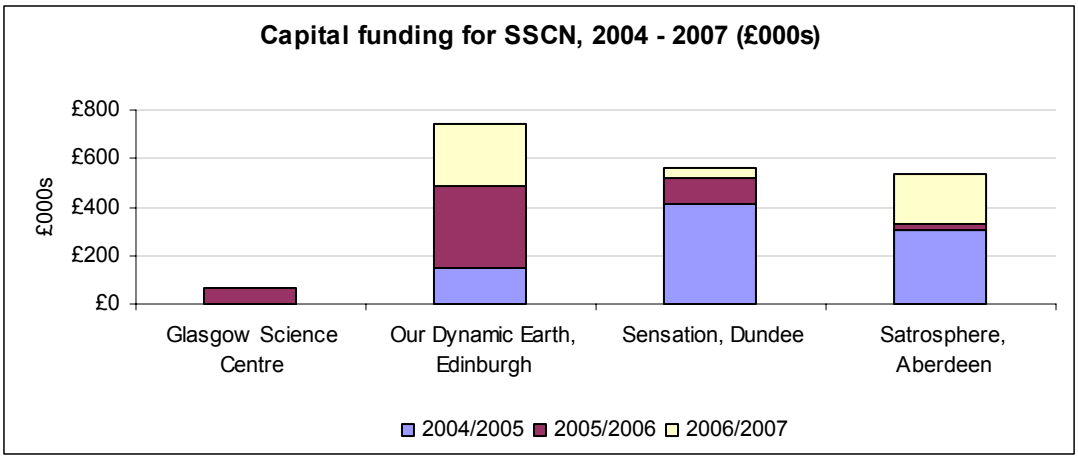
Figure 6.6: Revenue funding for SSCN, 2004 - 2007



Source: Scottish Government

6.5.3 Capital funding allocated to the science centres over the three year period amounted to £1.9m. This capital funding ensured that significant improvements were undertaken relating to infrastructure and exhibitions, and leveraged further funding from other sources including the Millennium Commission ReDiscover grant programme. Nearly 40% of this grant funding was allocated to ODE and only 3% to GSC (Figure 6.7). The GSC endowment fund, which provided another source of public funding for capital improvements at GSC, was their main source of infrastructure funding in addition to funds from the Scottish Government.

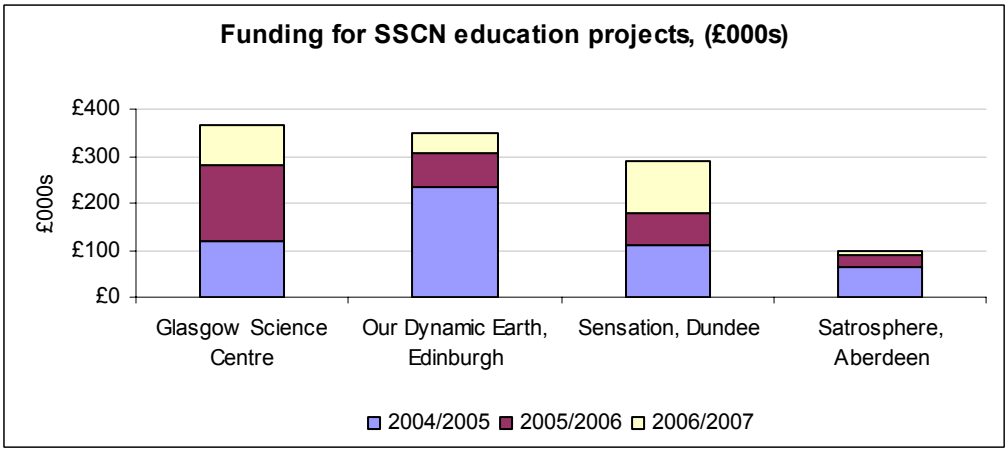
Figure 6.7: Capital funding for SSCN, 2004 – 2007 (£000s)



Source: Scottish Government

6.5.4 A further £1.1m was allocated to education projects across the SSCN. Around a third of this funding was allocated to both GSC and ODE, while Satrosphere received the lowest allocation (9%) (Figure 6.8).

Figure 6.8: Funding for SSCN education projects (£m)



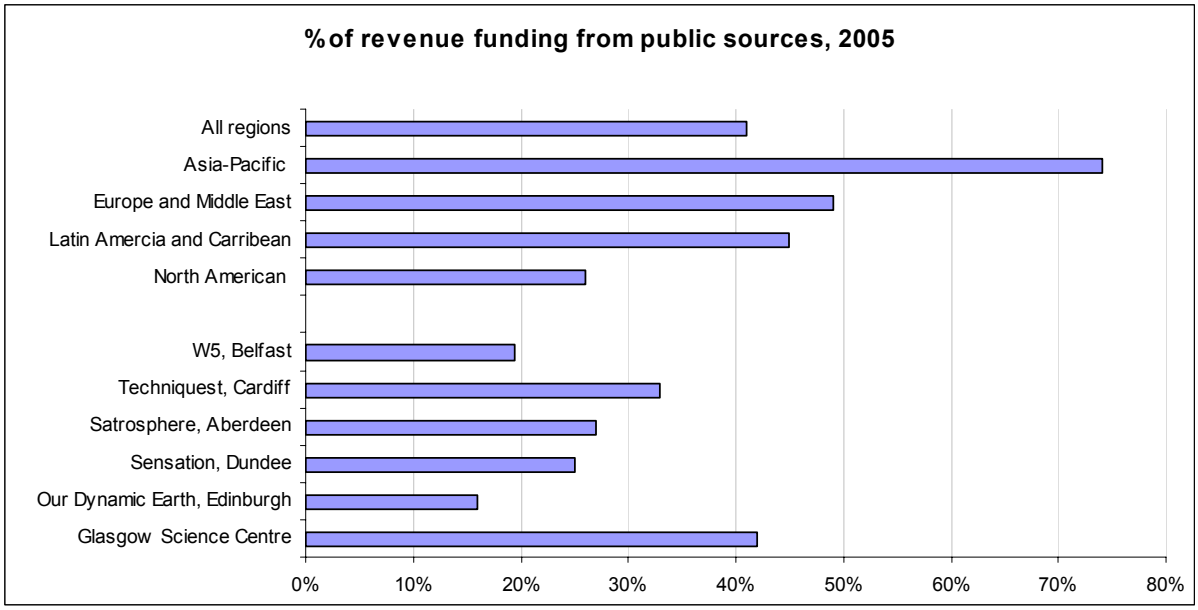
Source: Scottish Government

6.5.5 The Jura Report[11] underlined that ongoing public revenue support was required to ensure the future viability of the centres. This is backed by international evidence which demonstrates that with the exception of a small number of science centres in the US which are completely self funding, public subsidy is required.

[11] "Development of the Concept for a National Science Centre" Final Report, Jura Conultants, March 2004

6.5.6 An international survey of science centres undertaken by the Association of Science Technology Centres (ASTC) [12], which included responses from around 200 science centres across 35 countries demonstrated that public funding accounted for an average of 41% of total income. In North America, this was lowest at an average of 25% and highest in the Asia-Pacific region at 74%. (Figure 6.9).

Figure 6.9: % of revenue funding from public sources



Source: ASTC, Scottish Government, W5 and Techniquest

6.5.7 In terms of the science centres in Scotland, ODE had the lowest proportion of revenue funding from public sources at around 16% in 2005/2006, while the proportion was highest at GSC at 42%. In comparing the level of public funding with other established science centres within the UK, Techniquest in Cardiff has a well established relationship with the Welsh Assembly Government and receives one third of its total funding from this source, particularly to support its schools programme. W5 in Belfast receives a public subsidy amounting to 20% of total income. For the forthcoming financial year beginning in April 2007, W5 will no longer receive any deficit funding, with all public support being linked directly with funded programmes.

6.5.8 The funding approach adopted by the Scottish Government has focused on encouraging an absolute reduction in the level of core funding, while being matched by an increase in funding for "value added" activities such as educational provision, events, workshops, etc. While this approach is laudable, it is clear that the existing funding structure continues to cover core funding and is not financially sustainable in

[12] "Assessing the Economic Impact of Science Centers on their Local Communities" Ilze Groves, Questacon – the National Science and Technology Centre, February 2005

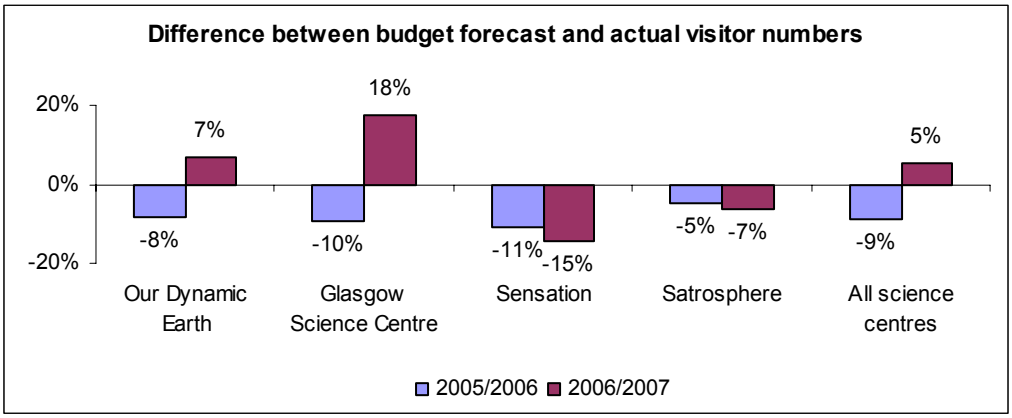
the long term. It does not provide any direct incentives for the science centres to focus on achieving their main objective while at the same time reduce their funding requirement and improve their financial performance.

6.5.9 A change in emphasis, where funding is correlated more with outputs being delivered by the four centres, is reported by all of the science centres as the best means of negotiating the future funding of the network. This approach would be consistent with the performance management framework outlined in chapter five, and would relate inputs directly with outputs through the performance objectives. By linking funding directly with the performance objectives, this provides a clear incentive for these performance objectives to be met.

6.5.10 The key performance objective outlined previously was "To attract more visitors year on year from across Scotland from all backgrounds and ages". Currently, with a deficit funding model, there is limited incentive for this objective to be achieved. The centres currently provide an estimate of forecast visitor numbers as part of the grant application process, although this is not directly related to the funding that they receive (the funding tends to simply reflect the financial deficit).

6.5.11 In most cases, the visitor forecast was higher than actual visitor numbers. The only exception was ODE and GSC, both of which experienced actual visitor numbers for 2006/2007 which were higher than forecast in the application for funding (Figure 6.10)[13].

Figure 6.10: Difference between forecast and actual visitor numbers



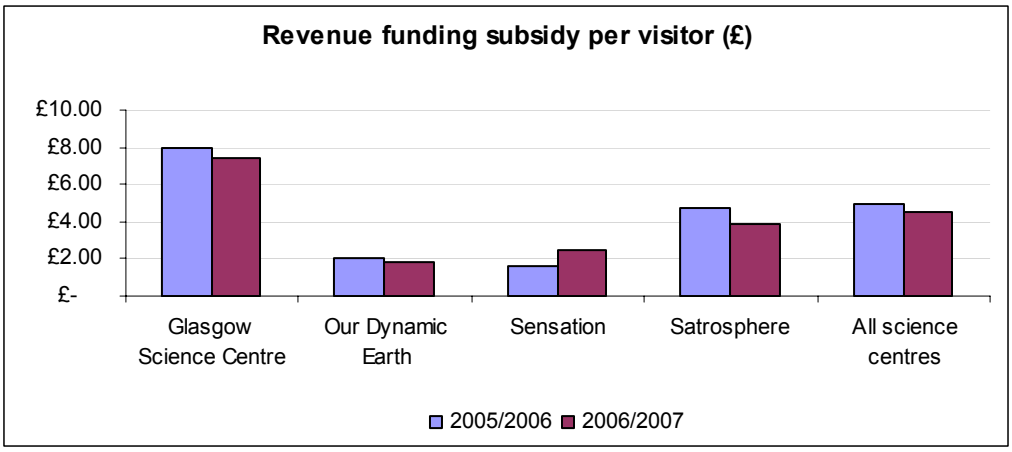
6.5.12 In terms of comparing the actual number of visitors with the level of revenue support, the average subsidy across all the science centres was £4.98 per visitor[14] in

[13] The figures refer to onsite visitor numbers, including public visit and school inreach, which is the focus for the performance objectives (i.e. does not include school outreach)

[14] This includes public visitors and school inreach and excludes outreach

2005/2006, which had fallen to £4.53 for 2006/2007 (Figure 6.11). The level of subsidy per visit has fallen for GSC, ODE and Satrosphere, while it has risen for Sensation. The subsidy per visitor at GSC remains over 2.5 times the average of the other three centres.

Figure 6.11: Revenue funding subsidy per visitor (£)



6.5.13 Table 6.4 below shows, for 2005-06, the number of visitors at each of the science centres and also the level of revenue funding from the Scottish Government. It is clear from the table that the share of public sector support for all of the science centres does not reflect the share of total visitors. For example, while the Glasgow Science Centre's share of total visitors was just under 45%[15], its share of total funding was just under 75%. At Our Dynamic Earth on the other hand, the share of total visitors was 35% compared to its share of total revenue funding of 14%.

[15] 47% including school inreach

Table 6.4: 2005-06 Visitor Numbers[16] and Revenue Support

	Visitors	% of total	School inreach	% of inreach total	Visitors and inreach	% of total	Revenue Support (£s)	% of Total
GSC	184,826	44.7	56,301	55	241,127	46.7	1,891,000	74.3
ODE	144,734	35.0	27,072	26.5	171,806	33.3	359,000	14.1
Sensation	50,459	12.2	10,036	9.8	60,495	11.7	96,000	3.8
Satrosphere	33,537	8.1	8,883	8.7	42,420	8.2	199,000	7.8
Total	**413,556**	**100**	**102,292**	**100**	**515,848**	**100**	**2,545,000**	**100**

Source: Scottish Government

6.5.14 Linking public sector financial support more clearly with outcomes through a set of performance objectives would provide a strong incentive for objectives to be achieved. The performance management framework presented in the previous chapter presents two key performance objectives relating to the number of visitors underpinned by a set of sub-objectives relating to quality and collaboration. This would ensure that the quality of outputs was maintained and developed. It would also encourage partnership working and leverage from other sources, in order to maximise the outputs that could be achieved through funding from the Science and Society budget. It is therefore recommended that the Scottish Government adopt a funding formula, related to the performance against objectives, for the provision of on-going financial support for the science centres.

6.5.15 It is also recommended that the formula used is straightforward and transparent and the revenue funding reflects the key objectives, particularly the share of total visitor numbers. For example, the simplest formula would be for the Scottish Government to announce at the beginning of the year the total amount of revenue funding available and to allocate the funding to each science centre on the basis of the share of total visitors at each centre. An additional condition could be that the quality objectives are met. All payments could be made on a quarterly basis, with a core payment made in each quarter and a "funding adjustment payment" made in the following quarter when the visitor numbers become available.

6.5.16 During the course of this study a number of potential funding formulae have been considered for future use. Some of these have reflected different levels of payments

[16] Does not include school outreach

for different types of visitors. For example, the funding allocation could include a core payment to reflect the share of total number of visitors at each science centre, with additional payments to each of the science centres reflecting the number of visitors from target groups, such as schoolchildren and people from disadvantaged communities. The higher the number of targeted groups however, the more sophisticated the formula becomes and the more difficult it is collect the necessary data and apply the formula effectively. For example, it may not be possible to gather the required data on social background for all visitors. It is therefore recommended that an outcome based approach to funding be adopted by the Scottish Government and that the formula used is straightforward and transparent and that the revenue funding reflects the key objectives and the share of total visitor numbers.

6.5.17 If social background is to be taken into account in the formula, one key consideration is the extent to which a formula which focuses on visitor's social grade can be used in relation to moving to a policy of universal free entry. The National Museums that have moved to a system of free admission have been compensated through an increase in the block grant payment, rather than relating this directly to the increase in visitor numbers. The recommended mechanism for capturing data on the age group and origin of visitors to determine their socio-demographic profile, would be through capturing postcode data at the cash registers. However, with free entry, cash registers would no longer be required and another mechanism would need to be developed to capture this data.

6.5.18 One development which could be integrated with the development of free entry to the science centres is the National Entitlement Card (NEC) scheme. The NEC is an electronic smart card which is issued by the Scottish Government through local authorities. It was launched on 1 April 2006 to coincide with the start of the Scotland-wide National Concessionary Travel Scheme. Eventually the National Entitlement Card will be available to everyone in Scotland.

6.5.19 The NEC provides access to a range of public services both locally and nationally. Other services are likely to be added to the card as they become available, such as library membership The smartcard technology used in the card enables it to be used for cashless transactions, and is being used for this purpose for secondary school catering. This could provide a mechanism to monitor and manage free admission to the science centres, as a national cultural entitlement.

6.6 Summary

6.6.1 The aim of this chapter has been to investigate a number of potential interventions in terms of pricing structures that could help to achieve the performance objectives developed for the SSCN.

6.6.2 In terms of the impact of free admission on the two science museums in England, the Museum of Science & Industry in Manchester and the National Museum of Science

and Industry (NMSI), the number of visitors increased by over 50% between 2000/2001 and 2002/2003, equivalent to an additional 1.6m visits.

6.6.3 The responses from our survey of visitors suggest that the impact of universal free entry would result in the number of trips at ODE increasing by over three times, and trips to GSC by over four times. These figures suggest that the impact of a shift to universal free entry would be higher than the equivalent impact within the national museums which introduced universal free entry in 2001.

6.6.4 Overall, there was relatively limited support within the science centres as well as with wider stakeholders regarding the implementation of universal free entry. The level of support for free entry to under 18s was much higher, with a general feeling that it would be desirable for this to be introduced within the science centres. There was also particularly strong support for the development of a more systematic and structured support for transport to and from the science centres for school groups.

6.6.5 On the basis of our analysis, universal free entry would result in the biggest impact on visitor numbers, resulting in an estimated 1.2m additional visits to the four science centres. While this would result in a loss of admission income, this would to a large extent be compensated for by an increase in secondary income from retail, café, and car parking. However, there could be a substantial increase in operating costs due to the increase in visitors, and so the overall increase in public grant is estimated at just over 2.5m.

6.6.6 The lowest cost option, in terms of additional public subsidy, is to allow free entry for under-18s. The analysis suggests that this option would result in an increase in costs of around £0.125m per annum, while at the same time increasing visitor number by 65%. One possible approach to implementation would be the adoption of a staged approach, as introduced by the National Museum of Science and Industry. This could involve an initial decision to allow free entry for under-18s and then universal free entry at a later date.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1.1 The main purpose of this study has been to inform policy, delivery and future commitments to the Scottish Science Centre Network (SSCN). This has included the development of performance objectives, a review of performance against these objectives and an assessment of a number of future policy interventions.

7.1.2 The SSCN was established in 2005 to promote greater collaboration and networking between Scotland's four main science centres and other key stakeholders within industry, education and the wider community. The total funding that has been allocated to the SSCN over the three years from 2004/2005 to 2006/2007 has amounted to £10.4m. Over 70% of this expenditure related to revenue support, and the remainder relating to capital expenditure (18%) and education related projects (11%).

7.1.3 There are four key themes emerging from the Science Strategy for Scotland where the science centres are well placed to make a unique and worthwhile contribution. These correspond to the four network policy areas articulated in the SSCN strategy and include:

- Complementing, enhancing and supporting the 3-18 Science Curriculum
- Profiling careers in Science, Technology, Engineering and Mathematics
- Disseminating scientific research and discussing relevance and application in society
- Showcasing new products and processes and discussing relevance and application in society

7.1.4 The consultations did underline that there remains a broad range of views regarding the role of the science centres and the extent to which they should extend their role beyond a perceived core function, which was focused on their contribution to engaging children, primarily of primary school age in science and technology. Contributing to the 3-18 Science Curriculum is widely accepted by the vast majority of stakeholders as a central and core function of the science centres. However, it was underlined by the then Scottish Executive Education Department that currently the science centres are considered to be only one of a number of resources that could be used to support the outcomes arising from A Curriculum for Excellence.

7.1.5 While a number of examples of best practice were highlighted in the consultations, the SSCN was still considered to be in the early stages of development with a much greater emphasis being given to areas for improvement. A key area will be the identification and dissemination of best practice arising from the independent review of education provision undertaken by the HMIE.

7.1.6 While greater collaboration and sharing of best practice was developing in relation to the science centres' education provision and contribution to the science

communication agenda, there was no evidence of best practice being identified and disseminated in relation to the more commercial aspects of the businesses such as catering, hospitality and facilities management. The differing scale and nature of operations between the science centres limits the potential for greater collaboration in these areas.

7.1.7 The relationship between the SETPOINTs and the SSCN is of critical importance and the linkages between these two networks need to be developed much further. In terms of greater networking with science centres outside Scotland, the development of a "Celtic Fringe" Network was strongly supported by both Techniquest in Cardiff and W5 in Belfast as well as the science centres in Scotland.

7.1.8 The study has highlighted that the strategic objective of the funding delivered by the Science and Society Team within the Scottish Government is "to effect change in public attitudes to science". It should be noted that while the science centres are one of the principal means through which this objective can be achieved, there could also be other means used in order to meet this objective such as through other science and society initiatives and venues.

7.1.9 One of the main objectives of this study was the development of a set of performance objectives, and it is recommended that these should be used to measure the future performance of the science centres.

Recommendation One:

This review recommends that a set of performance objectives be introduced for measuring the future performance of the science centres. For measuring performance, the key objectives should focus on:

- **attracting more visitors year on year from across Scotland from all backgrounds and ages**
- **attracting more school visits year on year from across Scotland**

7.1.10 The figures for 2006/2007 indicate that there has been an overall rise in visitor numbers across the network of 7%, with public visitors rising by 3% and school inreach by 25%. The most significant rise is at ODE, where school inreach has risen by nearly two thirds over the past year, while public visitors have risen by over 10%. GSC has experience an overall rise in total visits by 3%, although this includes a fall of 1% in public visitors. Both Satrosphere and Sensation have experienced a drop in the number of both public and school visits, amounting to 3% and 7% respectively. Overall, these figures suggest that while ODE is meeting the key performance

objectives relating to increasing visitor numbers, these are not being met by GSC in terms of public visits and Sensation and Satrosphere in relation to all visitors.

7.1.11 The two key performance objectives have been supplemented by a set of six sub-objectives, with a focus on quality and collaboration. These include:

- To maintain average customer satisfaction at no less than 8 out of 10
- To achieve and maintain at least a four star rating from VisitScotland
- To ensure that all of the recommendations arising from the 2006 HMIE inspection are implemented by 2009
- To ensure that all science engagement activities delivered are subject to an established quality standard by 2009
- To provide evidence of clear linkages with the learning outcomes arising from the 3-18 Curriculum for all visits by Scottish schoolchildren
- To ensure all activity is effectively co-ordinated with all science engagement partners

7.1.12 While these performance objectives are specifically relevant to the four science centres, they also have relevance to all science communication activities delivered in Scotland. One of them will also require a lead from the Scottish Government in terms of facilitating implementation. This is detailed in relation to the following recommendation, which has particular reference to school and community outreach activities which are delivered by a number of organisations such as science centres, SETPOINTs and universities.

Recommendation Two:

This study recommends that all science engagement activities funded by the Scottish Government are subject to agreed quality procedures and standards.

7.1.13 The SSCN is one of a number of entities that are developing as key players with regard to science communication. ECSITE-UK is the national body of science and technology centres, and is the main UK forum for networking for science centres. All of the Scottish science centres are members of ECSITE UK alongside eight other organisations in Scotland, including a number of museums, visitor centres and the Edinburgh International Science Festival. These 12 organisations attract over 2.3m visits every year, 20% of which is accounted for by the four science centres.

7.1.14 Alongside the Scottish members of ECSITE-UK, SETPOINT Scotland operates a number of regional networks. It acts as a focus for STEM activity, delivering science communication outreach in schools and organising a number of science festivals. The other key sector is higher education which is involved in delivering STEM outreach as well as a number of qualifications in Science Communication. The value of a

collective branding for science engagement activities should be further explored as a means of further raising the profile of the science communication sector in Scotland.

Recommendation Three:

This review recommends that the Scottish Government should consider the broadening and deepening of the Scottish Science Centres concept to include these other players involved in the delivery of science engagement activities.

7.1.15 Although profiling careers in Science, Technology, Engineering and Mathematics was generally perceived by all consultees to be a central function of the science centres, their role was more in terms of facilitating the work of other agencies. A number of initiatives have been developed by Careers Scotland in relation to STEM activity, and some of these have been highly regarded as examples of best practice. Given the re-organisation of Careers Scotland and the possible re-focussing of activities towards other priorities, such as the NEET group (not in employment, education, or training), there is a need to consider how these initiatives can be best developed in the future.

Recommendation Four:

This review recommends that consideration should be given to ensuring that the momentum built up in relation to Careers Scotland STEM initiatives is not lost, and a review is undertaken of the most appropriate future delivery mechanisms for these activities.

7.1.16 In terms of disseminating scientific research and showcasing new products and processes, these roles were perceived as more peripheral by a large number of stakeholders, with an emphasis on facilitation rather than pro-active development. The SSCN Strategy places a strong emphasis on value of the science centres as a platform for disseminating research and profiling new products and processes by developing further linkages with higher education and industry. While these linkages currently remain underdeveloped, there is evidence of growing joint activity, particularly with a number of higher education institutes, through initiatives such as Meet the Scientist. However, links with industry remain more limited.

Recommendation Five:

This review recommends that there needs to be greater practical consideration regarding the means through which industry and further and higher education linkages can be fostered and further developed, with lead agencies identified, in order to ensure that this policy aim can be achieved.

7.1.17 The impacts of a number of potential future policy interventions have been investigated, including:

- Universal free entry
- Half price entry
- Free entry for under 18s
- Free entry for school groups
- Half price entry for school groups
- Free transport for school groups

7.1.18 Evidence from the two science museums in London and Manchester and the findings from our survey of visitors have been used to provide estimates of the impact of free admission and other charging regimes on the number of visits to the four Scottish science centres.

7.1.19 On the basis of the analysis, universal free entry would result in the biggest impact on visitor numbers, resulting in around 1.2m additional visits to the four science centres. While this would result in a loss of admission income, this would be compensated for by an increase in secondary income from retail, café, and car parking. However, it is assumed that this would result in a substantial increase in operating costs due to the increase in visitors, and so the overall increase in public grant is estimated at just over £2.5m. This equates to £2.14 for every additional visitor to the science centres.

7.1.20 The analysis suggests that free admission for under-18s would be the only payment scenario where there would be an increase in total admission income compared to the status quo. The results from the survey suggest that a charging regime where there were no admission charges for under 18s would basically be revenue neutral for both GSC and ODE, as the reduction in income would be fully compensated for by new visits by paying adults. On the basis of this analysis, admission income would rise by 1% at both centres under this scenario. However, in order to ensure that there was no loss in admission income, it is likely that the move to free admission for under-18s would need to be accompanied by a significant level of publicity to raise awareness of this new policy amongst the general public.

7.1.21 On the basis of the analysis, the introduction of half price admission would lead to a rise in admission income at GSC, while it would fall at the other three science centres. Of all the proposed options, free admission for under-18s would be the most cost effective, with an estimated payment of just 49p required for each additional visit.

7.1.22 In terms of the three potential interventions focused on school groups, the analysis suggest that free transport for schools would generate the greatest increase in visits, amounting to 276,000 additional visits per annum. This option also generated the most significant increase in admission income for the science centres, given that they benefit from increased demand without any lowering of admission prices. It is estimated that this option would require an increased public grant of more than £2.5m, significantly more than the other options for school visits.

7.1.23 Overall, the option for half price admission for schools performs the least well in terms of cost effectiveness. This is because the fall in admission price only leads to a very small increase in school visits, but this fall in income would need to be compensated for by an increase in public financial support.

7.1.24 The implementation of free entry for under-18s would help to meet the policy objectives while providing the best value for money option. This could also be implemented as part of a staged approach to universal free entry, the option which would make the greatest contribution against the key objective of attracting more visitors from throughout Scotland from all background and ages. It is likely, nevertheless, that further more detailed work would be required to assess the potential costs and benefits before progressing further with the implementation of any of these policy interventions.

Recommendation Six:

This review recommends that the Scottish Government undertakes a further more detailed cost benefit analysis before progressing with the implementation of the policy of free entry for under-18s and universal free entry.

7.1.25 The current funding mechanism used by the Scottish Government compensates the science centres, to a large extent, for their funding deficit. It concentrates support on those science centres that perform less well in financial terms and provides little incentive for the centres to improve their financial position. This review concludes that an outcome based approach to funding be adopted by the Scottish Government. It is also recommended that the share of funding for each science centre should be directly linked to performance against the key performance objectives.

Recommendation Seven:

This review recommends that an outcome based approach to funding be adopted by the Scottish Government and that the formula used is straightforward and transparent and that the revenue funding reflects the key objectives and each science centre's share of total visitor numbers.

7.1.26 This approach would be consistent with the performance management framework outlined in this report, and would relate inputs directly with outputs through the performance objectives. By linking funding directly with the performance objectives, this provides a clear incentive for these performance objectives to be met.

ANNEX I – LIST OF CONSULTEES

Name	Position	Organisation
Dr Jane Polglase	Policy Manager	Association of Scottish Colleges
Sandra Lowson	National STEM Co-ordinator	Careers Scotland
Prof Alan Roach	Secretary	Deans of Science and Engineering in Scotland
Saima Mirza	Museum Sponsor	Department for Culture, Media and Sport
Kirk Ramsay	Chief Executive	Glasgow Science Centre
John Thorburn	Chairman	Glasgow Science Centre
Diane Duncan	Head of Skills and Learning Infrastructure	Highlands and Islands Enterprise
Dr Jack Jackson	Former HM Assistant Chief Inspector of Education	HMIE
Helen Wilkinson	Policy Officer	Museums Association
Gordon Rintoul	Director	National Museums of Scotland
John Simpson	Chief Executive	Our Dynamic Earth
Dr Des Bonnar	Chairman	Our Dynamic Earth
Graham Shanks	Chief Executive	Satrosphere Science Centre
Hugh Morel	Chairman	Satrosphere Science Centre
Stuart Patrick	Chief Operating Officer	Scottish Enterprise Glasgow
Frank Creamer	Policy Executive	Scottish Executive Education Department
Prof Maggie Gill	Head of Science and Research Group	Scottish Executive Environment and Rural Affairs Department
Prof Roland Jung	Chief Scientist	Scottish Executive Health Department
Prof Wilson Sibbett	Former Chairman	Scottish Science Advisory Committee
Paul Jennings	Chief Executive	Sensation
David Sigsworth	Chairman	Sensation
Fred Young	Chief Executive	SSERC
Anita Shaw	Development Director	Techniquest
Prof Muffy Calder	Professor of Computing Science	Universities Scotland
Dr Sally Montgomery	Chief Executive	W5

ANNEX II – SURVEY OF VISITORS

This annex reports on the survey of visitors which was undertaken as part of the study to inform the assessment of future interventions.

In order to obtain evidence for the impact of possible future interventions, user surveys were undertaken at four different locations:

- Our Dynamic Earth, Edinburgh
- Glasgow Science Centre, Glasgow
- National Museum of Scotland, Edinburgh
- Kelvingrove Museum, Glasgow

Our Dynamic Earth and Glasgow Science Centre were chosen, because they are the two science centres with the highest visitor numbers. Given the survey was being undertaken at the end of January, one of the quietest periods of the year, this was an important consideration in order to maximise the number of responses. The National Museum of Scotland and the Kelvingrove Museum were chosen as additional venues for the user surveys. Admission is free for both these museums and it was important to find out if visitors who go to free museums would also go to science centres and the importance of price in the decision to visit. A brief summary of the surveys undertaken at each of the four locations is provided below.

Our Dynamic Earth: The user surveys at our Dynamic Earth were undertaken on Wednesday, 24 Jan 2007 and continued on Saturday, 27 January 2007 due to the extremely low number of visitors during the first visit. The survey was conducted in the exit area adjacent to the café as well as in the shop area. A total of 20 visitor groups, including two school parties, were surveyed at this location.

Glasgow Science Centre The visitor survey was conducted on Friday, 28 Jan 2007. The survey was undertaken on the first floor of the science mall, which was more conducive to interviewing visitors than at the exit to the science centre. A total of five school groups and a further seven visitor groups were interviewed during the day.

National Museum of Scotland: The user survey at the National Museum of Scotland was undertaken on Thursday, 26 Jan 2007. A total of 18 visitor groups were interviewed, and most of the participants were with children. The survey was undertaken at the Connect Gallery – a permanent science exhibition at the museum.

Kelvingrove Museum: The visitor survey at the Kelvingrove Museum was undertaken on Monday 29 Jan 2007. Most of the visitors were adults without children and there were only a few families with children. A total of 17 visitor groups were interviewed during the day.

The visitors at all locations were asked questions focussed on the following areas:

- Size and profile of visiting group and place of residence
- Type of visit
- Past visits to the science centres, the National Museum of Scotland and the Kelvingrove Museum
- Intended future visits to the science centres
- Average length of stay for visits
- Influence on frequency and length of visits if science centres were free, free for under 18s or 50% lower admission price
- For school groups, influence of free transport on visits to science centres
- At science centres only, value for money on a scale of 1-10 and willingness to pay a higher admission price.
- Most important measure out of the marketing mix – Price, Product, Promotion, Place – to encourage a greater number of people to visit the science centres

A total of 67 interviews were undertaken with visitor groups at the four venues representing a total of 137 adults and 325 children. Across the sample, 30% of the interviewees were male and 70% were female.

Respondents were asked to state which definition best described their trip on that day. The highest percentage were leisure visits (48%), followed by educational visits (34%), school educational visit (10%) and tourist trips (7%). The types of visits for the four venues can be seen in figure 1 below.

Figure 1 Type of visit for the four survey venues in %

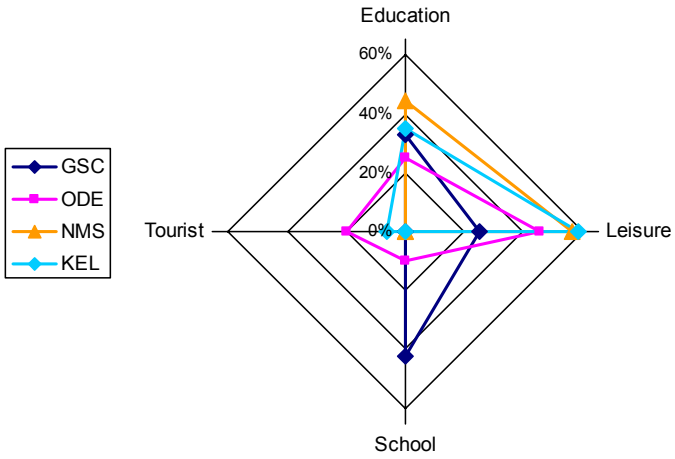
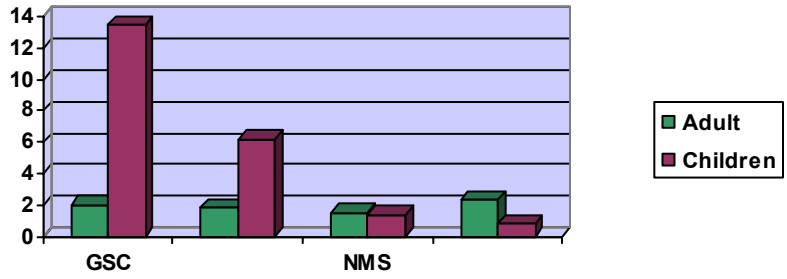


Figure 1 shows clearly that at GSC, most of the visits were school group visits (42%) followed by educational visits (33%). At ODE there was a much higher percentage of tourist visits (20%) compared to the other venues. At the National Museum, all of the visits were leisure and educational and at the Kelvingrove Museum, this figure was only slightly lower (94%) with the remaining visitors being tourists. Leisure was cited as the main type of visit at three out of the four venues - with the exception of GSC where it only represented 25% of all visits.

The average size of a visitor group at all locations was 2 adults and 4.9 children (including school groups). A more detailed breakdown about the average number of adults and children in each visitor group in the sample is illustrated in Figure 2 below. The average number of children is particularly high at GSC due to a high number of school group visits.

Figure 2: Average number of adults and children in a visitor group



The children were particularly young at the National Museum and the Kelvingrove Museum (mainly under 5), whereas the children at GSC were mostly school children in the age group 8-11. At ODE all age groups were represented, but the age group 8-11 was predominant due to the school groups that participated in the survey.

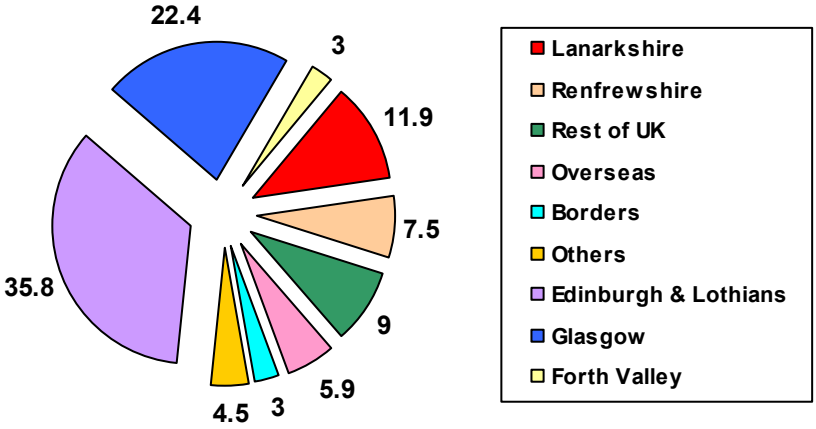
At GSC and the National Museum of Scotland, the visitor groups mainly originated close to the venue, while at ODE and the Kelvingrove Museum however, visitors came from different parts of Scotland and elsewhere.

At GSC, 58% of the survey participants were from the City of Glasgow, 17% from Renfrewshire, 17% from Lanarkshire and 8% from Dumfries and Galloway. At ODE, 35% were from Edinburgh and the Lothians, 20% from the Rest of the UK, 15% from Lanarkshire, 10% from the Forth Valley and 5% respectively from the Borders, Fife, Renfrewshire and overseas.

At the National Museum Scotland, 89% were from Edinburgh and the Lothians and the remaining 11% were equally split between the Borders and Lanarkshire. At the Kelvingrove Museum, 47% were from Glasgow, 12% respectively from Lanarkshire, Renfrewshire and the rest of the UK and 6% respectively from Ayrshire, Edinburgh & Lothians and Overseas.

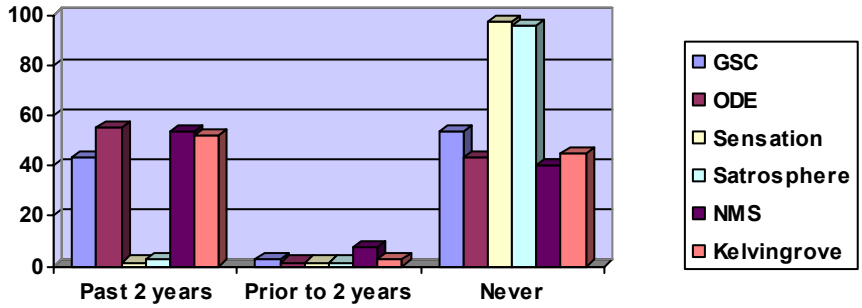
For all locations, the area of residence is illustrated in Figure 3 below.

Figure 3 Areas of residence of visitor groups (%)



At all locations, visitors were asked if they had visited any of the four science centres or two museums. The results are presented as a percentage of all survey participants in Figure 4 below.

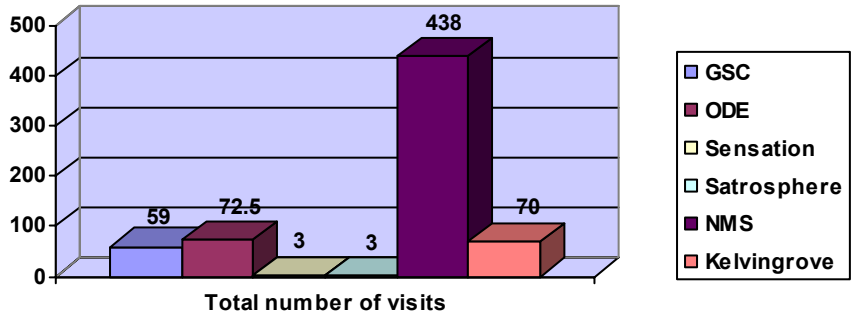
Figure 4: Past visits to specified location in %



Only few survey participants have ever visited Sensation (3%) or Satrosphere (4%) before. This is not surprising given that these attractions are generally focused on a more local catchment area. Over half of all respondents had been to ODE in the last two years and 43% to GSC.

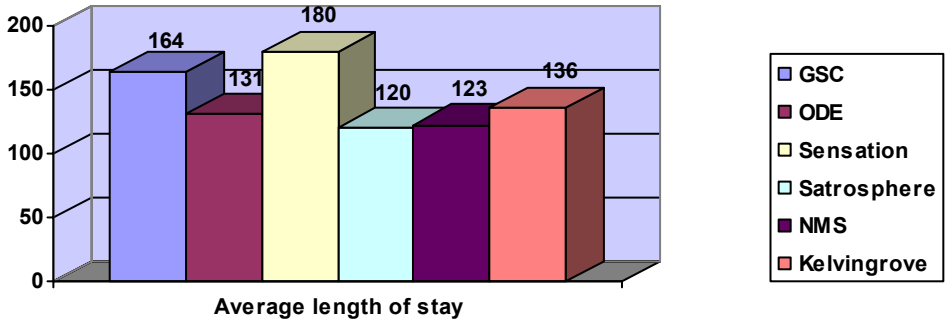
The total number of visits to all six locations in the past two years reported in the sample is show in Figure 5 below. The National Museum of Scotland accounted for two thirds of all visits within the sample. As Kelvingrove Museum had only recently re-opened after a major refurbishment, the number of visits over the past two years will have been significantly lower than if the museum had been open over this period. Overall, the average number of visits over the past two years to the NMS was 6.5 compared to around 1 visits for ODE, GSC and Kelvingrove.

Figure 5: Total number of visits to science centres and museums



The average length of stay for the six locations is shown in Figure 6 below.

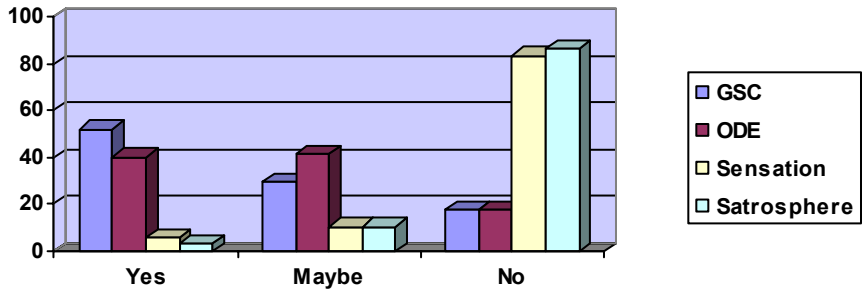
Figure 6: Average length of stay for each visit in minutes



Visitors at GSC and ODE were asked to rate the value for money of their visit. On a scale of 1 (poor) – 10 (excellent), the average value for money was 8.7 at GSC and 8.0 for ODE. For school groups the average value for money was 9.4 compared to 8.5 for educational visitors, 7.4 for leisure visitors and 8.5 for tourists. Out of the visitors who paid an admission price at GSC on third would have been willing to pay a higher admission price, compared with 30% for the visitors at ODE.

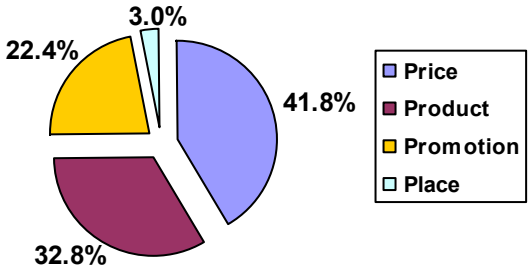
Visitors were asked if they intended to visit one of the four science centres in the next two years. The answer of all survey participants are illustrated in Figure 7.

Figure 7: Intended visits to science centres in the next 2 years in %



Visitors were asked what they considered to be the most important measure to encourage a greater number of people to visit the science centres, based on the marketing mix Price, Product, Promotion and Place. Price relates to a reduction in price, product – what is on offer needs to be of a higher quality of of greater interest, promotion – there needs to be more marketing among the general public or target groups, place – transport links need to be improved or there need to be an increase in the number of satellite locations. The results are shown as percentages of all responses in Figure 8 below.

Figure 8: Best measure to encourage people to visit science centres



The results indicate that the most important measure to encourage people was price (42%), followed by the product (33%). A considerable number of people also mentioned promotion (22%) as an important factor and stated that the science centres need more marketing to make people aware of their existence and of the product they offer.

Looking at the survey venues individually, it is interesting that price was particularly important for people at GSC (50%) compared to the importance of the product (25%), promotion (16 %) and place (8%). This shows that at the GSC, visitors are more price sensitive compared to ODE. At ODE however, the main factor was Product (40%) followed by Price and Promotion each with 30%.

ANNEX III – MODEL FOR FUTURE INTERVENTIONS

This annex provides details of the financial spreadsheet model which has been developed to assess the impacts arising form the various future interventions.

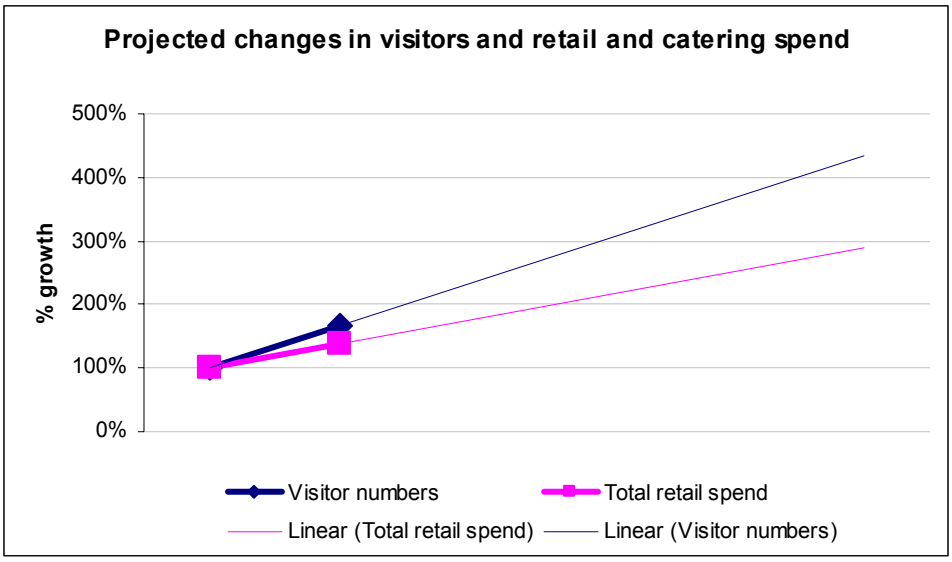
The model that has been developed to appraise the various future interventions is based evidence from the impact of free admission on the two science museums, the Science Museum in London and the Museum of Science and Industry in Manchester and the findings from our survey of visitors. These have been used to provide estimates of the impact of free admission and other charging regimes on the number of visits to the four Scottish science centres. The key assumptions underpinning the model are outlined in the following section.

Interviews were undertaken at Glasgow Science Centre and Our Dynamic Earth as well as at the National Museum of Scotland and Kelvingrove Museum to assess the potential impact of various pricing options on the propensity to visit a science centre. Respondents were asked at the four locations, the number of visits they had made to each of the science centres in the past two years and how this would have changed based on alternative payment scenarios. The results from this survey form the basis of the estimates on potential impact on visitor numbers. Estimates of the impact on visitor numbers at Sensation and Satrosphere have been based on the average of the values for ODE and GSC.

Baseline values for visitor numbers and income have been based on data supplied for 2005/2006 for all the centres. The related impact on secondary income such as expenditure on retail, café and car parking has been based on the experience at the Science Museum in London and the Museum of Science and Industry in Manchester. The impact at these two locations suggests that while overall secondary spend in shops and cafes had increased, this was at a lower rate than the overall increase in visitors so that spend per visitor had fallen.

With a 67% increase in visitor numbers, secondary spend increased by 38%. This ratio has been projected forward and used to estimate the increase in secondary income including café, retail and car parking income at the four science centres as a result of various changes in visitor numbers. It has been assumed that there will be no increase in secondary income associated with school visits to the science centres.

Figure C1: Projected changes in visitors and retail and catering spend



With an increase in visitor numbers, while this is likely to lead to an increase in secondary spend, there will also be an increase in operating costs for the four science centres. We have assumed that the marginal costs associated with each additional visitor above existing levels would be £2.50. This accounts for the additional expenditure related to increased wear and tear on exhibits and buildings and a requirement for more staff for front of house services. A higher figure of £5.00 has been used for the marginal cost of additional school visits, which accounts for the likely higher staff costs associated with this group.

A figure of £6 has been used for the average cost of free transport for each school pupil. This is based on feedback from consultees on the costs of transport and the previous work undertaken by the Museums Association on the costs of transport for school visits to museums. There are a large number of factors which will influence the costs of such a commitment. The total distance travelled, duration of travel and integration with other journeys being undertaken will all impact on the cost per school pupil, with the figure being much higher for schools in more rural and peripheral areas and lower in more urban centres. In addition, if the contract for free transport for schools was issued centrally rather than negotiated for each individual visit, there would likely to be cost efficiencies due to economies of scale.

A summary of the tables derived from the model are outlined below.

	Increase in visitors	Change in admission income	Change in retail and café income	Change in parking income	Change in gross income	Compensation for increase operating costs	Total compensation required	Payment per new visits
Free entry for paid admissions								
Our Dynamic Earth	327,398	-£660,122	£600,506	£195,997	£136,380	£818,496	£682,115	£2.08
Glasgow Science Centre	617,131	-£789,443	£784,025	£110,010	£104,591	£1,542,827	£1,438,236	£2.33
Sensation	141,312	-£166,493	£151,533	£148,118	£133,157	£353,279	£220,123	£1.56
Satrosphere	93,921	-£123,376	£172,071	£0	£48,696	£234,803	£186,107	£1.98
All science centres	**1,179,762**	**-£1,739,434**	**£1,708,134**	**£454,124**	**£422,824**	**£2,949,405**	**£2,526,581**	**£2.14**
Half price entry for paid admissions								
Our Dynamic Earth	101,813	-£97,880	£186,743	£60,950	£149,813	£254,532	£104,720	£1.03
Glasgow Science Centre	209,887	£53,522	£266,648	£37,415	£357,584	£524,718	£167,134	£0.80
Sensation	46,398	-£6,700	£49,754	£48,633	£91,687	£115,995	£24,308	£0.52
Satrosphere	30,838	-£4,965	£56,498	£0	£51,533	£77,095	£25,562	£0.83
All science centres	**388,936**	**-£56,023**	**£559,642**	**£146,997**	**£650,617**	**£972,340**	**£321,723**	**£0.83**

	Increase in visitors	Change in admission income	Change in retail and café income	Change in parking income	Change in gross income	Compensation for increase operating costs	Total compensation required	Payment per new visits
Free for under 18s								
Our Dynamic Earth	94,826	£8,095	£173,927	£56,767	£238,789	£237,064	-£1,725	-£0.02
Glasgow Science Centre	111,209	£11,505	£141,284	£19,824	£172,613	£278,022	£105,409	£0.95
Sensation	31,710	£2,234	£34,004	£33,237	£69,475	£79,275	£9,800	£0.31
Satrosphere	21,076	£1,655	£38,613	£0	£40,268	£52,689	£12,421	£0.59
All science centres	**258,821**	**£23,489**	**£387,827**	**£109,829**	**£521,145**	**£647,051**	**£125,906**	**£0.49**
Free entry for schools								
Our Dynamic Earth	38,352	-£123,474	£0	£0	-£123,474	£191,760	£315,234	£8.22
Glasgow Science Centre	73,059	-£189,344	£0	£0	-£189,344	£365,295	£554,639	£7.59
Sensation	14,218	-£33,115	£0	£0	-£33,115	£71,088	£104,203	£7.33
Satrosphere	12,584	-£32,679	£0	£0	-£32,679	£62,921	£95,600	£7.60
All science centres	**138,213**	**-£378,611**	**£0**	**£0**	**-£378,611**	**£691,064**	**£1,069,675**	**£7.74**

	Increase in visitors	Change in admission income	Change in retail and café income	Change in parking income	Change in gross income	Compensation for increase operating costs	Payment for transport costs	Total compensation required	Payment per new visits
Half price entry for schools									
Our Dynamic Earth	5,640	-£48,875	£0	£0	-£48,875	£28,200		£77,075	£13.67
Glasgow Science Centre	10,744	-£74,949	£0	£0	-£74,949	£53,720		£128,668	£11.98
Sensation	2,091	-£13,108	£0	£0	-£13,108	£10,454		£23,562	£11.27
Satrosphere	1,851	-£12,935	£0	£0	-£12,935	£9,253		£22,188	£11.99
All science centres	**20,325**	**-£149,867**	**£0**	**£0**	**-£149,867**	**£101,627**		**£251,494**	**£12.37**
Free transport for schools									
Our Dynamic Earth	76,704	£349,842	£0	£0	£349,842	£383,520	£622,656	£656,334	£8.56
Glasgow Science Centre	146,118	£536,475	£0	£0	£536,475	£730,589	£1,186,133	£1,380,248	£9.45
Sensation	28,435	£93,825	£0	£0	£93,825	£142,177	£230,828	£279,180	£9.82
Satrosphere	25,169	£92,590	£0	£0	£92,590	£125,843	£204,309	£237,562	£9.44
All science centres	**276,426**	**£1,072,731**	**£0**	**£0**	**£1,072,731**	**£1,382,128**	**£2,243,926**	**£2,553,324**	**£9.24**

ISSN 0950 2254
ISBN 978 0 7559 6833 6
(Web only publication)

www.scotland.gov.uk/socialresearch

RR Donnelley B53796 11-07