

The Association for Science and Discovery Centres

**Assessing the Impact of UK Science and
Discovery Centres: Towards a set of
common indicators**

Consultation Document

May 21 2010



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Foreword

Each year 20 million adults and children of all backgrounds choose to visit a UK science and discovery centre or museum. Over 14 million people visit in their leisure time to explore and discover the sciences informally with their families and friends.

Together our membership makes up the UK's largest publically accessible network dedicated to both informal science learning and family science engagement, employing thousands of dedicated engagement professionals.

Science and discovery centres feel they specialise in opening up the sciences to a very broad range of people in innovative, engaging and enjoyable ways. To achieve this they work with a variety of experts including artists, storytellers, comedians, scientists, ethicists, designers, animators, multimedia specialists and community and youth engagement specialists.

Alongside this, science and discovery centres work in local and regional collaborations with universities, beacons for public engagement, science cities, science alliances, science festivals, industry, local media and other visitor attractions and arts and cultural establishments. Within the formal education sector most centres collaborate with their council education and learning departments, regional STEMpoints, Science Learning Centres and of course their local schools.

Their collective goal is to intrigue, inspire and involve people with the sciences in the most effective, innovative, impactful and creative ways possible. Some centres focus on specific areas of science such as the environment and climate change, or space science, whilst others help people explore all the sciences in their broadest interpretations.

Our goal in writing this report is to create a simple methodology by which we can begin to demonstrate the impact that science and discovery centres collectively have on the people of the UK. We have tried to approach this in a way that reflects the specific impacts of the creative, innovative, interactive science experiences that we feel are the strength of the UK's science and discovery centres.

In recent years government departments have made substantial investments in programmes of evaluation and monitoring which attempt to capture the impact of organisations across the cultural and sporting sectors. These include DCMS 'Taking Part', DCMS impact indicators for their sponsored museums, and MLA renaissance in the regions, all of which are reviewed in this report. Of particular note in relation to this report, was the publication of the McMaster review 'Supporting Excellence in the Arts: From Measurement to Judgement' in Jan 2008¹ which heralded an increased awareness of the need to ensure that innovation, creativity and excellence are not impeded by an exclusive focus on quantitative measurement.

Awareness of the effect that measuring itself can have on outcomes has underpinned this report. We do not want to develop an unwieldy series of measures which themselves adversely affect the

¹ <http://www.culture.gov.uk/images/publications/supportingexcellenceinthearts.pdf>

ability of our science and discovery centres to provide inspiring, creative and engaging experiences for all². To us, the engagement of the visitor with science and nature, and their overall positive experience is paramount.

This report has been developed from a thorough review of impact measurement in a number of creative and cultural sectors, along with considerable consultation with staff within our centres and in allied professions. The report seeks to identify a simple, practicable tool for the UK's science and discovery centres to demonstrate their impact.

Finally, this is a consultation document, not an end point. We are absolutely aware of the challenges each centre faces in undertaking new assessments of this type. Yet without a consistent framework how can we collectively demonstrate the impact of what we do?

We hope that you will join us over the coming months in shaping the methodology into something that we, as a sector, can use to collect evidence to demonstrate the great work and impact of the UK's science and discovery centres.

Dr Penny Fidler

Chief Executive of ASDC

ASDC Vision

A society where people are intrigued, inspired and involved with science.

ASDC Mission

To bring together the ASDC membership to play a strategic role in the nation's engagement with science.

² In 2008 Ofsted identified that the teaching of science in schools was being adversely affected by many teachers' concerns about meeting test and examination requirements, to the detriment of the development of pupils' skills in scientific enquiry in particular. In other words, the tool used to measure and collect evidence of impact (in this case learning) was negatively impacting on the learning itself [http://www.ofsted.gov.uk/Ofsted-home/News/Press-and-media/2008/June/Science-lessons-should-be-more-stimulating-says-Ofsted/\(language\)/eng-GB](http://www.ofsted.gov.uk/Ofsted-home/News/Press-and-media/2008/June/Science-lessons-should-be-more-stimulating-says-Ofsted/(language)/eng-GB)

The UK's Science and Discovery Centres



Executive summary

In 2007, the House of Commons Science and Technology Select Committee launched an inquiry into whether science and discovery centres should be publicly funded. The report concluded that: “Science and discovery centres contribute to the education of young people about science and inspire them to take up careers in science, technology, engineering and mathematics. They also engage the public with scientific issues and play important roles in their local communities.”³

The Select Committee wanted to see independent research, commissioned as a Government priority, to determine how effective science centres are at promoting interest in science and encouraging young people to embark on a career in science.

Should the independent research confirm the contribution made by science and discovery centres, then, “the Committee expects the Government to review its policy on long-term funding for science centres along similar lines to museums and galleries.”⁴

In 2009 BIS commissioned Frontier Economics to undertake this independent research, which was subsequently published in October 2009 entitled ‘Assessing the Impact of Science Centres in England’. The authors of the report were unable to establish the impact of science centres as compared to selected BIS-funded organisations⁵, and recommended that science and discovery centres, as well as these BIS-funded organisations, improve the data they collect to assess impact.

ASDC has taken up this challenge for the science and discovery sector. Our report outlines the creation of a set of common indicators and ‘impact cards’ which could be used, for the first time, to assess in a consistent manner some areas of impact of science and discovery centres. These indicators will be used as a starting point for consultation with our members. This report concludes with a major recommendation for the next step in the process of measuring impact nationally.

Each year 20 million adults and children of all backgrounds choose to visit a UK science and discovery centre or science museum⁶. Over 14 million people visit in their leisure time to explore and discover the sciences with their families and friends, and the remainder visit with their schools. Since people choose to visit in their leisure time and teachers choose to bring their students, the way in which science is offered to this broad range of people has to be engaging, enjoyable and enticing or, as with other visitor attractions, they would vote with their feet and choose to go elsewhere.

³ House of Commons Science & Technology Committee. The Funding of Science and Discovery Centres, Eleventh report of session 2006-07 HC 903-I, Published on 22 October 2007

⁴ Press notice issued by the House of Commons Science & Technology Committee. The Funding of Science and Discovery Centres, Eleventh report of session 2006-07 HC 903-I, Published on 22 October 2007

⁵ Defined in the Frontier Economic Report as The British Science Association, STEMNET, The Royal Academy of Engineering and The Resource Centre for Women in Science, Engineering and Technology (UKRC).

⁶ Whilst we talk about ‘visits’, in this instance we include science outreach visits into schools and community groups.

All science and discovery centres already evaluate qualitatively and quantitatively to monitor and improve the work they do with their visitors. However, since they are all independent entities they have evolved different approaches. This report follows considerable consultation both within our network, and with other national partners to attempt to create a set of common indicators that will enable the UK's science and discovery centres and museums to measure their impact consistently with one another and as a whole. We should be clear that this is still the first step in the process, rather than a conclusion. There are thousands of science engagement professionals and other staff in our sector who will all need to *want* to be part of this national assessment and celebration of their impact.

Impacts across Government agendas

ASDC believes that science and discovery centres and museums have impacts in many realms; social, economic, environmental, intellectual and emotional. Their impacts can be felt locally, regionally and nationally (and in some cases internationally), and impacts can be both long-term and short-term.

In producing this set of indicators, we have been pragmatic and considered what we *can* measure, as well as what we *want* to measure. We have been asked by BIS to create indicators that could assess the impact of our work against the BIS science and society agenda. Clearly this is only a subset of the variety of work UK science and discovery centres do. UK science and discovery centres undertake projects, arts and dialogue programmes in areas as wide-ranging as health and obesity, environmental sustainability and carbon reduction, innovation and entrepreneurial endeavours, strengthening skills and supporting communities. The target audiences are children, schools, families, individual adults and wider communities. In this way we feel UK science and discovery centres have impact across the wider Government agendas, of which the BIS science and society agenda is a subset.

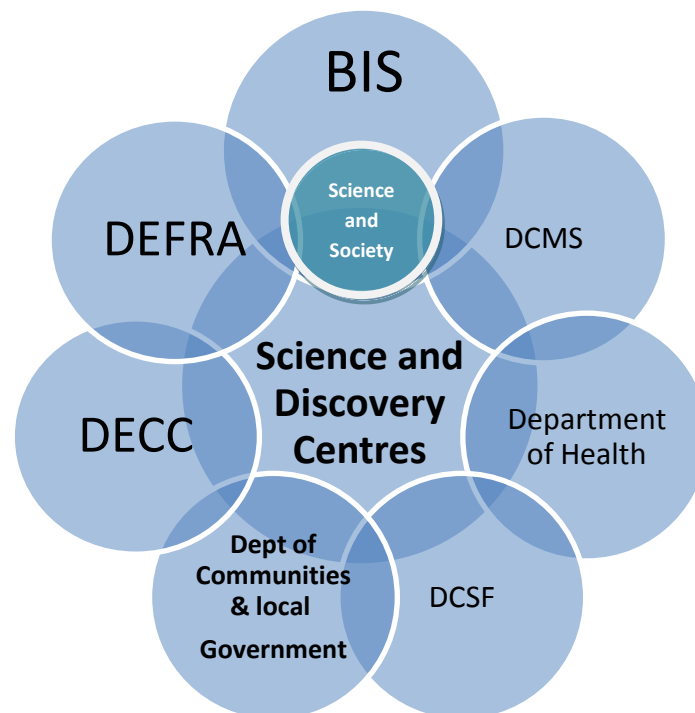


Figure 1: UK science and discovery centres have impact across a wide range of government agendas of which the BIS science and society agenda is a sub-set.

This report does not aim to provide a mechanism to measure all of these impacts. Neither does it aim to provide a mechanism to definitively measure the long-term impact of a visit to a centre⁷. Rather the goal of this report is to suggest a selection of indicators that might be reliably and consistently used as a starting point in the variety of science and discovery centres across the UK and to present a consistent, practical and low-cost mechanism for doing so.

Since, in the first instance, we are asking science and discovery centres to undertake this data collection without additional financial support, the indicators must also have value to the centres themselves, in that they should provide a helpful mechanism for centres to evaluate their own performance, demonstrate their impact to partners and to plan for the future.

The set of indicators given here is as a result of detailed examination of a number of other impact measurement tools used by government departments, such as DCMS and DCSF, major funders, other BIS-funded organisations and several science and discovery centres themselves who already have sophisticated evaluation frameworks in place. In our opinion, we have created the most achievable and useful set that can be collected by our centres at this time given that no additional budget has been supplied. We would hope that our 50 centres will help shape these into the final indicators, and with time as a sector increasingly demonstrate - beyond doubt - the value science and discovery centres bring to our nation and the future of science in the UK.

We should also be clear that these indicators will no doubt act as a sub-set of the wider impacts a centre chooses to measure. Most centres, as vibrant enterprises, with specific missions have their own KPIs against which they report. Likewise all funded programmes will still need to be evaluated in objective-specific ways and in the manner requested by the funder. We have tried to take into account the KPIs of a number of our centres in creating this framework.

Both quantitative and qualitative

In order to capture the impacts of the science and discovery centres on the BIS science and society agenda we propose asking our members to report specific data annually.

The methodology we propose first collects the quantitative data, for example, how many adults and children explore science in their leisure time at our centres and how many school students take part in specialised curriculum-supporting workshops. However we do not believe alone this is sufficient. We must correlate this with the quality of the experience. Thus we propose assessing via three bespoke 'impact cards' targeted at teachers, students or families. The areas of impact we are specifically looking are within the realm of the GLOs (Generic Learning Outcomes) created by the Museums, Libraries and Archives Council (MLA) and used extensively by most government-funded museums. We also use these cards to explore if visitors feel science and discovery centres are inclusive places, trusted to offer science in an honest manner and in a way that is relevant to everyday life.

⁷ Despite considerable investment in monitoring and evaluation across comparable organisations such as museums, an accepted mechanism for assessing long term impact of visits remains undeveloped.

Our research has shown that our 50 centres include different things in their visitor counts, therefore section 3 of this report details precisely what should and should not be included to achieve a level of national consistency. We have organised the ASDC quantitative indicators in the manner in which they impact on the BIS science and society agenda.

This report also includes the 12 performance indicators used for the 17 DCMS-sponsored museums in England and frequent reference to the MLA⁸ indicators and criteria. In our research it became apparent that for several years DCMS have put considerable research and development resources into creating and agreeing a common set of indicators between 17 centres⁹. We should note that despite this they have only succeeded in agreeing one qualitative indicator – that of visitor satisfaction¹⁰ – primarily because qualitative indicators are difficult to create. However, they have now commissioned elegant research by a specialist independent consultant to interview thousands of visitors to understand the qualitative impacts of the centres they fund. We have tried to go further than the DCMS quantitative indicators, without incurring costs, to assess what is important to our centres. We will await the wider consultation with all our members to see if they feel measuring common outcomes rather than outputs is feasible with limited resources.

Learning and engagement ‘Impact Cards’

As with the DCMS indicators, the majority of the ASDC indicators are quantitative. In order to capture the quality of the learning experience in a consistent manner we have created three ‘Impact Cards’. Each card will be directed at one of the key target audiences of science and discovery centres, namely school students, teachers, family and leisure visitors (adults).



These impact cards will gather evidence of impact in terms of learning and engagement and will map to the ASDC performance indicators. Following extensive research and consultation we have chosen to assess the impact on visitors through their own subjective reporting, exploring what they feel they have gained from their visit to a science and discovery centre. This is in contrast to other options which included us creating an objective assessment of quality of what is delivered (for example by assessors and expert reviewers visiting all the centres, or by checklists), or an objective assessment of what people discuss or the way they interact with other participants during a visit.

⁸ <http://research.mla.gov.uk/evidence/documents/Statistical%20Report%20-%202009-10-30%20Renaissance.pdf>

⁹ Morris Hargreaves McIntyre. *Balancing the Scorecard: Review of DCMS Performance Indicator Framework*, March 2007

¹⁰ ‘A Passion for Excellence’ the governments improvement strategy for culture and sport, published in 2008, identifies 3 sets of tools; ‘monitoring tools’, ‘challenging tools’ and ‘supporting tools’ indicating the need to develop a range of measures to quantify impact. This consultation report focuses on establishing a series of monitoring measures which in future could be supplemented by additional qualitative measurement tools.

We have chosen to use the widely accepted 'generic learning outcomes' (GLOs) of the Museums, Libraries and Archives Council as our framework for these qualitative questions which will help determine, for example, changes in skills, knowledge or attitudes towards science as a result of a visit to a science and discovery centre.

Final recommendation

Within this report we make a major recommendation for the future. The need for a robust, independent 'National Impact Study' for the UK science and discovery centres, which records, defines, and proves once and for all, the variety of important impacts our 20 million visitors feel, and what keeps them coming back and paying for the pleasure.

We would like to note that a well-respected independent research company, Morris Hargreaves McIntyre, is currently measuring qualitative impact for a large number of national museums, several science and discovery centres and the Wellcome Collection, as well as work commissioned by DCMS. They are also part of the evaluation in progress on the Scottish science centres via the Scottish Government. Their teams have already interviewed many thousands of visitors at various science and discovery centres and art museums and they now have comparable datasets against which we could potentially benchmark. This existing body of work, although commissioned and owned by a variety of organisations, might potentially act as a springboard for a 'National Impact Study' for science and discovery centres as discussed in the final part of this report.

Proposed ASDC Indicator Framework (Quantitative)

| | |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Engaging the public with science¹¹ |
| 1. | Total number of visitors |
| 2. | Total number of children visiting |
| 3. | Total number of adults visiting per year |
| 4. | Total number of web visitors |
| | Inspiring school students with science and science careers |
| 5. | Number of children visiting in formal school groups |
| 6. | Number of facilitated 'hands-on' curriculum-linked activities delivered (Please give the split you have e.g. KS1,2,3,4,5 for England) |
| 7. | Number of school students taking part in facilitated 'hands-on' curriculum-linked activities |
| 8. | Number of school students brought together with science role models (scientists, engineers, science specialists and other experts) |
| | Supporting teachers to inspire their students with STEM |
| 9. | Number of teachers bringing students |
| 10. | Number of teachers receiving CPD |
| 11. | Number of individual schools your centre has interacted with in the past year (including outreach) |
| | Widening participation with the sciences |
| 12. | <ul style="list-style-type: none"> • Number of people from low income backgrounds (C2DE classification and NS-SEC groups 5-8) • Number of people engaged from ethnic minorities • Number of people engaged with a disability • Number of people over the age of 65 • Number of people visiting in family groups in leisure time |
| 13. | Outreach activities Numbers of adults and children reached through outreach (outreach should be a subset of your overall visitor figures) |
| | Visitor satisfaction |
| 14. | % of visitors who would recommend a visit ¹² |
| | Finance: Self-generated income¹³ |
| 15. | <ul style="list-style-type: none"> • Admissions % • Trading % • Fundraising % • Public funds % |
| 16. | Number of people engaged specifically with environmental and sustainability projects |

¹¹ A visitor will 'engage' in a variety of ways, none of which are measured here. This is simply quantitative. The evidence for engagement will be collected via the three specific qualitative 'impact' cards aimed at students, teachers and leisure visitors.

¹² & ⁶ both are from the DCMS performance framework so we might compare our levels of visitor satisfaction and self-generated income with those achieved by the national museums.

1. Introduction

1.1 The Goals of this Report

In July 2009 BIS published the Frontier Economics report entitled ‘Assessing the Impact of Science Centres in England’. This report recommended that science and discovery centres, as well as BIS-funded organisations, improved the data they collected to assess their impact. Towards the end of 2009, BIS asked ASDC to address the following specific recommendation of the report:

“We recommend that the Association for Science and Discovery Centres liaise with BIS to develop a set of indicators, which would:

- (i) Capture the impacts of science centre activities on BIS’ Science and Society agenda and*
- (ii) Be consistent with the indicators used for the assessment of the comparator programmes.*

The primary goal of this report is to propose a tool and a methodology by which science and discovery centres can demonstrate the impact of their activities in terms of the Government’s Science and Society agenda.

Specifically this report will:

1. Define a range of common indicators to capture the broad impacts of science and discovery centres against the BIS science and society agenda.
2. Propose a common mechanism to measure the quality of the learning experience of visitors in a simple and low-cost manner.
3. Review the existing impact measurements used by national museums, UK science and discovery centres, relevant funders, DCMS, BIS comparator organisations, other cultural organisations and science centres overseas, and use this as a basis for our recommendations.

1.2 The Background to this Report

House of Commons Science and Technology Select Committee

In 2007, the House of Commons Science and Technology Select Committee launched an inquiry into whether science and discovery centres should be publicly funded. The report concluded that:

“Science and discovery centres contribute to the education of young people about science and inspire them to take up careers in science, technology, engineering and mathematics. They also engage the public with scientific issues and play important roles in their local Communities”

Science and Technology Select Committee, October 2007

The Committee further commented that some centres are struggling financially and “that it believes the remaining centres deserve continued support from the Government, local authorities, regional development agencies, the education sector, the charity sector and the business sector.”¹⁴

However, the Committee wanted to see independent research, commissioned as a Government priority, to determine how effective science centres are at promoting interest in science and encouraging young people to embark on a career in a science subject.

If this independent research did confirm the contribution made by science and discovery, “then the Committee expects the Government to review its policy on long-term funding for science centres along similar lines to museums and galleries”¹⁵. The report also recommended that science centres should:

- continue to focus on securing funding in a range of ways including commercial activities
- that in the interim period [before national evidence for impact is gathered] Government should make available limited, competitively awarded, short-term funding for those science centres that are at risk of closure
- that steps should be taken to reduce the tax burden on science and discovery centres.

“During this short inquiry, we have been impressed by the range of subjects tackled by science centres, their commitment to education and public engagement and the role they play in their local communities, despite the financial difficulties facing many of them.

“We hope that the Government will take a lead in continuing to develop further these close ties with everyone involved so the science centre sector can evolve and flourish.”

Phil Willis: Chairman of the Select Committee

¹⁴ Press notice issued by the Science and Technology Committee on 19 October 2007 relating to the Select Committee ‘Science and Discovery Centres report’

¹⁵ Press notice issued by the Science and Technology Committee on 19 October 2007 relating to the Select Committee ‘Science and Discovery Centres report’

The Government-commissioned research by Frontier Economics

In response to the Select Committee recommendations, The Department for Business, Innovation and Skills (formerly DIUS¹⁶) commissioned the consultancy 'Frontier Economics' to¹⁷:

1. Evaluate the impact of science centres in England on the Government's Science and Society agenda; and
2. Assess whether science centres represent 'good value for money' in comparison with other STEM-related organisations

A key aim of the study was to assess whether there was a robust evidence base that would facilitate the Department's decision on whether to establish a national funding stream for the science and discovery centre sector in England.

Conclusions of the report

The Frontier Economic's report concluded that "We have not been able to assess whether science centres are good value for money relative to other comparator programmes. This is because there is insufficient evidence on the long-term outcomes of science centres or comparator programmes"¹⁸.

One of the major disappointments of this report was that it did not make any recommendations as to what data the researchers would have wanted science and discovery centres to collect, nor what would have helped in the cross-sector comparison of value for money.

What did the Frontier Economics report recommend?

1. The quality of data provided by the organisations which currently receive funding from BIS should be significantly improved.
2. Science centres should be encouraged to collect similar types of information to:
 - capture the impacts of science centre activities on BIS' Science and Society agenda and
 - be consistent with the indicators used for the assessment of the comparator programmes

¹⁶ DIUS: The Department for Innovation, Universities and Skills

¹⁷ Directly quoted from 'Assessing the impact of science centres in England' by Frontier Economics, July 2009

¹⁸ As above, Frontier Economics

2. Defining impact

2.1 Introduction: impact in many fields

The breadth and meaning of the word ‘impact’ is a source of continuous discussion, particularly in the fields of formal education, lifelong learning and third sector enterprise. Within the field of science and discovery centres internationally there is lively debate over measuring areas of impact, including whether the most interesting areas of impact, such as instigating long-lasting motivational and attitudinal change, can indeed be measured in a cost-effective manner.

We should remember at this point not to fall into the age-old trap eloquently summarised by someone immersed in the world of collecting evidence:

***“Everything that can be counted does not necessarily count;
Everything that counts cannot necessarily be counted.”***

Albert Einstein

A variety of research reveals that science and discovery centres and museums have wide-ranging impacts in the emotional, intellectual, social and economic realms.^{19 20}

This report aims to measure the impacts of science and discovery centres on the BIS science and society agenda.

This report does not aim to measure all of the impacts of a science and discovery centre. Rather the goal of this report is to suggest a selection of important impacts that might be reliably and consistently measured, and to provide a consistent mechanism for doing so.

Each year, 20 million adults and children of all backgrounds choose to visit a UK science and discovery centre or museum²¹. Over 14 million people visit in their leisure time to explore and discover the sciences with their families and friends. The way in which the science is offered to this broad range of people must be engaging, enjoyable and enticing. We are judged daily on the quality of what we do by our numerous visitors in the sense that if they did not think the experience was enjoyable or valuable in some way, they would be unlikely to pay to return.

¹⁹ Rennie, L. and McClafferty (1996). Science centres and science learning. *Studies in Science Education*, 27(1), 53-98.

²⁰ The Impact of science and discovery centres; a review of worldwide studies by Dr Penny fidler, ASDC: <http://sciencecentres.org.uk/reports/impact-of-science-discovery-centres.html>

²¹ Data published by ASDC in 2008 as 19.5 million visitors, verified by Frontier Economics in 2009. For 2009-10 centres have reported an increase in visitor numbers.

Each year, about 6 million school students²² take part in engaging hands-on activities and inspirational curriculum-linked workshops in our 50 member science and discovery or museums. This is as a direct result of quarter of a million teachers²³ across the nation using their professional expertise in assessing that the unusual hands-on science activities provided by the centres are sufficiently intriguing and involving to have a positive impact on their students.

The science and discovery centres and museums constitute the only UK-wide network of publically accessible venues dedicated to inspiring and engaging people of all ages and all backgrounds with science; indeed, the vast majority of UK science and discovery centres have been created with this as their explicit mission and primary purpose.

Accessible science hubs

Centres work in a vast array of collaborative partnership. All the UK's science and discovery centres work in partnership with local universities, industry, schools, their communities and with the nation's other science engagement networks. Most also work closely with other science and discovery centres and museums in the UK and abroad by, for example, sharing their content specialism, geographical location, funding sources or have similar types of operations²⁴.

Almost every science and discovery centre offers events with their audiences to celebrate National Science and Engineering Week, most run outreach activities at local schools and community centres, whilst many are partners with (or indeed hosts or co-founders of) their regional Stempoint, Beacon for public engagement or their city's science festivals.

Together, science and discovery centres and museums run tens of thousands of individual curriculum-linked schools events, community programmes and specialist practical workshops each year sectors many of which involve traditionally hard-to-reach audiences. Centres work in partnership with the research councils to train scientists in public engagement and to showcase their scientists' work in specific areas, and many centres offer CPD to science teachers and are involved with their regional Science Learning Centre.

Science and discovery centres and museums have significant impact in a variety of realms, for example, as major tourist attractions, as local cultural centres, as local employers and as part of the local supply chain with retail and catering outlets.

However, within the context of this report, we are attempting to create a set of indicators that measure the impact of Science and discovery centres against the Government's Science and Society agenda.

²² All centres measure child numbers differently. This is based on an estimate given by many centres that two-thirds of their visitors are families and peer groups, and one-third are school students. We will be able to accurately determine these numbers once these consistent indicators have been agreed.

²³ This is an approximation based on 1 teacher visiting per 24 students

²⁴ For example, there are frequent collaborations between the 'small and medium centres', 'Millennium centres' or centres with environmental sustainability as their driving force.

Practical limitations of this research (not measuring long-term impact)

Whilst we feel many of the most important impacts of science and discovery centres are long-term (e.g. inspiring motivational and attitudinal change in people's interests and perceptions of science) we have agreed with BIS that this report will not attempt to provide a mechanism to measure the long-term impact of science and discovery centres. The reason for this is, as noted in both the Select Committee report and the Frontier Economics report, measuring long-term impact is a costly and long-term venture and would require additional funding for ASDC and UK centres to implement.

2.2 Impact on the Goals of the BIS Science and Society agenda

The BIS Science and Society agenda has two broad objectives:

1. To increase the number of people who choose to study STEM subjects and work in research and science.
2. To strengthen the level of high quality engagement with the public on all major science issues. The ultimate aim is to increase the STEM literacy of the population.

Note: In addition to these objectives there is an emphasis on ensuring that people from a diverse range of social backgrounds can participate. This involves targeting 'hard to reach' and disengaged groups.

However, although these broad goals²⁵ capture the essence of the Government's Science and Society agenda, they do not do justice to the scope, complexity and subtlety of their ambition. To understand this we need to consider the more detailed strategy that is currently in development by BIS and the five Expert Panels listed below:

1. Science for all
2. Science and Trust
3. Science and careers
4. Science and Learning
5. Science and the media

²⁵ Referenced in the Frontier Economics report as Documented in The STEM Programme Report: <http://www.dcsf.gov.uk/hegateway/uploads/STEM%20Programme%20Report.pdf> and The Science and Innovation Investment Framework, p103-109

Reports from each of these panels were published in March 2010 and are available on the BIS website.²⁶ The vision of each panel is shown in the box below.

Science for All: “Creating a culture where science is more relevant to everyday life and where public engagement activity by science, business, academia and policy is valued, recognised and rewarded”

Science and the Media: “Increasing opportunities for contact and partnership working between the media and scientists in order to create a better understanding about each others’ work and produce better products”

Science and Learning: “Creating an effective learning system that the science and business communities regard as fit for purpose and delivering a scientifically literate society”

Science for Careers: “Raising awareness of the opportunities for those who study science, and providing increased information on the range of science careers on offer to make the scientific workforce more representative of the diversity of modern society”

Science and Trust: “Promoting the underpinning of science in the UK by social responsibility and ethics. Providing independent evaluation of activities so that societal issues are reflected in transparent decision making by Government and business”

2.3 Shared goals: how science and discovery centres deliver on the BIS science and society agenda

The BIS science and society agenda strives to create a more scientifically engaged and literate society, with people from all backgrounds choosing to study and work with science. These goals are shared by the UK’s science and discovery centres. In most cases they are the driving force behind their organisations and the many thousands of staff within the ASDC network who welcome the public and involve them in science 364 days of the year. We have created figures 1-4 to better explain the areas of overlap between ASDC and BIS science and society goals, as well as the overall unique position and role of science and discovery centres.

²⁶ <http://interactive.bis.gov.uk/scienceandsociety/site/>

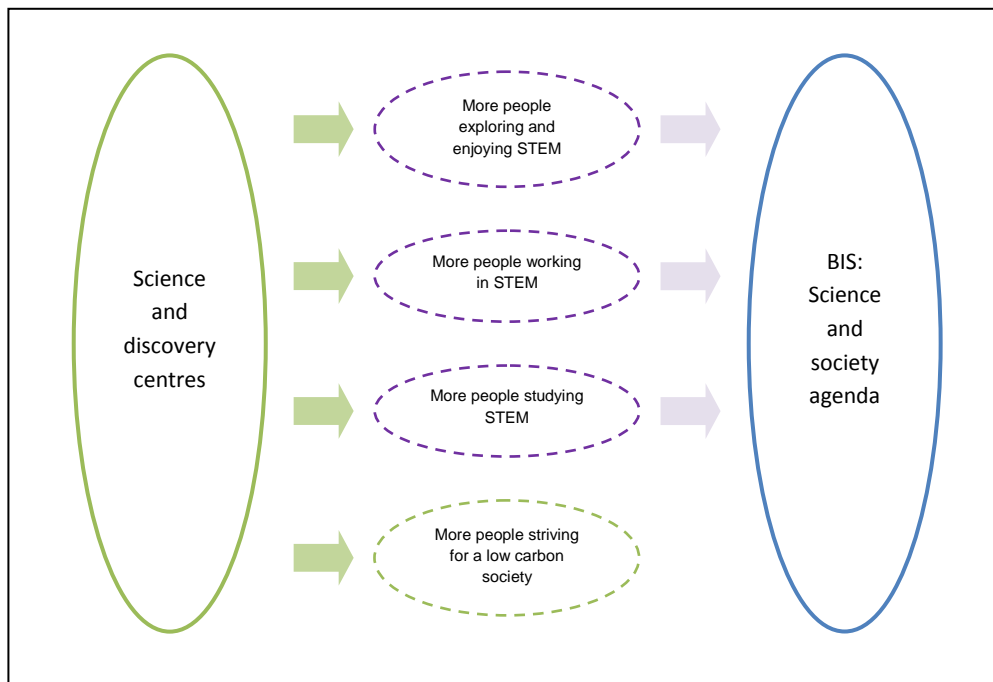


Figure 2: Science and Discovery centres are highly focussed on inspiring people to achieve the three main stated goals of the BIS science and society agenda; namely increasing the numbers of people exploring and enjoying STEM (increasing scientific literacy), increasing the numbers working in STEM and increasing the numbers studying STEM. In the figure above we have added a fourth goal relating to inspiring more people to strive for a low carbon society. This goal is shared by the majority of our centres and is the over-arching vision of several. Whilst centres also have important goals relating to other areas such as community, culture and heritage, we have included the low carbon goal here owing to its enormous importance to the future security and well-being of our nation.

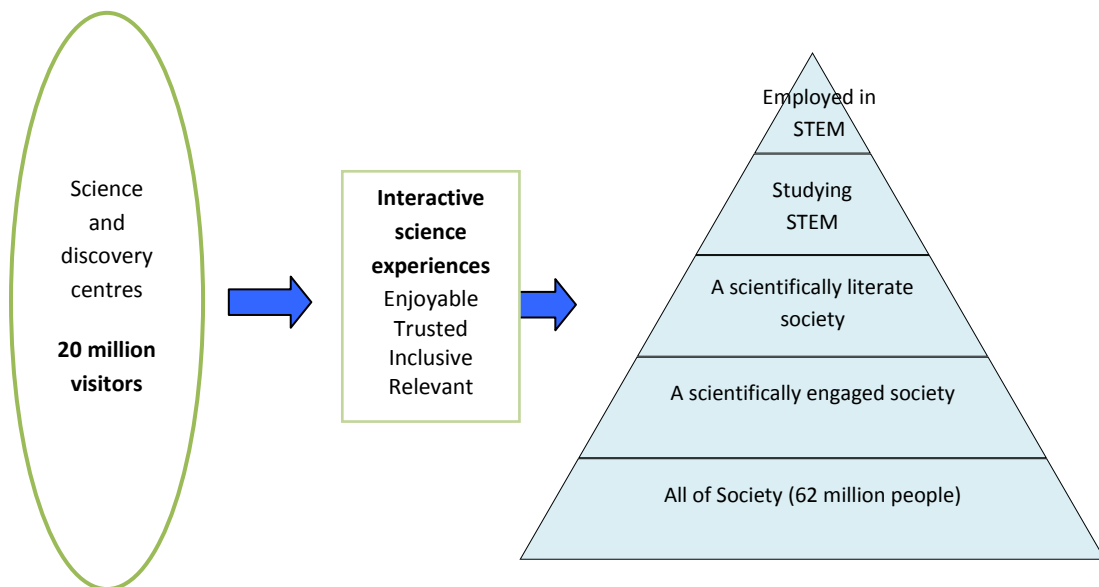


Figure 3: Science and discovery centres attract 20 million visitors each year. They offer members of the public an opportunity to explore the sciences by taking part in interactive science experiences in an accessible venue in a manner that we believe is enjoyable, trusted, inclusive and relevant. We believe that the net result of this is to create a society that is more scientifically engaged, scientifically literate, with more people wanting to study and work with STEM. We ask readers to note that the pyramid represents the number of people involved in each 'level'. We are not suggesting that the primary goal of science and discovery centres is to increase the number of people 'Employed in STEM'. Many practitioners see increasing scientific literacy and broadening this part of the pyramid as a far more important.

What is unique about exploring science in a science and discovery centre?

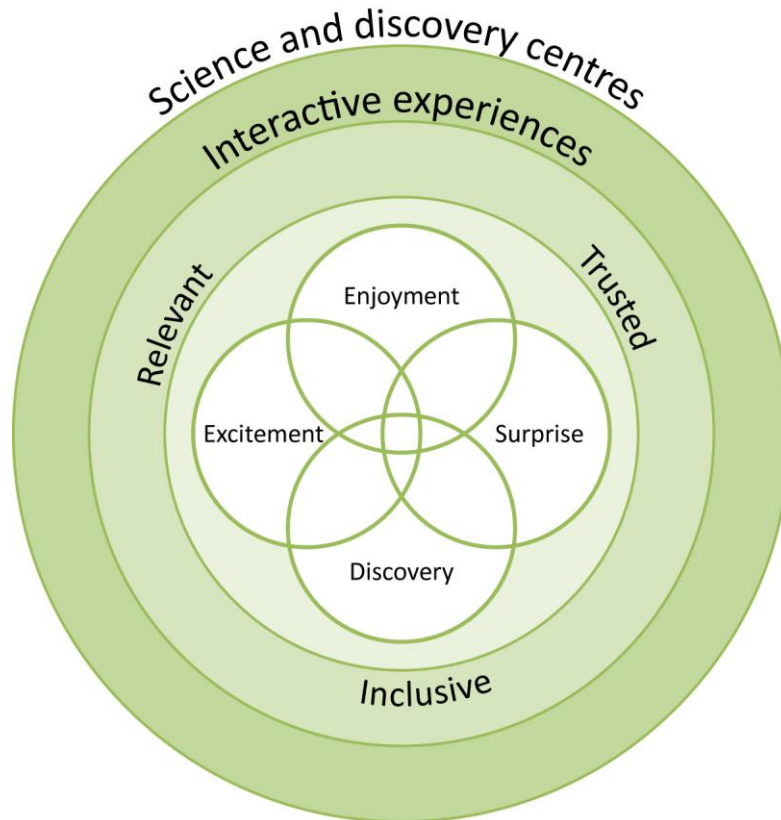


Figure 4: The above diagram shows what we feel is unique about a visit to a science and discovery centre, and what we will test in our impact cards. One of the unique elements of informal science learning in science and discovery centres (and festivals) is that a major goal is to engender emotional engagement with the subject matter.

In the centre of this diagram are elements of the experience we would hope visitors would feel as part of their science experience; enjoyment, surprise, discovery and excitement. All of these we feel are likely to drive motivations to find out more and develop an interest in the sciences. These are encapsulated by a ring representing the way our visitors have said they feel our centres are trusted, inclusive and relevant. Again, this is something we will test in the impact cards. Wrapping all this up is the outer circle with the words 'interactive experiences'. This is the core of what we do and the way we innovate. It is the way all our centres interact with our visitors, and the single item that runs through the science experience of every visitor to every centre.

The impact of visiting a science and discovery centre

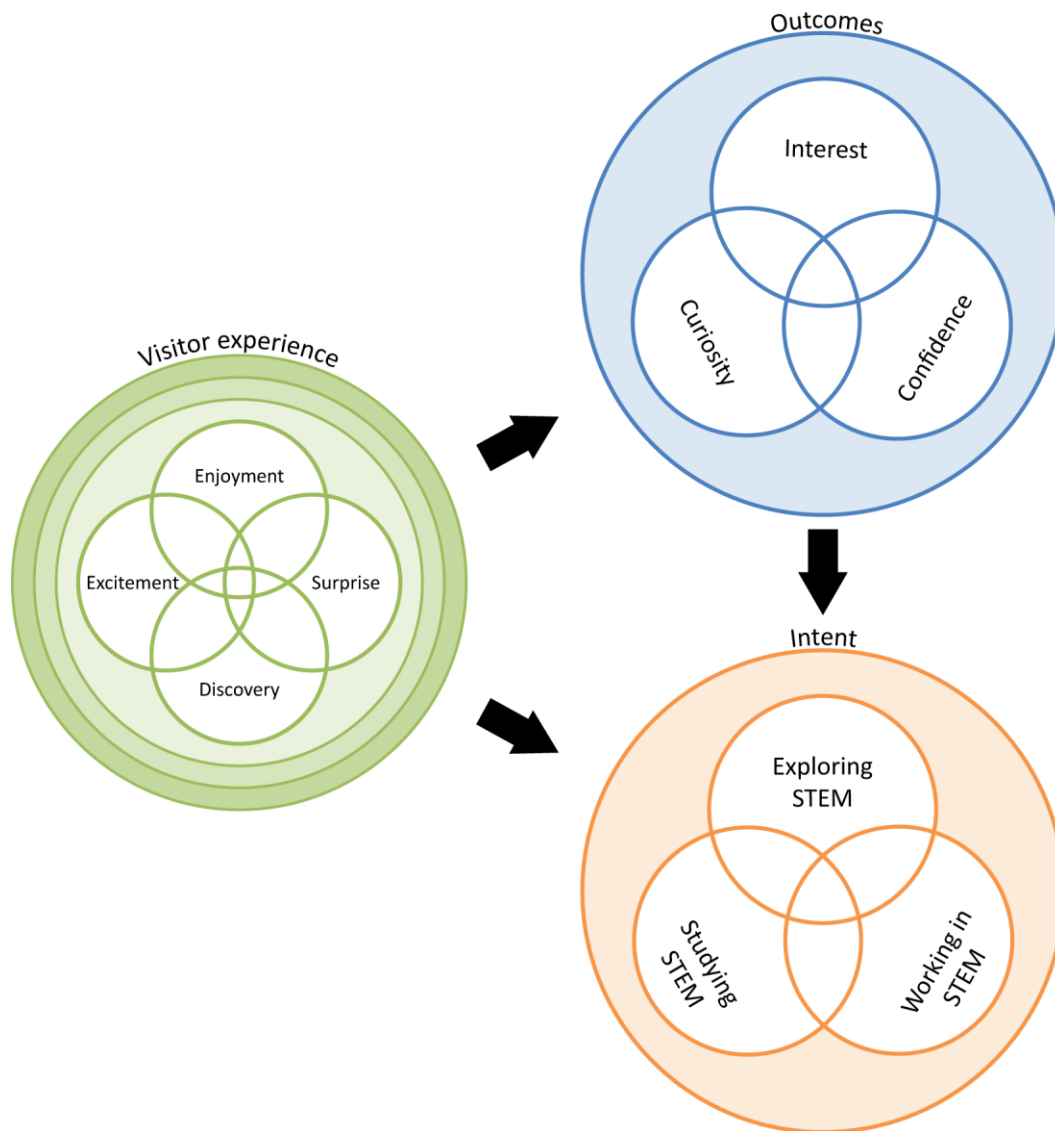


Figure 5 Extrapolating from figure 4, we feel that the visitor experience in a science centre engenders enjoyment, surprise, discovery and excitement, all wrapped up in interactive experiences offered in a trusted, inclusive and relevant manner (the green circle). Our model postulates that this supports the development of three outcomes; Interest, Curiosity and Confidence (the blue circle), which the impact cards will test for. Both the initial visitor experience or the outcomes of increased interest, curiosity or confidence in science would, we believe, be capable of sparking the desire to people to explore STEM further, or (generally for younger people) Study STEM and Work in STEM.

3. Measuring Impact

3.1 Introduction

As described earlier, this report does not aim to measure all of the impacts of science and discovery centres, but a selection of important impacts that might be reliably and consistently measured.

Following extensive research of current impact indicators (reviewed in section 4), in addition to consultation with staff and senior managers within a number of science and discovery centres and other organisations, we have devised an indicator framework with three accompanying impact cards to take the first step in assessing in a consistent way many of the important impacts of UK science and discovery centres.

This section begins by summarising our proposed indicator framework that our research and consultation has suggested would be most valuable. It then gives detailed guidance notes on what should be included and excluded within these indicators as critically, there is a wide variability within our sector as to definitions of indicators due to the different funding bodies that different centres report to.

The three 'impact cards' we have created begin to assess, in a consistent manner, some of the qualitative impacts of the work of science and discovery centres. Most centres do far more in-depth and robust evaluation themselves; however, these approaches have all evolved separately and are therefore different. Our goal is to have a common framework that everyone might be able to submit data to (that overlaps with their current reporting requirements). We have created a 'light-touch' system that we hope can easily be incorporated into existing practice.

The proposed indicators aim to be SMART: Specific, Measurable, Achievable, Relevant and Time-bound. Whilst there are a vast number of things we would want to measure about our work, we have had to take a pragmatic view limited by the data collection centres can realistically achieve for no additional funding.

Quantitative and Qualitative

Clearly any impact assessment framework must include both quantitative and qualitative research. The impact assessment framework we propose will:

- A. Record the numbers and backgrounds of people visiting science and discovery centres in a consistent manner, under the following headings, which match the BIS agenda:
 - Engaging the public with science
 - Inspiring school students with science and science careers
 - Supporting teachers to inspire their students with STEM
 - Widening participation in science
- B. Create three separate 'Impact Cards' to use as self-completed exit surveys to measure qualitatively the experience of people within each of these groups:
 - School Students
 - Teachers
 - Families and Leisure Visitors

Benefit to the sector and individual centres:

The goal of this type of data collection is that in the future we will be able to summarise findings in this manner: *“Together Science and Discovery Centres delivered 200,000 individual curriculum-linked workshops to 4.3 million school students. 89% of these students said the experience had inspired them with science. 62% felt they wanted to learn more about science as a result of their visit (n=2000 students)”*

We considered an alternative method for grouping the indicators as shown below. However, we rejected this based on the lack of consistency we could achieve at low cost in measuring the quality of the experience delivered, and the lack of linkage to the BIS agenda.

1. The reach: i.e. the numbers and backgrounds of participants and visitors
2. The range of the experience offered by the centres
3. The quality of the experience delivered
4. The learning achieved (using the GLO's)

“Learning is in the mind of the beholder”²⁷

There are a variety of ways of measuring quality. One option would be to create a comprehensive list of criteria of quality and agree these with a number of experts in the field, then develop and implement a process of peer review so that centres might review the performance of one another in a regular manner and score accordingly. Whilst possible, this is a costly exercise. In addition because the reviewers would necessarily come from different institutions they would bring with them differing opinions of what constitutes quality.

For this work we have chosen the approach that quality can be judged in terms of the learners learning. Do they feel they have learned? Do they feel they have enjoyed themselves? Do they feel more positive towards science following their participation?

In many ways this has a level of subtlety as often the most powerful experiences are caused by a specific resonance a visitor has with something or someone which affects them on an emotional level making the experience altogether more memorable (creating delight, enjoyment, surprise). After all, how valuable is an event that experts feel is high quality, if the learner has not engaged and benefited from it. We have coined the phrase ‘learning is in the mind of the beholder’ to explain the hidden power of this type of quality assessment.

²⁷ Dr Penny Fidler

3.2 ASDC Indicator Framework

| Engaging the public with science ²⁸ | |
|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Total number of visitors |
| 2. | Total number of children visiting (15 years and younger) |
| 3. | Total number of adults visiting per year (16 years and over) |
| 4. | Total number of web visitors |
| Inspiring school students with science and science careers | |
| 5. | Number of children visiting in formal school groups (up to age 18) |
| 6. | Number of facilitated interactive curriculum-linked activities delivered (Please give the split you have e.g. KS1,2,3,4,5 in England) |
| 7. | Number of school students taking part in facilitated interactive curriculum-linked activities |
| 8. | Number of school students brought together with science role models (scientists, engineers, science specialists and other experts) |
| Supporting teachers to inspire their students with STEM | |
| 9. | Number of teachers bringing students |
| 10. | Number of teachers receiving CPD |
| 11. | Number of individual schools your centre has interacted with in the past year (including outreach) |
| Widening participation with the sciences | |
| 12. | <ul style="list-style-type: none"> • Number of people from low income backgrounds (NS-SEC groups 5-8) (reported as %) • Number of people engaged from ethnic minorities (reported as %) • Number of people engaged with a disability (reported as %) • Number of people over the age of 65 (reported as %) • Number of people visiting in family groups in leisure time (reported as %) |
| 13. | Outreach activities Numbers of adults and children reached through outreach (outreach should be a subset of your overall visitor figures) |
| Visitor satisfaction | |
| 14. | % of visitors who would recommend a visit ²⁹ |
| Finance: Self-generated income ³⁰ | |
| 15. | <ul style="list-style-type: none"> • Admissions % • Trading % • Fundraising % • Public funds % |
| 16. | Number of people engaged specifically with environmental and sustainability projects |

²⁸ A visitor will 'engage' in a variety of ways, none of which are measured here. This is simply quantitative. The evidence for engagement will be collected via the three specific qualitative indicator cards aimed at students, teachers and leisure visitors.

²⁹ & ⁶ both are from the DCMS performance framework so we might compare our levels of visitor satisfaction and self-generated income with those achieved by the national museums.

3.3 Guidance notes for the proposed indicator framework

A: Engaging the public with science

Indicator 1: Total number of visitors

Following consultation with a number of member science and discovery centres as well as the evidence given within 'Balancing the Scorecard' A review of DCMS Performance Indicator Framework³¹, and the discussions between the Scottish science centres on this matter, it is evident there are a number of different ways museums and science and discovery centres assess their total annual visitor number. For example, some do not count corporate hire visitors, members, children under three or visitors to their parks and gardens within their total annual visitor count, whilst others do. Likewise some count visitors to their café and shop within their total annual visitor count, whilst others do not.

Following our research we would recommend the following inclusions and exclusions to what is counted within an organisations visitor numbers. The rationale for each is detailed below.

Recommended Definition

Annual Visitor Counts *should* include:

- All your on-site visitors, including your education visitors
- Outreach 'visitors'
- Corporate entertainment visitors
- Member visits
- People you do not charge for (e.g. children under 3 years, carers)
- Your special events visitors, e.g. to lectures and galas
- Visitors to all your sites where science-related content is on offer, including IMAX, science theatres and planetarium

Annual Visitor Counts *should not* include:

- Visitors who only visit your café or shop
- Visitors to your web-site or on-line exhibitions
- Visitors to your travelling exhibitions at other sites
- Volunteers (including scientists), contractors, suppliers

If you count visitors to your outdoor uncharged areas (e.g. nature park, nature trail) we will ask for these separately

³¹ By Morris Hargreaves Macintyre

Evidence-base for inclusions and exclusions

INCLUDED: Corporate entertainment visitors

There is clear variability over the inclusion of corporate visitors into the overall visitor figures. For the purposes of consistency we recommend they are included in annual visitor counts.

In discussion with a number of science and discovery centres, and as mirrored by the consultation in the DCMS report, it is clear that members feel strongly that a corporate client's choice to make a booking with their organisation is driven by the nature of the venue. The client very often wants to entertain guests in a science-based, fun, engaging environment and has hence selected this venue to reflect their own values and aspirations. In most cases the client's and their guests visit the exhibitions and take part in planetarium or other shows and are often engaged in a manner similar to any other visitor. After all this is why they have booked this venue and not a hotel.

Corporate entertainment also provides a mechanism to build partnerships and engage with local universities, businesses and local government and potential supporters. We would recommend that the number of corporate entertainment visitors is separately noted, and used as an indicator of success in terms of attracting investment and generating income.

INCLUDED: Members and repeat visitors

In this instance, we take our lead from DCMS. For DCMS sites that have free entry, there is an established pattern of repeat visitors, often people who 'pop in' for an hour and are always included counted afresh on each visit.

In contrast, in ticketed independent charitable centres each individual visit costs the full ticket price. The closest approximation is members who have purchased an annual ticket as they are keen to visit frequently. To ensure consistency with DCMS visitor counts, we thus recommend that centres count each repeat or member's visit as a separate visit. Likewise, those uncharged visitors on repeat visit programmes should be counted for each visit, as per DCMS. Generally ticketing systems do not count free entries of this nature, so we recommend an approximation is given annually. We will create a mechanism for you to tell us if you are giving us an estimate.

INCLUDED: Outreach visitors

We recommend that these are separately counted and reported, but are included in all annual visitor counts, for all indicators.

EXCLUDED: Visits to cafes and shops

The delightful nature of a free museum means there is no cost barrier to people taking up the opportunity to visit the museum briefly. For this reason the majority of DCMS museums have their retail outlets within the museums. Since there is no entry charge, people can still visit quickly to select a gift or eat lunch and are therefore counted by the magic eye beams as visitors.

In contrast, where there is a charged entry, for example all the charitable science and discovery centres, the retail outlets are purposely outside the ticketing point to maximise revenue and to appeal to the widest range of repeat visitors and passing trade.

As we understand it, visits to cafes and shops in DCMS-funded museums are counted within the visitor numbers, whereas in ticketed science and discovery centres they are not.

Currently we recommend that all visitors to the shops and cafes in science and discovery centres are not counted within the annual visitor count, however, we might wish to discuss this to bring ourselves in line with the DCMS annual visitor count.

SEPARATE COUNT: Visits to parks, gardens and outdoor spaces

Another area of variability relates to visits to uncharged parks, gardens and outdoor spaces. For several of our members, only visits to the hands-on science centre is charged and counted whereas visits to the grounds and outdoor spaces, which contain a great deal of interpretation around science and the environment, are generally excluded from the visitor figures. These spaces are generally maintained from the same budget as the science and discovery centres, and usually form part of the overall visitor experience and serve to attract visitors.

This applies to only a small number of centres and therefore we ask them to offer separate counts of outside areas. For the avoidance of doubt, many city councils use the public spaces around science centres for a multitude of public events. The visitor attendance here would not be counted as, whilst the science centre is an attractor and may well put on activities, the event is not funded or arranged by the science centre. Outreach delivered at such events to specific numbers of publics can be counted as outreach numbers.

All our UK centres have mechanisms in place to count their visitor numbers. These range from 'magic eye beams' and exit and shop sensors to manual clicker counts and advanced ticketing systems such as TOR.

Where visitor numbers are based on the actual numbers of tickets sold, there is a high degree of certainty in the numbers. In the larger museums where magic eye beams are employed, the degree of certainty is lower (despite instrument calibration). For example people who only visit the shop or the café are counted as visitors. Visitors who pop out of the venue to meet a friend or for lunch in the sun are counted as two visitors.

Special note relating to double-counting

For reasons of logistics, many venues count visits to different parts of their site separately and then add these together. These might, for example, be through tickets sold at the entrance to an IMAX, gardens, or hands-on science area. Alternatively for education visitors who arrive from coaches through a different entrance or for visitors to special exhibitions on different parts of a site. In many cases it is not easy to ascertain if it is one individual visitor who has visited both venues, or two separate visitors. There is a clear risk of double-counting here. This issue was also raised in the MHM review of the DCMS Performance Indicator Framework report commissioned by DCMS.³²

³² Morris Hargreaves McIntyre. *Balancing the Scorecard: Review of DCMS Performance Indicator Framework*, March 2007

Indicator 2: Total number of children visiting per year

Children Visitor Counts *should* include:

- All your on-site child visitors, including your education visitors
- All Outreach 'visitors' (ALSO RECORD SEPERATELY)
- All Member visits
- Children you have not charged on this visit (Free repeat visits or 'local children go free' and two for one offers)
- children you never charge for (e.g. children under 3 years,)
- Your special events visitors, e.g. to fairs, science shows
- Visitors to all your sites where science-related content is on offer, including IMAX, science theatres and planetarium
- The numbers of children visiting in school groups, whether facilitated or not by staff
- Visits by UK Summer School students that are in support of the curriculum
- Visits by nursery groups
- All GCSE classes where the students are both 15 and 16 years, include the numbers for the whole class
- For the avoidance of doubt, please use the guidance for total visitor numbers - this should simply be the child component of your total visitorship

Children Visitor Counts *should not* include:

- Children who only visit your café or shop
- Children who only visit your web-site or on-line exhibitions
- Children visiting your travelling exhibitions at other sites

³³

Special consideration for school groups age 15 and 16

For the avoidance of doubt and in line with the DCMS indicator, for school visits by mixed groups of 15-16 year olds (GCSE year/ Year 11 in England), the whole class should be regarded as children i.e. of compulsory school age.

Programmes with repeat visits for classes

Please note that any one class that visits in the morning and returns that afternoon for a second session should be counted as having made one visit. If they return on a separate day, they may be counted as two visits in line with DCMS indicators and other repeat visitors.

Confusion caused by variability in child and adult ticketing

All UK science and discovery centres who charge an entry fee, have a reduced price for children. However, the definition of a child varies from under 14 to under 18. Likewise there is variability in the age that young children are permitted free entry (e.g. under 3 to under 5 years).

This causes a problem because most charitable centres who must charge an entry fee, assess their visitor numbers through their ticketing systems. Meaning they under-report the number of children visiting before their 16th birthday.

³³ NOTE: The DCMS Performance Indicator excludes visits by children being educated at home, and outreach programmes

We recommend that each centre puts for this indicator what age range they have reliable data for and are reporting on, and gives alongside an ESTIMATE of the full numbers of children visiting before their 16th Birthday.

Indicator 3: Total number of adults visiting per year

Total numbers of adults *should* include:

- All visitors aged 16 years or over including any formal learning groups aged 16-19
- All inreach and outreach numbers
- All repeat visitors, members
- All teachers
- For the avoidance of doubt, please use the guidance for total visitor numbers - this should simply be the adult component of your total visitorship

Total numbers of adults *should not* include:

- Students of 16 years who visit with their school class with mixed ages of 15-16; these students are classed as children for the purposes of these indicators

Indicator 4: Total number of web visitors

Total numbers of web visitors *should* include:

- Number of individual web visits

B: Inspiring school students with science and science careers

Indicator 5: Number of school students visiting in FORMAL education visits

Number of formal education visits *should* include:

- children visiting in school groups, whether facilitated or not by staff
- Visits by UK Summer School students that are in support of the curriculum
- Visits by nursery groups
- 16-18 year olds in formal groups (and all A level groups)
- outreach

It *should not* include:

- adult learning groups (these are counted as adults)
- Informal learning groups (guides, scouts etc)

Please note that any one class that visits in the morning and returns that afternoon for a second session should be counted as having made one visit. If they return on a separate day, they may be counted separately as with other repeat visitors.³⁴

Indicator 6: Number of facilitated interactive curriculum-linked activities delivered

Total numbers of curriculum linked activities *should* include:

- Schools workshops, shows, labs, meet the experts, dialogue events, planetarium shows (if curriculum linked), nature walks, storytelling or drama sessions
- Facilitated sessions in an area of the exhibition floor, including dialogue activities and working with scientists
- Activities for all ages within the curriculum

Notes:

- The purpose of this indicator is to demonstrate the large number of small group facilitated interactions that science and discovery centres facilitate. Please use this as a guide when interpreting this indicator.
- It would be unusual for schools workshops not to be both interactive and curriculum-linked. We would expect this indicator to record your total number of schools workshops + all other curriculum-linked dialogue events + mentor and other activities
- If you have the data split by Key Stage (England) or P1-P3, P4-P7, S1-S2, S3-S4, S5-S6 (Scotland) we will collect this also

Indicator 7: Number of school students taking part in facilitated interactive curriculum-linked activities

Total numbers of hands-on experiences *should* include:

- The numbers of students taking part in all the activities recorded in the above Indicator (number 6).
- This number will be a subset of indicator no. 5 (number of children visiting in formal school groups).

³⁴ The DCMS Performance Indicator excludes:

- visits by children being educated at home
- children under 16 participating in off-site outreach programmes

Indicator 8: Number of school students brought together with science role models

This should include:

- All dialogue events involving scientists, ethicists etc
- All meet the scientist, meet the expert
- All interactive experience with scientists including staff scientists (with a masters or PhD in a STEM subject)
- All interactions with professionals practicing their science (e.g. horticulturists, 3D designers, engineers)

This should not include:

- Staff with a degree in a stem subject

Note: This figure will be a subset of indicators numbers 5 and 7.

C: Supporting teachers to inspire their students with STEM

Indicator 9: Number of teachers bringing students

This should include:

- Inreach and outreach
- Includes teachers and teaching support staff on visits

This should not include:

- Parents and other adults supporting a visit

Indicator 10: Total number of teachers receiving CPD**This should include:**

- Inreach and outreach
- Teachers and teaching support staff (e.g. lab technicians)
- Teachers on secondments and work placements
- "Participation in INSET training in the museum or elsewhere
- Teachers attending previews
- Teachers co-creating resources with your centre, or other collaborations

This should not include:

- Pre- or -post visits to museums where teachers do not meet with museum staff, or conversations are limited to logistics.

Indicator 11: Number of individual schools your centre has interacted with in the past year**This should include:**

- All inreach and outreach
- Teachers and teaching support staff on CPD
- All special projects
- All primary, middle and secondary schools

This should not include:

- HE colleges and Universities
- Schools who your staff have spoken with and advised, but who you have not taken part in any activity with you.

Notes: Five science and discovery centres hold STEMPOINT contracts with STEMNET, and/or manage the STEM ambassadors programme for their area. This is a natural alliance given both organisations share the goals of inspiring students with science, (in a variety of ways) and science centres have established relationships with schools in their region. Since we are counting other funded projects within the impact of science and discovery centers, we include these within the figures. However, we restrict inclusion to schools who have taken part in an activity and recommend advice over the phone and sign-posting to other activities should not be included here.

D. Widening participation

Indicator 12: Widening participation with the sciences

This should include:

- Number of people from low income backgrounds (NS-SEC groups 5-8)
- Number of people engaged with a disability (reported as a %)
- Number of visitors aged over 65 (reported as a %)
- Number of people engaged from ethnic minorities (reported as a %)
- Number of people visiting in family groups in leisure time (reported as a %)

Note: Many centres do not collect this data due to the expense. Centres will need to advise us on what they can collect.

Special issues

In general, owing to the expense involved, centres only collect this data from general visitors where it is part of their funding agreement (e.g. Government-funded organisations).

Many centres, in particular smaller and more rural centres, do not collect this data except within specific projects. These centres would require expertise and assistance from DCMS as well as funding to achieve this, for example as an exit interview on days of different visitor demographics (holidays, weekends, schooldays).

Alternatively, centres might be able to collect postcode data on schools visiting if DCSF would offer expertise in how this might relate to NS-SEC groups 5-8. Again, investment is needed here.³⁵

Indicator 13: Outreach activities

This should include

- Number of formal outreach events
 - Number of students worked with via formal outreach events
- (these would be a subset of the other figures)

³⁵ NS-SEC: National Statistics Socio-economic classification groups 5-8; this includes

Class 5. Lower supervisory and technical occupations.

Class 6. Semi-routine occupations.

Class 7. Routine occupations.

Class 8. Never worked and long term unemployed.

(Source: Office for National Statistics)

E. Visitor satisfaction

Indicator 14: Percentage of visitors who would recommend a visit

Percentage of visitors who would recommend a visit

How likely are you to recommend a visit here to your friends or family?

Note: This question is asked by DCMS as their only qualitative indicator and therefore we ask it here as a comparator. We have not asked 'how satisfied were you with your visit' as there is much evidence to show this is a non-robust indicator as people answer this question based on their prior expectations (for example, members and repeat visitors are harsher critics than first time visitors).

DCMS uses the following 6 categories of answers:

- Definitely will
- Probably
- Possibly
- Probably not
- Definitely not
- Don't Know

F: Finance: Self-generated income

Indicator 15: Finance; self-generated income as a proportion of total income

- Admissions (%)
- Trading (%)
- Fundraising (%)
- Public Funds (%)

Indicator 16: Number of people engaged specifically with environmental and sustainability projects

As a nation and as a global society we face a number of challenges, most pertinently those related to carbon emissions and their consequences. As a sector engaging 20 million members of the public each year we are well placed to engage people with the science of climate change and, if done correctly, to influence their attitudes and behaviours. We have therefore included this indicator to assess the level of activity in this area, because of its importance both strategically to our sector and to the nation.

Frequency of data submission

UK science and discovery centres use a variety of financial years, the most popular starting in January, April and September:

- We will ask centres to submit data annually to contribute to the UK figures.
- Initially we will ask centres if they can report their figures for the previous calendar year (Jan-December)
- If this is difficult, we will ask centres to report for their previous financial year, with the idea to transition to one agreed 'year' in the future
- Collecting quarterly or monthly data would be ideal to show seasonal peaks and enable us to aggregate the data and define the 'year' as the calendar year despite the centres fiscal year. However this would require additional funding for the data analysis.

3.4 Measuring the quality of experience

At this point we should learn from the DCMS experience. In 2007, DCMS commissioned Morris Hargreaves McIntyre to undertake a consultation into the set of 23 KPIs used to assess the performance of our national museums. As a result of this consultation, DCMS developed 12 common Performance Indicators that all the DCMS sponsored museums provide data for. In addition to these each museum was given the option of setting another 5 performance indicators of their choice. All of these were set out in each individual museum's Funding Agreement on the DCMS Website. Because of the difficulty and subjectivity of measuring quality, the 12 Standard DCMS KPIs include only one qualitative KPI: 'Percentage of visitors who would recommend a visit'.

All our member centres evaluate the quality of the experience they offer in different ways. As major visitor attractions, the vast majority ask about visitor satisfaction and enjoyment as a way of improving performance and addressing the needs of their visitors. This is routine for paid visitor attractions and many employ market research companies to more fully understand their audiences, and what are the drivers and barriers to a visitor's enjoyment.

Our task is to create indicators which measure the impact of Science and discovery Centres against the BIS science and society agenda. Thus, we have arranged our quantitative questions in order to demonstrate our impact in 4 key strategic areas of BIS:

1. Engaging the public
2. Inspiring students
3. Supporting teachers to inspire students
4. Widening participation

Audience Segmentation Models

The Audience Segmentation Models reveal much about the motivations of visitors and what they seek out and learn from their visit. We investigated a number of segmentation models to explore if there was a better way of grouping our visitors (for example, Falk's model of audience segmentation). However, following consultation with a number of science and discovery centres practitioners, it seemed sensible that we should segment our audiences in ways that fitted most naturally for our centres making it easy for them to ask the questions.

The 3 'Impact Cards' are therefore for the following groups:

1. For teachers
2. For school students
3. For leisure visitors including families



Optional Extra's: Exit Interviews and Follow ups

There is the possibility of adding later a set of common questions that centres might like to use to follow up teachers and students after visits to begin to assess the longer-term impact the science and discovery centre has had on students and teachers.

Different content specialisms

In all aspects of this report, the word science and the sciences refers to the broadest meaning of the word relating to understanding the world around us. This includes technology, engineering, maths, environmental science, nature, social science and others. However, we appreciate that the visitors answering the questions will not always relate a question about science to their visitor experience. This is particularly relevant for centres that focus on nature and the environment.

Ideally all UK science and discovery centres will use the same wording on the indicator cards, but we would like to receive feedback from all our centres on this issue.

The Impact of Outreach

For many UK science and discovery centres, particularly those working in or near rural areas, a large proportion of the people and schools they work with might be via outreach. This has a huge impact particularly in relation to hard-to-reach groups within communities and rural areas.

This set of indicators currently does not specifically assess this aspect and we would be delighted within the consultation period, for outreach providers to take the 3 impact cards, and create from these a similar set they feel would measure the impact of outreach activities across the UK.

The Scale used

For the purposes of all these questions we have chosen to use a standard Likert Scale with the following 5 intervals:

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree




How to use the impact cards:

- These are for staff in centres to use with their visitors.
- Staff are welcome to print out the full learning and engagement 'impact cards' and use with visitors (our preferred option)
- Alternatively, staff might prefer to incorporate the questions within their own standard question sets
- We anticipate these will be given out like exit surveys and completed in an unsupervised manner, returning completed 'impact cards' to the front desk or survey box.

How many?

We will consult members on what is a reasonable number of cards for them to achieve, and discuss this with statisticians during the consultation phase. We prefer at this stage not to stipulate a percentage or set number of cards to be completed. For example, asking for 2% of visitors each year means 1000 cards for centres with 50 000 visitors and 40,000 cards

Learning Impact Card for School Students³⁶

| For Students | Strongly agree | Agree | Neither agree nor disagree | Disagree | Strongly disagree |
|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------|-------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------|
| |  | |  | |  |
| During my visit: | | | | | |
| I enjoyed myself | | | | | |
| I learnt something new | | | | | |
| I did something new | | | | | |
| | | | | | |
| My visit today made me feel: | | | | | |
| More confident with science | | | | | |
| Keen to find out more | | | | | |
| More interested in science | | | | | |
| Studying science might be fun | | | | | |
| Working in science might be interesting | | | | | |
| | | | | | |
| [insert name of science centre] is a good place to learn about science in a different way to school | | | | | |
| When I get back to school I think the experience from today will help me in science classes | | | | | |
| I would recommend this place to my friends | | | | | |

| Mapping the questions to the GLOs | |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enjoyment, inspiration, creativity | <ul style="list-style-type: none"> I enjoyed myself [a science centre] is a good place to learn about science in a different way to school |
| Attitudes and values | <ul style="list-style-type: none"> More confident with science More interesting in science Studying science might be fun Working in science might be interesting |
| Knowledge and understanding | <ul style="list-style-type: none"> I learnt something new |
| Skills | <ul style="list-style-type: none"> I did something new |
| Activity, behaviour and progression | <ul style="list-style-type: none"> Keen to find out more When I get back to school I think the experience from today will help me in science classes I would recommend this place to my friends |

³⁶ Note, smiley faces should only be used up to age 11

Impact cards for Teachers³⁷

| For Teachers | Strongly agree | Agree | Neither agree nor disagree | Disagree | Strongly disagree |
|---------------------------------------------------------------------------------------------|----------------|-------|----------------------------|----------|-------------------|
| Impact on my students | | | | | |
| I feel this visit inspired my students | | | | | |
| My students learned something new about science | | | | | |
| [insert name of centre] is a good place to learn about science in a different way to school | | | | | |
| I feel my students will be more interested in science than before they came | | | | | |
| The visit supported the students' hands-on practical skills | | | | | |
| About me | | | | | |
| I discovered something new during my visit | | | | | |
| The visit met my curriculum needs | | | | | |
| When I get back to school I will use experiences from today to help reinforce what I teach | | | | | |
| The visit made me feel more positive towards science | | | | | |
| If we had the money, we'd like to bring our students every year | | | | | |
| I would recommend a visit to other teachers | | | | | |

| Mapping the questions to the GLOs | |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enjoyment, inspiration, creativity | <ul style="list-style-type: none"> I feel this visit inspired my students [a science centre] is a good place to learn about science in a different way to school |
| Attitudes and values | <ul style="list-style-type: none"> I feel my students will be more interested in science than before they came The visit made me feel more positive towards science |
| Knowledge and understanding | <ul style="list-style-type: none"> I discovered something new during my visit |
| Skills | <ul style="list-style-type: none"> I did something new The visit supported the students' hands-on practical skills |
| Activity, behaviour and progression | <ul style="list-style-type: none"> When I get back to school I think the experience from today will help me in science classes If we had the money, we'd like to bring our students every year I would recommend a visit to other teachers |

³⁷ Each of the questions maps to a specific GLO,

Learning Impact Cards for Family groups / Leisure visitors

Note: the survey card should be given to adults

| Impact card for adults in family groups/ leisure visitors | Strongly agree | Agree | Neither agree not disagree | Disagree | Strongly disagree |
|-----------------------------------------------------------------------------------------------------------|----------------|-------|-------------------------------|----------|----------------------|
| I enjoyed my visit | | | | | |
| I learned something new | | | | | |
| I feel that science is more interesting than before my visit | | | | | |
| I would trust science centres, like this one, to portray science more honestly than the media/ government | | | | | |
| This visit has made me want to find out more about science | | | | | |
| This visit made me feel that science is relevant to my life | | | | | |
| I feel today has made me a little more confident about approaching science in the future | | | | | |
| I would recommend a visit to others | | | | | |

| Mapping the questions to the GLOs | |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enjoyment, inspiration, creativity | <ul style="list-style-type: none"> I enjoyed my visit |
| Attitudes and values | <ul style="list-style-type: none"> I would trust science centres, like this one, to portray science more honestly than the media/ government I feel that science is more interesting than before my visit I feel today has made me a little more confident about approaching science in the future This visit made me feel that science is relevant to my life |
| Knowledge and understanding | <ul style="list-style-type: none"> I learned something new |
| Activity, behaviour and progression | <ul style="list-style-type: none"> This visit has made me want to find out more about science I would recommend a visit to others |

4. A review of relevant indicators of impact

In arriving at our recommendations we have reviewed a considerable number of impact assessment frameworks. Below is a summary of those we consider most pertinent.

4.1 DCMS Performance Indicators

DCMS have seventeen sponsored museums and galleries. The particular relevance to this report is that DCMS have undergone a considerable journey of consultation to arrive at 12 common performance indicators against which the impact of their museums and galleries are measured. Despite the work and expertise that has gone into creating this list of indicators, we should learn from the fact that only one of the common DCMS indicators is qualitative - that of visitor satisfaction measured by the percentage of visitors who would recommend a visit.

The DCMS framework is particularly relevant for the following reasons:

1. DCMS have put considerable efforts into assessing the impact of their 17 sponsored museums and galleries (seven of whom are our members). Despite this they choose to use no real qualitative indicators to assess impact.
2. The reason DCMS do not collect qualitative data is that as experts with a great deal of experience in this area they appreciate collecting qualitative data can be 'problematic and time-consuming' and therefore have not made their funding conditional on qualitative measures.
3. As with other cultural institutions, DCMS does not ask its sponsored museums to measure their impact in terms of learning, attitudinal or motivational impact, or impact on future careers.
4. As major visitor attractions, within a variety of content areas and geographical locations, they are the closest set of indicators to assess what science and discovery centres do.

DCMS PERFORMANCE INDICATORS

The 12 DCMS KPIs are summarised below and complete definitions for the indicators are available online.³⁸

| Access | |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Number of visits to the museum/gallery (excluding virtual visitors) |
| 2. | Number of unique website visits |
| Audience Profile | |
| 3. | Number of visits by children under 16 |
| 4. | Number of visits by UK adult visitors aged 16 or over from NS-SEC groups 5-8 |
| 5. | Number of visits by UK adult visitors aged 16 and over from an ethnic minority background |
| 6. | Number of visits by UK adult visitors aged 16 and over who consider themselves to have a limiting long-term illness, disability or infirmity |
| 7. | Number of overseas visitors |
| Learning/Outreach | |
| 8. | Children <ul style="list-style-type: none"> • Number of facilitated and self-directed visits to the museum/gallery by children under 16 in formal education • Number of instances of children under 16 participating in on-site organised activities • Number of instances of children under 16 participating in outreach activity outside the museum/gallery |
| 9. | Adults <ul style="list-style-type: none"> • Number of instances of adults aged 16 and over participating in organised activities at the museum/gallery • Number of instances of adults aged 16 and over participating in outreach activities outside the museum/gallery. |
| Visitor Satisfaction | |
| 10. | % of visitors who would recommend a visit |
| Income Generation | |
| 11. | Self generated income <ul style="list-style-type: none"> • Admissions • Trading • Fundraising |
| Regional Engagement | |
| 12. | Number of UK loan venues |

³⁸ guidance notes for the DCMS KPI's are available at:

http://www.culture.gov.uk/images/publications/Performance_Indicator_Guidance.pdf

In addition to these 12 KPIs, each museum was given the option of setting another 5 performance indicators of their choice to allow for the variety of missions across the UK. All of these are set out in each individual museum's funding agreement³⁹.

Creation of the DCMS indicators

In 2007, DCMS commissioned Morris Hargreaves McIntyre (MHM) to review the existing DCMS performance indicator framework and make recommendations on whether the indicators should be retained, refined or removed. Their report 'Balancing the Scorecard: Review of DCMS Performance Indicator Framework'⁴⁰ reveals the detailed findings from a number of consultative workshops between the consultants and the individual museums. These findings have been broadly similar to feedback given by science and discovery centres on the nature of specific indicators. Like the DCMS sponsored museums, there was considerable discussion around what should, or should not, be included in figures for total numbers of visits, numbers of child visits and education visits.

DCMS Centres within ASDC

Our goal is to create a set of indicators which can be used throughout our sector, of which science-related DCMS-funded museums are a fundamental part. DCMS centres will of course report to their funders in their usual manner, but we hope to achieve some overlap between the indicators of the two sectors.

Seven of the 17 DCMS-sponsored museums are part of the ASDC network, with three of these museums being represented on the ASDC board of Trustees*. These are:

1. National Museum of Science and Industry*
2. Horniman Museum*
3. MOSI (Manchester museum of science and industry) *
4. Natural History Museum
5. National Maritime Museum
6. National Museums Liverpool
7. Tyne and Wear Museums

4.2 The Scottish Government evaluation of Science Centres

In October 2008 the Office of the Chief Researcher within the Scottish Government commenced an evaluation of four Scottish Science Centres. The evaluation is due to be completed in October 2010. The evaluation looks at the following four Scottish science centres:

1. Our Dynamic Earth
2. Glasgow Science Centre
3. Dundee Science Centre
4. Satrosphere

³⁹ http://www.culture.gov.uk/reference_library/publications/5491.aspx

⁴⁰ 'Balancing the Scorecard: Review of DCMS Performance Indicator Framework' by Morris Hargreaves McIntyre
http://www.culture.gov.uk/reference_library/publications/3588.aspx

The Scottish Evaluation is particularly relevant for the following reasons:

1. The Scottish Government has allocated considerable resource to develop an evaluation of the Scottish sciences centres who receive their funding
2. The science centres involved are all ASDC members and represent a variety of centres in terms of size and content

The key themes of relevance to the Scottish Science Centres Evaluation from ‘The Science for Scotland’ strategic framework (2008) include: developing a science culture in Scotland; building capacity and encouraging the growth of scientists in Scotland; encouraging school children to develop scientific careers; strategic knowledge exchange and improving Scotland’s international reputation as a Science Nation.

The evaluation utilises quantitative and qualitative social science methods to examine the impact of the Science Centres’ activities in engaging the public in science and draws on a range of data sources including:

| | |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| A Visitors’ Survey | Fieldwork is conducted every quarter over two years by Morris Hargreaves McIntyre |
| An Omnibus | Conducted annually over two years by MRUK |
| A short literature review exploring the evidence of the impact of science centres in public engagement | In-house analytical activity |
| A literature review of the links between childhood and adult participation in cultural events including science events | Edinburgh University |
| Reflective narratives and contextualisation material from the four science centres | Reporting annually |
| HMIE (2007) work and any actions following HMIE recommendations | HMIE and the science centres |
| Ratings material from Visit Scotland | VisitScotland |

4.3 The Wellcome Trust

As the UK’s single biggest charitable funder of science-based public engagement initiatives, the Wellcome Trust has developed a framework to assess the wide variety of public engagement programmes and projects they fund. They have divided their assessment into three key areas in which they evaluate projects:

1. **Impact:** a subjective assessment of impact on the participants
2. **Reach:** the numbers and backgrounds of participants
3. **Quality:** as assessed by an external expert in the field

It should be remembered that each assessment is completed in relation to the stated objectives of each individual project.

The Wellcome Trust also has a rolling programme of evaluation undertaken by Morris, Hargreaves and McIntyre measuring key aspects that are critical to the success of Wellcome Collection in meeting its vision and strategy. Wellcome Collection's performance is measured quantitatively and qualitatively against its four key strategic aims, namely to:

1. Stimulate public awareness and debate about biomedical issues.
2. Encourage dialogue across professions, disciplines and with the public.
3. Inspire future generations of science, medicine and history professionals.
4. Increase appreciation of the Wellcome Trust's origins, aims and activities.

4.4 Renaissance in the Regions

Renaissance is the MLA's programme to transform England's regional museums. Central Government funding is provided through this programme to regional museums across the country to raise their standards and deliver results in support of education, learning, community development and economic regeneration. The Renaissance programme has received £300 million since 2002. Renaissance investment has been targeted at 9 regional 'Hub's (each Hub is a cluster of 4-5 museums). Significant investment has been made in the development of monitoring and evaluation mechanisms to ensure that all Hubs are counting the same things in the same way and overall data has been collected from over 200 museums as part of this programme. In this sense the programme of evaluation is much wider and more complex than that using the DCMS KPIs described above. It attempts to collect a greater level of quantitative and qualitative data in relation to impact. The harmonisation of definitions between Renaissance and DCMS sponsored institutions implemented from 2008-09 means that now comparisons can be made across a wider range of museums.

Renaissance produced an Audience Data Collection Manual⁴¹ in 2008, designed to ensure the comparability and accuracy of both qualitative and quantitative data. However Renaissance, and specifically its mechanisms to assess impact, have been criticised.

A review of the Manual⁴² describes 'over-bureaucratic' procedures and makes a number of recommendations in relation to data collection and analysis and the adoption of a set of statistical standards. The review concludes that, despite substantial investment in the development of monitoring systems, 'It has not been possible to provide a solid assessment of Renaissance's overall impacts on the basis of the documentation available'.

An assessment of the strengths and weaknesses of Renaissance evaluation has informed the creation of the ASDC indicators, and in particular the development of simple and practical evaluation tools.

⁴¹

http://www.mla.gov.uk/what/programmes/renaissance/~media/Files/pdf/2008/MLA_Audience_Data_Collection_Manual_Nov_2008_Final_v2

⁴² 'Realising the Vision Renaissance in the Regions 2001-2008 Review of the Renaissance Review Advisory Group 2009' p 12

http://www.mla.gov.uk/what/programmes/renaissance/~media/Files/pdf/2009/Renaissance_Review_Report

4.5 SROI: Social Return On Investment

SROI is an outcomes-based measurement tool that helps organisations to understand and quantify the social, environmental and economic value they are creating⁴³.

SROI was developed by The New Economics Foundation (NEF) to assess the financial return on investment for organisations who aim to create social change. The end point is a ratio (return on investment) showing that, for example, for every £1 of funding put into the organisation, the social return is £1.80.

A current three-year New Economics Foundation project, funded by the Office of the Third Sector and Scottish Government, aims to simplify the *SROI* process by making available a database of common indicators and financial proxies. These will be available from 2010.

The SROI can be undertaken by individual organisations via an on-line tool, or by a trained NEF or SROI consultant⁴⁴ on behalf of an organisation.

The relevance of SROI to this work

SROI is an excellent tool and ASDC would highly recommend that individual Science and Discovery Centres consider carrying out their own SROI. The results of the SROI can be used in future funding applications to show a more objective financial return on investment in your centre.

It was not appropriate for ASDC to use this method to achieve the goals of this project since we are not measuring the impact of our own work, but creating a set of indicators to measure in a consistent manner, the impact of over 50 independent Science and Discovery Centres.

The staff time and resources needed to carry out an *SROI* can be extensive and expertise is needed to complete it, making it an individual financial choice for each Science and Discovery Centre. However staff we have spoken to in the course of our research who have carried out a SROI speak very positively of the process and outcomes.

⁴³ <http://www.proveandimprove.org/new/tools/sroi.php>

⁴⁴ www.sroi-uk.org

4.6 Measuring impact using the generic learning outcomes (GLOs)

Generic Learning Outcomes⁴⁵ were developed by The Research Centre for Museums and Galleries at Leicester University on behalf of MLA and are part of the Inspiring Learning for All framework developed for museums, libraries and archives to:

- Provide evidence of the impact of their activities
- Assess strengths and plan improvements
- Improve strategic and operational performance

GLOs are now widely used by the museums sector and since 2007⁴⁶ ASDC has recommended the use of GLO's to its members. GLOs act as a framework and provide a methodology and common language to assess the impact in terms of learning (in its broadest sense). They can be used to collect evidence of impact in the 5 areas below:

The relevance of GLOs and GSOs

The GLO and GSO frameworks can be used to help collect evidence of impact in a number of key areas which directly relate to BIS science and society objectives, for example in assessing whether visitors' attitudes towards science have changed as a result of their visit to a science and discovery centre, understanding what people have learnt about science during the course of their visit or by demonstrating improved group and inter-group dialogue and understanding (for example between the public and scientists).

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Figure 6 Schematic of the Generic Learning Outcomes created by the Museums, Libraries and Archives (MLA) and used here as a framework to assess learning impact.

⁴⁵ <http://www.inspiringlearningforall.gov.uk/> <http://www.inspiringlearningforall.gov.uk/toolstemplates/genericlearning/index.html>

⁴⁶ Inspiration, Engagement, Learning by ASDC 2007 <http://sciencecentres.org.uk/reports/>

⁴⁷ For more information on GLOs see Appendix 1

Science and discovery centres can use GLOs to sort and analyse comments and feedback they have gleaned from visitors through a range of evaluation techniques such as questionnaires, focus group discussions, comment cards etc. They help organisations define the type of impact they are achieving (or not) and help ensure that organisations focus on the outcomes they want to achieve for visitors throughout the process of development of new exhibitions or activity programmes.

4.7 Measuring impact using the social learning outcomes (GSOs)

The GSO framework expands on the generic learning outcomes, within the Inspiring Learning for All (ILfA) resource, to address social impact and was developed through a number of national pilot schemes in 2005-6. It helps organisations plan for and evaluate the wider social benefits of their activities. These outcomes are grouped into the following 3 areas:



Figure 7 Schematic of the Generic Social Outcomes created by the Museums, Libraries and Archives (MLA) and given here to demonstrate the other areas of social impact that science and discovery centres feel they have.

GSOs provide a tool which can be used by science and discovery centres to measure what are often considered to be some of the more intangible benefits that they deliver to their local communities. Examples of social outcomes in science and discovery centres are activities which help children and young people to enjoy life and make a positive contribution, projects which build the capacity of community and voluntary groups or those which extend the engagement of adults with children and young people.

⁴⁸ For more information on GSOs see Appendix 1

4.8 The Taking Part survey and indicators, commissioned by DCMS

The Taking Part survey, commissioned by DCMS in 2005, delivered in partnership with Arts Council England, English Heritage, the Museums, Libraries and Archives Council and Sport England, aims to provide quality-assured data on participation, attendance, attitudes and related factors across its sectors. They also look at why people do, and do not participate and attend. Data is also gathered on a variety of other sectors and topics including social capital, engagement in various sectors while growing up and volunteering.⁴⁹ On 18 March 2010 DCMS published the rolling annual estimates from the 2009-10 Taking Part adult survey.⁵⁰

4.9 RCUK Public perceptions of science annual survey

We reviewed the questions used for this survey with a view to using some in our indicator set to enable us to compare our data with a national dataset over several years. However, whilst the questions are highly relevant to finding out about the general relationship between science and society, they were not specific enough for our needs. For example ‘How well informed do you feel, if at all, about science and scientific research and developments?’

The results of the 2008 survey do however reveal that “A fifth of the population said they had visited a science museum or science centre in the 12 months prior to the survey”. The report also states that “leisure activities such as visiting science museums and science centres can be used as a measure of involvement in science.”⁵¹

4.10 VAQAS: The Visitor Attraction Quality Assurance Service

VAQAS was launched nationally in 2001 and is the consumer-focused quality assessment service for all types of visitor attractions. It is run by the DCMS-backed VisitBritain. For several years, ASDC has recommended that all its members join this quality assurance scheme to receive official recognition of their quality as visitor attractions and their ongoing commitment to high quality customer experiences⁵².

VAQAS has worked closely with Regional Development Agencies and Destination Management Organisations as well as the MLA (who use VAQAS as a requirement for museum registration) and the Highways Agency (who use VAQAS as a criteria for brown tourist signage).

⁴⁹ http://www.culture.gov.uk/reference_library/research_and_statistics/4828.aspx

⁵⁰ http://www.culture.gov.uk/reference_library/publications/6759.aspx

⁵¹ RCUK and DIUS. Public Attitudes to Science 2008 A Guide. A report prepared for Research Councils UK and the Department for Innovation, Universities and Skills by People Science & Policy Ltd/TNS, March 2008.

⁵² ASDC (as Ecsite-uk). Inspiration, Engagement and Learning, The Value of Science and Discovery Centres in the UK, 2008.

VAQAS is used in England, Wales and the Channel Islands. Building on this, VisitScotland uses a 'stars' grading system to indicate the standard of customer care and range of facilities on offer at assessed establishments (five star being the maximum).

How is the quality assessed?

The quality assessment covers the whole visitor journey from initial enquiries to the visit. The assessment is annual and carried out at any time the attraction is open to visitors.

Assessments take into account the type and style of the attraction, so an assessment of a rural discovery centre will be quite different from that of a national science museum. Styles of presentation and interpretation will differ, and visitor expectations will reflect that. Quality is therefore assessed in context, relative to the sector of the industry in which the attraction sits. The visit is followed by a debrief and a report, including the identification of staff training needs.

4.11 Measuring impact via affect

Heidi Bartlett is undertaking some interesting development work on behalf of the Royal Zoological Society of Scotland (Edinburgh Zoo)⁵³ to assess the impact of their work on visitors. Rather than assessing the quality of what is delivered, or the impact the person says they feel, they are developing tools with which a trained evaluator can assess the impact on participants via external observation with methodologies originating from the field of psychology. They aim to:

Monitor visitor emotions by adapting an instrument called the Specific Affect Coding System (SPAFF) which is used to code affect from trained observation of visitor's facial expressions, vocals and gestures. This is combined with Russell's Affect Grid to permit really fast, non-invasive 'in-situ' coding by the observer.

Monitor cognitive learning from 'visitor talk' by listening to and documenting visitor conversations as they move around exhibits. Conversations are then later analysed and coded for 'types of talk' rated along a hierarchy of knowledge formation. Talk is categorised as relating to either perception (level 1), concept forming (level 2), applying/connecting with other contexts (level 3), deconstructing, evaluating, creating new concepts etc. This method also gives insight into what visitors are actually interested in, as well as obstacles to their learning.

⁵³ www.edinburghzoo.org.uk

They are also trialling an interactive mechanism to measure visitor attitude using dialogue boards. The method is an adaptation of the traditional Thurstone Scale combined with the idea of Concept Cartoons or graffiti walls. Visitors express their attitudes towards a science topic by agreeing/disagreeing with different cartoon people expressing a range of views scaled according to Thurstone's method. Visitors get to 'talk with the board' at start and end of visit so changes in attitude can be assessed. The methodology developed through this research will be available towards the end of 2010.

4.12 Schools Participation Database

MLA Partnership, working with the DCMS and the DCSF, have developed a strategic planning tool for museums - the Schools Participation Database. The tool is an excellent online database that can be used to analyse school visits against for example, attainment figures, frequency of visiting, patterns of visiting, driving distance, socio-economic profiles, schools in areas of deprivation and ethnicity.

For example if you would like to work with schools who haven't visited before, who are 30 minutes away, and who have low science scores this tool can tell you who these schools are. The database can be found at www.mlaschools.org.uk.

Currently charitable science and discovery centres do not have access to this database. However, a number of ASDC members, who are also museums, currently have access to this scheme.

There is potential therefore, for science and discovery centres to better support science learning in their local schools and understand the impact of their work through this Schools Participation Database. ASDC could consult with members to assess the benefits of possible wider inclusion of the science and discovery centre network in this scheme.

The aim of the database is to give a national overview of school participation in museum learning activities as well as serving as a planning tool for individual venues. By entering their data into the Schools Participation Database, museums can then use the database to:

- Create reports that demonstrate to stakeholders outputs related to education work
- Quickly and easily create quarterly and annual reports of school visits
- Understand how schools currently work with museums
- Identify and target local schools with free mailing lists that are available to export or print directly from the website
- Access up-to-date DCSF information about schools
- Access up-to-date socio-economic information about schools
- Use as a strategic management tool to provide information to support local and regional planning
- See an up-to-date picture of school participation

An impressive number of reports can be run using the primary data entered by the centre into the Schools Participation Database (e.g. number of school visits, number of outreach contacts) in combination with information already in the database (such as DCSF School Attainment, population statistics etc). As an example, it can tell you the details of a centres participating and non-

participating schools by drive time, LEA, Phase of Education, type of establishment, attainment, museum visits, ethnicity, socio-economic class or deprivation.

4.13 Supporting excellence in the arts: From measurement to judgement by Sir Brian McMaster⁵⁴

This report, commissioned and endorsed by Government, was published in January 2008 and acknowledged the pitfalls of a reliance on ‘cumbersome targets’. The report covers the work of museums and galleries supported through DCMS (listed above and including ASDC members) and the MLA as well as the performing and visual arts.

It is unequivocal in its recommendation for the need to *‘move from a system based on measurement to one based on judgement, and one that in making judgements on excellence, innovation and risk-taking, doesn’t end up discouraging all three’*.

McMaster’s recognition that current systems of assessment are in danger of inhibiting innovation and risk-taking in the arts is one which we have borne in mind in the creation of our own indicators, since a key aim of science and discovery centres is, as with the arts, to have an emotional impact on our audiences. To inspire, engage and help them to feel involved with science.

‘As is occurring in other areas of the public sector there needs to be a move away from ‘top-down’ targets. In some cases these can be an effective and useful tool, but if applied crudely or permanently can become demoralising and distorting. At their most damaging, targets have led arts organisations to take decisions based on meeting quantifiable targets (such as filling seats) at the expense of less easily measurable but equally important outcomes such as excellence, innovation and risk-taking.’¹

Self assessment and peer review, the report’s recommended techniques for achieving a more informative and less damaging system of evaluation.

This report, and the assessment tools described within it, have been informed by the McMaster review and aim to provide a ‘light touch’ assessment method which will provide consistent and reliable information about the impact of the science and discovery centres without undermining their ability to create inspiring, innovative and exciting interactive experiences for visitors.

⁵⁴ <http://www.culture.gov.uk/images/publications/supportingexcellenceinthearts.pdf>

4.14 An overview of Indicators used by BIS-funded comparator organisations

Introduction

“Frontier Economics recommended that ASDC develop a set of indicators, which would:

- 1) Capture the impacts of science centre activities on BIS’ Science and Society agenda and*
- 2) Be consistent with the indicators used for the assessment of the comparator programmes.*

The four BIS-funded comparator organisations referred to in the above recommendation are:

- The Royal Academy of Engineering (RAEng)
- The British Science Association BSA
- STEMNET
- UK Resource Centre for women in science engineering and technology (UKRC)

We approached each of these organisations to explore if there might be indicators we might share.

Royal Academy of Engineering

The Royal Academy of Engineering produces an excellent ‘Guide for Grant Holders’⁵⁵. This outlines in a clear and simple manner how grant holders should undertake evaluation of their ‘Ingenious’ public engagement projects (up to £30,000). RAEng also offer training for their grant holders prior to the start of projects which incorporates training on evaluation. We would see this approach as an exemplar approach to be copied.

The RAEng system of evaluation is as follows:

Evaluation is split into three areas:

- 1. Metrics**
 - Numbers of activities, engineers, participants etc.
- 2. Experience (defined within the following areas)**
 - Enjoyable
 - Interesting
 - Interactive
 - Informative
 - Well-organised
- 3. Impact**

⁵⁵ www.raeng.org.uk/societygov/public_engagement/ingenious/evaluation.htm

- a. on engineers,
- b. on 'publics' (adults, children, schools, science centre visitors)etc,
- c. on 'specialist groups' (policy makers, media, artists, community groups, professional groups)

As defined in the fields of

- Awareness (increased awareness of engineering and its impact on society)
- Attitudes (improved attitudes/ interests to engineering)
- Skills (this only applies to engineers, not 'publics' or 'specialist groups', i.e. did engineers improve their PE skills)

British Science Association

The British Science Association have kindly prepared the following outline of impact measures they report on to BIS. We also thank their staff for input into the early stages of this report.

Impact measures agreed with BIS

"The British Science Association provides a quarterly report to BIS based on outcomes against the Government's 5 stated goals. Each report provides a narrative description of the impact of our activities, including successes and challenges, plus a summary of quantitative data based on KPIs that are agreed with BIS at the beginning of each funding period. The quantitative data includes website statistics, reports in the media and the number of beneficiaries of different kinds that we have reached."

STEMNET

STEMNET and the UK's science and discovery centres work in partnership in a variety of ways. Five of the ASDC members currently hold contracts with STEMNET for delivery of either STEM E&E Advisory Services (STEMPOINT contracts) and/or management of the STEM Ambassadors programme (MOSI in Manchester, Thinktank in Birmingham, Intech in Winchester, Science Oxford in Oxford and Techniquest in Cardiff). ASDC has also been working collaboratively with STEMNET's After School Science and Engineering Clubs (STEM Clubs) to create a handbook to support teachers on out of school science visits.

STEMNET reports to BIS on a number of key measures associated with HMG funded programmes, backed up by independent evaluation⁵⁶ including:

1. The number and spread of schools interacting with STEMNET (for example, via STEM Ambassadors, STEM Clubs and Stempoints) and the level of their engagement
2. The number and diversity of STEM Ambassadors
3. The number of employers engaged with STEMNET

⁵⁶ BIS have information on this

5. The Methodology

Our goal has been to create an achievable indicator framework as the first step in assessing the impact of UK science and discovery centres in a consistent manner.

We would like to develop the methodology in partnership with those who will use it and thus are not being overly prescriptive at this time. Overall, we see the centres collecting the quantitative data in the variety of existing manners, and sharing their data with ASDC annually. UK centres vary in their fiscal year and most commonly they start in January, April and September. In the first instance we will seek to obtain data for calendar years although this might impose an additional burden on ASDC (for example if we have to take monthly data from 50 centres and aggregate this for calendar year). We would also need to discuss with our centres any issues of data protection and if centres would wish to share their data on these 16 quantitative indicators.

The impact cards we have described are simple and low cost, and link to the BIS agenda and the first 11 indicators. We would envisage centres either using these cards as they are, or incorporating the questions into their own on-going questionnaires. In particular these impact cards will provide information on the public perception of science and discovery centres in terms of trust, relevance and inclusion, as well as inspiration, enjoyment and attitudinal impact. Many centres currently have more detailed and robust evaluation methodologies in use and this will be a particular issue in asking everyone to ask some of the same questions.

As an overview, we would expect that these impact cards would be given on exit to teachers, students and leisure visitors to complete in a non-supervised manner, and to return to the front desk or survey box. We would be equally happy if some centres choose to put these questions onto touchscreen-based interactive which would sum up the data for them.

The data from each centre would then be submitted annually to ASDC as overall percentages for each question on each card and we would record and analyse this. Again, we will need to consult with our sector to understand how much of this data centres would be happy to make public.

6. Recommendation for the future: A National Impact Study

Within this report we have created a set of indicators, tied to three impact cards which, if used by every UK centre will make a huge step towards measuring the impact of UK science and discovery centres. However, inspiring the public to engage with science and the natural world in ever more innovative ways is our passion. We therefore feel that this report does not go far enough in truly measuring the rich and varied impacts of science and discovery centres.

We would like to recommend that in tandem with this low-cost, practicable data collection recommended here in this report, that an independent research company who specialises in measuring impact in terms of learning and engagement in cultural and science organisations is commissioned to undertake the world's first rigorous and robust 'National Impact Study' for science and discovery centres. We would hope this independent research would provide us with categorical evidence of the impact of science and discovery centres, achieving what similar research has done for DCMS; namely rigorously demonstrating the impressive impact of their major national museums.

The methodology we present here has been severely limited for two reasons. Firstly centres are not being paid for staff time to implement this data collection thus it needed to be simple and easy to achieve. Secondly, there was no resource on offer for ASDC or other organisation to analyse qualitative data, meaning we have only been able to collect self-reported impacts using a Likert scale.

To measure outcomes and longer-term impacts in a full-scale study we would need to:

- Agree a definition of a range of our outcomes and impacts
- Create a standardised methodology for collecting qualitative data from visitors, based on interviews by trained, independent external experts.
- Employ detailed interrogation of the full datasets by skilled social research analysts.

There has already been significant work done in this area and many of the larger centres within our network including the National Maritime Museum and the Scottish Science Centres are already routinely collecting outcome measures with others such as the Natural History Museum beginning to collect this data.

We therefore propose a year-long 'National Impact Study' collecting data from users of all fifty science and discovery centres that builds on existing good practice and extends it to the whole sector. Such a study would produce three valuable outcomes:

- A seminal report demonstrating robust evidence of the value of our science and discovery centres, establishing a baseline.
- A framework of definitions and methods that provides a template for repeated quantification of these qualitative measures against the initial baseline.
- A template and practical tools for local studies that can in due course be undertaken by individual science centres.

7. Further Reading

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UK Evaluation society: www.evaluation.org.uk

Visitor Studies Group: www.visitors.org.uk/

Acknowledgements

In creating this report, we have assessed a wide variety of indicator frameworks. All of these have shaped our thinking and we are grateful to the individuals and organisations listed below who have so generously shared their work.

- British Science Association
- DCMS
- EPSRC
- ESRC
- Glasgow Science Centre
- John H. Falk, Sea Grant Professor of Free-Choice Learning, Department of Science & Mathematics Education, Oregon State University
- King's College, London
- MLA (Inspiring Learning For All)
- Morris Hargreaves McIntyre
- National Science Foundation USA
- New Economics Foundation
- Paul Jennings PhD, science centre of Iowa, USA
- RCUK
- RCUK Public Attitudes to Science Survey
- UK Resource Centre for Women
- Science Learning Centre South West
- Science Museum
- Scottish Government (Office of the Chief Researcher)
- STEMNET
- STFC
- Dr Sue Cavell, Independent Consultant
- Techniquist
- The Association for Science and Technology Centres USA
- The National Coordinating Centre for Public Engagement
- The Royal Academy of Engineering
- The Royal Observatory Edinburgh
- The Wellcome Trust

The author (Dr Penny Fidler) and the Association for Science and Discovery Centres would also like to thank the following people for reviewing drafts of this paper and their comments and advice:

ASDC Trustee and Independent Consultant
At-Bristol
Eureka! The National Children's Museum
Glasgow Science Centre
Intech
Kings College London
Museum of Science and Industry
National Museum of Science & Industry
Pulse check research consultancy
The Association for Science and Discovery Centres
The Association for Science and Discovery Centres
The Horniman Museum
Thinktank, Birmingham Science Museum
Thinktank, Birmingham Science Museum
Thinktank, Birmingham Science Museum
Independent Consultant

Anne Hunt
Dr Goery Delacote
Leigh-Anne Stradeski
Dr Robin Hoyle
Phil Winfield
Professor Justin Dillon
Dr Robin Holgate
Jean Franczyk
Roger Thornham
Dr Mat Hickman
Samantha Yates
Vicky Brightman
Dr Nick Winterbotham
Dr Tim Caulton
Dr Kenny Webster
Emmie Kell

Appendix 1: Generic Learning Outcomes

Knowledge and Understanding

- Knowing what or about something
- Learning facts or information
- Making sense of something
- Deepening understanding
- How museums, libraries and archives operate
- Making links and relationships between things

Skills

- Knowing how to do something
- Being able to do new things
- Intellectual skills
- Information management skills
- Social skills
- Communication skills
- Physical skills

Attitudes and Values

- Feelings
- Perceptions
- Opinions about ourselves (e.g. self esteem)
- Opinions or attitudes towards other people
- Increased capacity for tolerance
- Empathy
- Increased motivation
- Attitudes towards an organisation (e.g. a museum, archive or library)
- Positive and negative attitudes in relation to an experience

Enjoyment, inspiration, creativity

- Having fun
- Being surprised
- Innovative thoughts
- Creativity
- Exploration, experimentation and making
- Being inspired

Activity, behaviour, progression

- What people do
- What people intend to do
- What people have done
- Reported or observed actions
- A change in the way that people manage their lives

Generic Social Outcomes

Stronger and Safer Communities

- Improving group and inter-group dialogue and understanding
- Supporting cultural diversity and identity
- Encouraging familial ties and relationships
- Tackling the fear of crime and anti-social behaviour
- Contributing to crime prevention and reduction

Strengthening Public Life

- Encouraging and supporting awareness and participation in local decision-making and wider civic and political engagement
- Building the capacity of community and voluntary groups
- Providing safe, inclusive and trusted public spaces
- Enabling community empowerment through the awareness of rights, benefits and external services
- Improving the responsiveness of services to the needs of the local community, including other stakeholders

Health & Well Being

- Encouraging healthy lifestyles and contributing to mental and physical well being
- Supporting care and recovery
- Supporting older people to live independent lives
- Helping children and young people to enjoy life and make a positive contribution