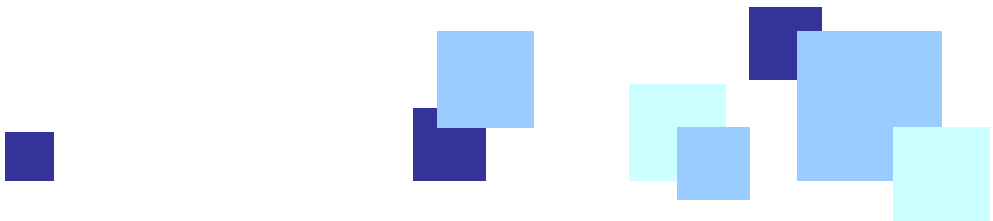
Assessing the Economic Impact of Science Centers on Their Local Communities

Phase 2 of an international study of the impact of science centers, funded by the Association of Science-Technology Centers (ASTC) and thirteen individual science centers



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Chapter 1 Summary and key findings

Evaluation of the impact of science centers and museums is a growing field of study, because of trends such as increasing competition and financial pressure, demands for greater public accountability and transparency, and government policies that require public institutions to demonstrate their achievements in a variety of areas. As part of this growing focus on impact evaluation, the Association of Science-Technology Centers and a number of individual science centers have jointly funded an international study of the impact of science centers on their local communities. Phase 1 of this study, in 2001–02, resulted in an annotated bibliography of 180 items relating to impact evaluation, and produced a model which divides the impacts of science centers on their communities into four categories: personal impact, societal impact, political impact and economic impact.

This report describes Phase 2 of the international study, focusing on the economic impacts of science centers on their local communities. Project objectives for this phase were to:

- collect and collate financial and other data from science centers round the world, in order to develop a set of baseline data depicting the economic activity of science centers in the regions covered by the science center network organisations supporting the project: ASPAC, ASTC, ASTEN, CASC, ECSITE and ECSITE-UK, NCSM, Red-POP and SAASTEC[1]
- prepare a summary of what an economic impact study involves, and of the types of information that need to be gathered in the course of an economic impact study focusing on a science center
- present a small number of 'case study' descriptions to illustrate projects that have already been carried out by science centers, museums and similar institutions to explore their economic impact on their communities
- develop a brief 'how to' guide for a science center wishing to carry out or commission its own economic impact study.

The project was guided by a steering committee consisting of the ASTC President and the executive directors of four of the regional network organisations: ASPAC, ASTC, ECSITE and Red-POP.

A substantial part of this report is an introduction to the topic of economic impact. It includes definitions of key terms, discussion of how economic impacts can be calculated—including a step-by-step guide to planning and carrying out an economic impact study—and a number of illustrative case studies. Another large part of the report is devoted to presenting and analysing survey-based data from 149 science centers and 50 other institutions about their revenue and expenditure, their employees and their visitors.

Economic activity of science centers around the world

A one-page questionnaire was distributed to some 700 science centers, museums and other science-based institutions around the world during April–June 2004. Data were received relating to 199 of these institutions, from 35 countries in five geographical regions: North America (81 respondents), Latin America & the Caribbean (13), Europe & the Middle East (50), the Asia–Pacific region (54) and Southern Africa (1). For all the survey respondents taken together:

- total operating expenditure for a single year exceeded US$1.1 billion, with 54% of this being for wages and salaries and other staff-related costs
- total capital expenditure for one year was US$308 million
- earned income accounted for 43% of revenue, public funding for 41% and private funding for 15%
- 61% of respondents reported an excess of revenue over expenditure, and a further 13% reported a break-even result
- nearly 77 million visits were reported by respondent institutions for one year—61.8 million on-site visits and over 15 million off-site visits
- a total of 10,756 people were employed in full-time jobs and 6,123 people were employed in part-time jobs (a total of 16,879 employees)
- a further 26,546 people were involved with respondent institutions as volunteers.

[1] Asia–Pacific Network of Science and Technology Centres; Association of Science-Technology Centers Incorporated; Australasian Science and Technology Exhibitors' Network; Canadian Association of Science Centres; European Collaborative for Science, Industry and Technology Exhibitions; The Science and Discovery Centre Network of the UK; National Council of Science Museums of India; Red de Popularización de la Ciencia y la Tecnología para América Latina y el Caribe; Southern African Association of Science and Technology Centres.

For the science center industry as a whole, the worldwide totals are considerably larger than those above, as these figures represent only about 25% of the membership of participating regional networks, and not all science centers and museums are members of a regional network.

The data were broken down by region and in some cases also by institution type or institution size. Several of the resulting subgroups were too small to be representative, but some interesting insights did emerge. For example, private funding made up a higher proportion of revenue (24%) in North America than in other regions; and public funding made a much larger contribution (74%) to revenue for institutions in the Asia–Pacific region than elsewhere. Institutions in North America made greater use of part-time staff and of volunteers than institutions in other regions. Outdoor space for public use was more likely to be found attached to institutions in the Asia–Pacific region and in Latin America & the Caribbean than in North America or in Europe & the Middle East.

Performance ratios also offered food for thought: visitors were less crowded in Asia–Pacific institutions than in others (number of on-site visitors per square metre of floor space) but the number of visitors per full-time equivalent employee was much larger in Asia–Pacific institutions than in others. Operating costs per square metre or per visitor varied considerably between regions, although here direct comparisons on a worldwide basis are not meaningful because the economies in different countries are very different from each other.

Respondents also listed many examples of less readily quantifiable economic contributions that science centers make to their local communities. They contribute to neighbourhood development or regeneration; attract tourists; provide an educational resource; promote research and innovation; offer opportunities to various sectors of the community; provide a meeting place; and become a source of pride for their local communities.

Economic impact studies

The activity described above has flow-on impacts on the economy of the region in which the science center operates. A study of the economic impact of a science center traces the flow and level of spending that can be attributed to the activities of the science center—it estimates the economic impact of the science center on a defined economic region over a particular time period.

Total economic impact has several components: the direct impact made up of spending by the science center itself (over US$1.1 billion for respondent institutions) and of the jobs that it provides; the direct impact resulting from spending by people who visit the region in order to go to the science center; the indirect impact resulting from extra business generated for suppliers of goods and services to the science center and its visitors; and the induced impact of increased ‘consumption spending’ in the region as a result of larger wages and increased organisational revenue being returned to the local economy by the science center, its suppliers and their suppliers.

Direct or primary impacts can be calculated from primary data—the science center’s expenditure and employment records, and survey-based data about the science center’s visitors: what proportion of visitors is from outside the local region and had the science center as their primary motivation for visiting the region; how long they stay in the region; what they spend money on while in the region; and how much they spend. For many respondents to this project’s survey, visitor spending is likely to make a significant contribution to overall economic impact, as the reported percentage of out-of-region visitors was in some cases as high as 98% (with a median value of 36%).

However, indirect and induced impacts (together making up what are known as ‘secondary impacts’) can only be estimated on the basis of a good understanding of the local region’s overall economy and the interrelationships among various industries within the economy. Economic models depicting these relationships are increasingly available, but they are region-specific and relate to a particular period of time. This means that results from any given economic impact study are not necessarily transferable to another context.

The case studies presented in this report illustrate a variety of approaches to estimating the economic impact of science centers and museums. Some studies focused only on direct impacts; others used economic models to estimate indirect impacts as well. Some were for individual institutions; others looked at the combined impact of a number of institutions in a region. Two of the studies went beyond readily quantifiable impacts, exploring ways of putting dollar values on things like providing free or reduced-fee admissions to a science center or ‘increasing human capital’. The case studies did not display any consistent pattern in the relationships among operational budget, direct economic impact and total economic impact, with the total economic impact being as high as five times the direct impact in one case but a much smaller multiple in others.

Because an economic impact study is based on the characteristics of the relevant local economy, there is no universally applicable factor for converting a direct impact figure to a value for the total economic impact of an institution’s activities. In fact, the United Kingdom’s Department of Culture, Media and Sport has ‘confirmed that there is no ready-made and reliable methodology in place for calculating the economic impact of cultural institutions’ (Travers and Glaister 2004, p. 17). Some researchers in the United Kingdom and USA (e.g. Travers and Glaister 2004 for the UK museum sector, Stynes 1997 for tourism in USA) have suggested that multipliers of around 1.5 to 1.7 might be reasonable in these countries; that is, the total economic impact could be about 1.5 to 1.7 times the direct impact. The Australian Bureau of Statistics (2001) has suggested 1.74 as an ‘indicative’ value

for a gross value-added multiplier for the libraries and museums sector in Australia. Other economists are sceptical about the use of multipliers and recommend a focus on direct impacts only. No data were located to indicate whether similar relationships might be valid in other countries.

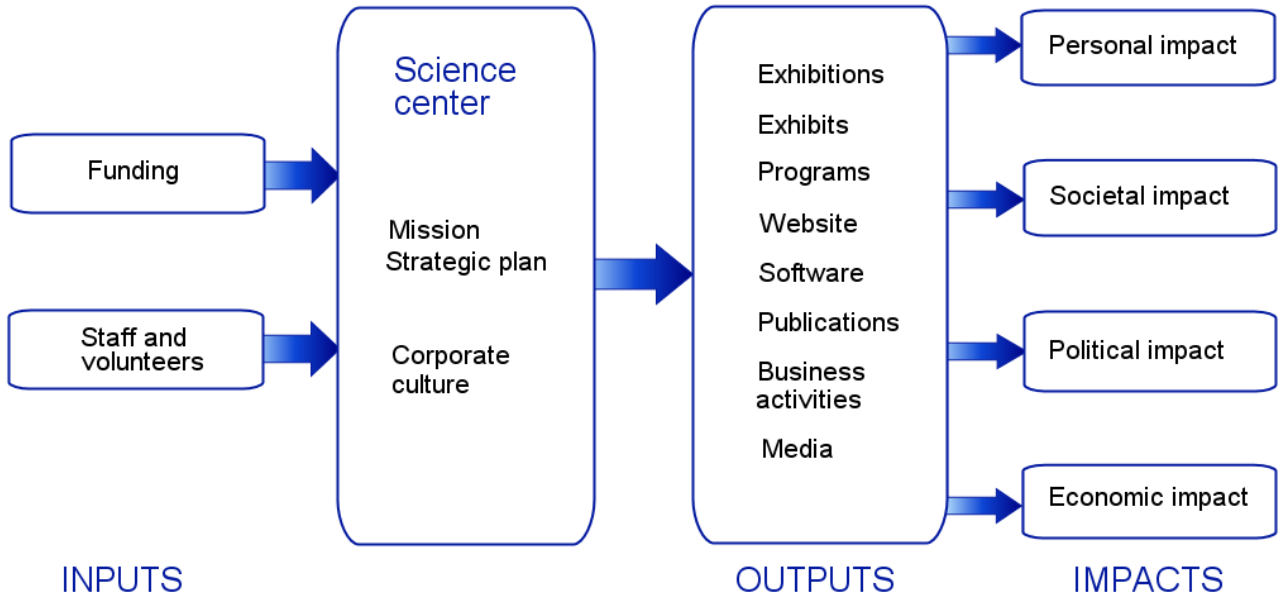
Chapter 2 Introduction

The evaluation of the impact of museums and science centers is a growing field of study. Scott (2003) points out three trends that have contributed to the rise of impact evaluation. Firstly, increasing competition and financial pressure have forced museums to focus more on what they do and how this meets community needs. Secondly, 'greater public accountability and transparency demand evidence of service provision'. And thirdly, government policies require museums to demonstrate their achievements in areas such as social inclusion, access and equity.

As part of this growing focus on impact evaluation, Garnett (2002) carried out Phase 1 of an international study of the impact of science centers during 2001–2002. She surveyed existing work on the impact of science centers and science museums on their communities, collecting and analysing reports on research aimed at exploring such impacts. The study was funded by a group of 13 science centers[2] and was guided by a steering group comprising Dr. Per-Edvin Persson (chair), Dr. John Durant, Dr. Annie Ghisalberti, Dr. Tom Krakauer, Mr. Roy Shafer, Dr. Walter Witschey and, from 2002, Dr. John Falk.

Garnett produced an annotated bibliography of 180 items and a model for the impact of a science center or science museum—a model which is summarised by Figure 2-1.

Figure 2-1 Model of science center impact



By far the majority (87%) of the 180 reports received by Garnett focused on aspects of personal impact. Some studies related to societal impact (9%) and economic impact (4%); there were no published or unpublished studies on the political impact—the influence on policy development—of science centers and museums.

As Garnett pointed out,

> … More economic impact studies would contribute to a stronger public awareness of the positive effects that science centers have on employment and income creation in their local region.

In the last few years, growing numbers of science centers and museums have carried out economic impact assessments, often in conjunction with other types of impact study. For example, Wavell et al (2002) reviewed quantitative data collection systems for museums, archives and libraries in the United Kingdom (UK), to assess the extent to which such data would permit evaluation of the impact made by these services and to identify what indicators of social and economic impact were missing from existing data collections. Travers et al (2003) provided an overview of the impact of London's Natural History Museum, considering 'what others think of [the museum]' as well as assessing the financial value of the museum's activities. Travers and Glaister (2004) have also looked at the group of 29 national museums and galleries in the UK, exploring not only their economic impact but also the government's approach to museums and galleries; creativity and innovation; and civic engagement. Scott's research (2003) sought perspectives on the impact of museums both from those working within museums

[2] At-Bristol, Cité des Sciences et de l'Industrie, Deutsches Museum, Experimentarium, Heureka – The Finnish Science Centre, Museum of Life and Science, newMetropolis Science and Technology Center, Ontario Science Centre, Oregon Museum of Science and Industry, Questacon – The National Science and Technology Centre, St Louis Science Center, Technopolis–FTI Foundation, The Franklin Institute.

and from the general public—including both museum visitors and non-visitors—'with a view to developing a set of impact indicators shared across both sets of stakeholders'; this study identified economic impact as one of five key ways in which museums are perceived to contribute to their communities.

In this study, we focus only on assessing the economic impact of science centers and museums—that is, the impact that an institution's activity has on the flow and level of spending in its local region. We do not look at the broader impacts of science center and museum activity, except to summarise some of the functions that contribute to these broader impacts as well as to the economic health of a community (see Chapter 5.4).

The study is Phase 2 of the international study of the impact of science centers, with funding from the Association of Science-Technology Centers (ASTC) as well as the original 13 individual science centers. It has been carried out at Questacon – The National Science and Technology Centre in Canberra, Australia. Guidance for the conduct of the study was provided by the executive directors of several regional science center networks: the Asia–Pacific Network of Science and Technology Centres (ASPAC); ASTC; the European Collaborative for Science, Industry and Technology Exhibitions (ECSITE); and Red de Popularización de la Ciencia y la Tecnología para América Latina y el Caribe (Red-POP). The Australasian Science and Technology Exhibitors' Network (ASTEN), the Canadian Association of Science Centres (CASC), the Science and Discovery Centre Network of the UK (ECSITE-UK), the National Council of Science Museums in India (NCSM) and the Southern African Association of Science and Technology Centres (SAASTEC) also assisted the project.

The rest of this report uses the term 'science center' to refer to science and technology centers and museums as well as related institutions. The exception is Chapter 8, which distinguishes between 'science centers' (science and technology centers or museums) and 'other institutions' (including aquariums, botanic gardens, children's museums, natural history museums , planetariums, zoos).

Chapter 3 Objectives of the project

The brief for the current project was to follow up the Garnett (2002) study by exploring the economic impact that science centers have on their communities.

The objectives of the project were to:

- collect and collate financial and other data from science centers round the world, in order to develop a set of baseline data depicting the economic activity of science centers in the regions covered by the science center network organisations supporting the project: ASPAC, ASTC, ASTEN, CASC, ECSITE and ECSITE-UK, NCSM, Red-POP and SAASTEC
- prepare a summary of what an economic impact study involves, and of the types of information that need to be gathered in the course of an economic impact study focusing on a science center
- present a small number of 'case study' descriptions to illustrate projects that have already been carried out by science centers, museums and similar institutions to explore their economic impact on their communities
- develop a brief 'how to' guide for a science center wishing to carry out or commission its own economic impact study.

Chapter 4 Project stages

The project was carried out in nine stages:

1. Carry out and document preliminary research and develop a preliminary draft of the survey questionnaire, and seek feedback on this from (a) representatives of science center networks and (b) the project adviser—a researcher working in the field of educational tourism, with experience in economic impact studies in this field. Draft an accompanying covering letter, also for approval by the steering committee. This stage included early work on the database for collating and analysing the data, to ensure that the questionnaire responses could be effectively handled, leading to the desired aggregations of data.
2. Revise the questionnaire on the basis of feedback obtained in stage 1. The final version of the questionnaire is at Appendix 3, and notes on the approach approved at stage 1(a) are at Appendix 4.
3. Distribute the questionnaire, with the assistance of the executive directors of the regional science center networks.
4. Contact science centers known to have carried out economic impact studies, to seek permission to use them as case studies in this project, and to obtain more information if necessary.
5. Collate the survey-based data about the economic activities of science centers.
6. Draft a report to summarise the survey findings, outline the case studies, and summarise key issues in carrying out actual economic impact studies.
7. Develop a 'how to carry out an economic impact study' guide for inclusion in the report.
8. Seek feedback from the steering committee on the draft report.
9. Produce and publish the final report.

The Director of the University of Canberra's Centre for Tourism Research was commissioned to provide advice and critical feedback at stages 1, 6 and 7 above, and to assist with the statistical analysis of the data collected.

The questionnaire (see Appendix 3) was sent to about 700 institutions by the executive directors of the regional science center network organisations. As some institutions are members of more than one network organisation, it was not possible to establish the exact number of survey recipients.

In total, 199 institutions are represented in the data reported in Chapter 8:

- Survey responses were received from 103 institutions, with one of these responses providing aggregated data for 28 science centers in India.
- Data for 20 UK-based science centers and museums were obtained from ECSITE-UK, on the understanding that this data would be published in aggregated form only (a few of these institutions had provided direct responses, which were used for the analysis in Chapter 8).
- In addition, data were sought from ASTC, for institutions that responded to the 2004 ASTC member survey (ASTC 2004a) but not to this project's survey. Of these institutions, 49 responded and gave permission for their data to be used in the current study.

Chapter 5 What is 'the economic impact of a science center'?

5.1 Overview

Our focus is on the readily quantifiable economic impacts of a science center: the flow and level of spending, in the local economic region, which can be attributed to the activity of the science center.

Economic impact studies have most often been used in situations where a change is being planned—for example, expansion in an industry, or a new construction project, or shutting down a military base. They have also been used in assessing the economic impact of sporting and cultural events, which can be considered as changes to the economic activity of a region. Increasingly, institutions with an ongoing presence and year-round activities in a region are also carrying out economic impact studies to assess and demonstrate the contribution that their activities make to their local economies. This contribution can be described in the way that Americans for the Arts (2004a) describe the impact of arts organisations on their communities: these organisations

> … pay their employees, purchase supplies, contract for services, and acquire assets within the local community. These actions, in turn, support local jobs, create household income, and generate revenue to the local, state and federal governments.

The choice of 'local region' can make a significant difference to how much economic impact an institution makes. The institution's impact on the immediate neighbourhood may be large, but this could be at the expense of other, neighbouring regions. On a broader scale, for example a whole country instead of a city or county, the impact may well be insignificant because resources are merely being shifted within the region.

Economic impact is made up of primary and secondary impacts:

- Primary or direct economic impact refers to expenditure by the science center itself, as in the first part of the statement cited above, plus expenditure by those visitors to the science center who come from outside the local region in order to visit the center.
- Secondary economic impact is a combination of indirect and induced impacts.
    - Indirect economic impact refers to the fact that spending by the science center and its audiences injects new money into the economy and stimulates the purchasing of goods and services to satisfy the needs of the science center and its audiences. These are the 'supplier' effects.
    - Induced economic impact is the flow-on created by the combined effect of direct and indirect economic impacts. Larger total wages and increased organisational revenues are, in part, returned to the local economy through further 'consumption' spending.

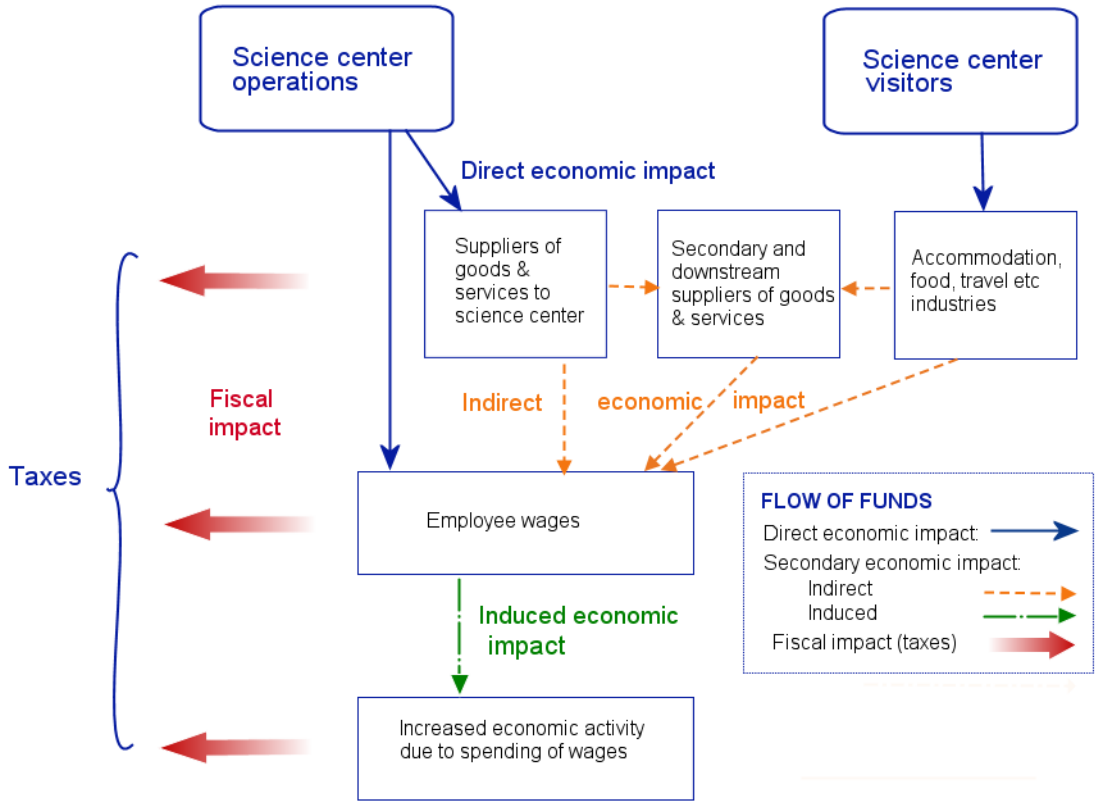
Indirect and induced impacts can only be quantified on the basis of a good understanding of the overall economy and inter-industry relationships in the region concerned.

Fiscal impact on the local (or wider) economy refers to changes in government revenues and expenditures—including changes in tax payments and changes in demand for public services—resulting from an institution's activities. This is related to but separate from the economic impact.

Figure 5-1 illustrates economic impact by showing the flow of funds from the science center and its visitors into the community. It also shows the tax-related components of the fiscal impacts.

Note that different kinds of economic analysis are often confused. Appendix 2 provides descriptions of seven types of analysis, drawn from Stynes (1997).

Figure 5-1 **Direct, indirect and induced economic impact: expenditure by the institution, its visitors, employees and suppliers**



5.2 Direct economic impact

An institution's direct economic impact occurs as a result of its own spending and spending by some of its out-of-region visitors. It also includes the jobs provided directly by the institution.

The *direct impact resulting from the institution's own spending*, on both employee wages and payments to suppliers of goods and services, is readily determined from the institution's salary and expenditure records.

To estimate the *direct impact due to spending by visitors*, data are needed on:

(a) the number of visitors from outside the local region—to isolate only that expenditure which would not otherwise occur in the region

(b) the proportion of these 'external' visitors for whom a visit to the institution was the key reason for travelling to the local region (it is only these visitors whose spending can be attributed to the institution being studied)

(c) a breakdown of external visitors between day visitors and those staying one or more nights in the local region, and—for the latter—the length of their stay in the region

(d) spending patterns for day visitors and holidaying visitors while in the region—what they spend money on (for example travel, food, accommodation, retail purchases and visits to other attractions) and how much they spend.

Data on item (a) are often collected in the form of postcode surveys by science centers at ticket sales points, but can be obtained as a part of wider-ranging surveys of visitors; these can also include questions on items (b)–(d). Local tourism organisations often collect data on items (b)–(d) for visitors to the region; such information can be used together with data collected by the institution itself.

5.3 Secondary economic impact

Secondary economic impacts include flow-on effects to other businesses and industries in the region—the extra turnover generated for suppliers and the resulting growth in employment and local spending power, and successive waves of such impacts among downstream suppliers and service providers. These flow-on effects are sometimes called multiplier effects.

Calculation of these secondary economic impacts is often done using an 'input–output model', which shows 'which goods and services are produced by each industry and how they are used' (ACT Auditor-General's Office 2002). Brand et al (2000) comment:

> Input–output tables provide a detailed map of financial interactions within an economy for a particular time period, typically a specified year, and identify the flow of goods and services between industries, consumers and government … The input–output approach is the most comprehensive and most widely used for economic contribution studies of this type.

Use of input–output models

The input–output model used and the resulting multiplier factors must be tailored for the local region—a customised or at least locally relevant model is critical to obtaining any meaningful secondary economic impact estimate. For example, the introduction to the RIMS II User Handbook (US Department of Commerce 1986), referring to the input–output model used in the Chicago study described in Appendix 7 (Case study 3), states that:

> Using RIMS II, multipliers can be estimated for any region composed of one or more counties and for any industry [listed] in the national I–O [input–output] table …
>
> Effective use of the multipliers for impact analysis required proper interpretation of the I–O relationships … users must provide information on the geographic and industrial patterns of the project or program expenditures under study or on the direct earnings and employment changes associated with the project or program.

This need for a locally based approach is reinforced by the caveats accompanying the *Arts & Economic Prosperity* calculator (Appendix 7, Case study 11), and by the fact that each of the 91 communities covered by the *Arts and Economic Prosperity* study had a customised input–output model.

Commonly used multipliers

While input–output tables depict the detailed inter-industry relationships in a region at a particular time, economic impact studies often use a variety of 'global' multipliers to portray the impact of the project, event or institution being studied. Terminology varies by country, and also among researchers, depending on the focus of their study.

- The *(total) output multiplier* measures the total output produced in the region's economy—including direct, indirect and induced—that results from the expenditure of one dollar (or other currency unit) by the institution. That is, it estimates the total spending that occurs: direct spending by the institution and its visitors plus successive rounds of re-spending as the dollars are traded for other goods and services in the economy. This is also referred to as the *sales multiplier* or the *consumption multiplier*.
- The *employee income multiplier* measures the total employee income in the region's economy that results from every dollar paid in salary or wages to the institution's employees. This is also called the *earnings or wages multiplier* or the *household income multiplier* and refers to the extra funds that are available for households in the region to spend.
- The *employment multiplier* measures the total number of jobs created in the region's economy as a result of one job created directly by the institution, or as a result of a given level of expenditure by the institution.
- The *(gross) value-added multiplier* refers to the economic value left in the community after leakages (e.g. payments to out-of-region suppliers) and taxes have been accounted for.[3]

Cautions about the use of secondary economic impact figures

Some economists (e.g. ACT Auditor-General 2002, Rosentraub 2003) express considerable scepticism about the use of multipliers or simple input–output models, and some suggest that more accurate, realistic and useful results are obtained through a standard benefit–cost analysis (see Appendix 2 for a description of different types of economic analyses). They point out that treasury officials are increasingly sceptical about economic impact claims, as these are often inflated as part of a 'sales pitch', tend to ignore costs of providing extra goods or services, and take little or no account of possible negative impacts.

Rosentraub (2003) comments:

> … many economic impact studies include multiplier effects that include as economic value the re-spending or recirculation of dollars in an economy. Multipliers as high as 2 or 3 have been used in some analyses … Across the past several years, however, a great deal of statistical work has challenged the validity of multiplier effects. It is now agreed that direct spending alone is a far more accurate measure of the economic value of an activity.

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[3] This description of these commonly used multipliers is based on those in Ahmadi (2003; p. 4) and MCIC (2001; p. 8).

While there is substantial political value in reporting the highest possible number, it is more prudent to note the direct spending produced and leave this figure unaltered by any multiplier.

Another view (Brent Ritchie, University of Canberra, pers. comm., October 2004) is that the use of multipliers may in fact be less problematical for the ongoing activity of institutions such as science centers than for one-off events. Changes in the economy that are attributed to events are often delayed or do not last, so that secondary impact figures can be misleading. However, the secondary impacts of the ongoing activity of a science center may be more consistent and long-lasting.

5.4 Other economic contributions to the community

Brand et al (2000) and Witschey (2001) are among those suggesting a broader base for considering 'economic impact', even though these broader impacts often cannot be readily quantified. A number of institutions responding to the current project's survey also listed hard-to-quantify ways in which they contribute to their local economies. These roles, and the activities detailed in Appendix 6, tend to fall into a number of broad categories, as illustrated by the following examples.

Contributing to neighbourhood (re)development

- a redevelopment engine, with museum site rehabilitation encouraging other property owners to 'fix-up' projects of their own (attracting federal funding to the region)
- a preservationist, caring for historic properties
- a leader in upgrading buildings and their operations to improve their performance—to reduce their energy use and their overall impact on the environment

Attracting tourists

- a tourist attraction in its own right
- a tourism partner, linking up with other attractions in the region
- a partner with local hotels in packaging tourism offers

Providing an educational resource

- a resource for science education, vocational guidance and training—providing, for example, student experiences both at the museum and in the classroom, teacher development programs and materials, distance learning opportunities, virtual exhibits on the internet
- a partner with other organisations, including schools, to bring the museum curriculum into the classroom or to organise innovative educational programs
- a producer and retailer of educational kits
- a reliable and trustworthy source of information

Promoting research and innovation

- a community asset for economic development, signalling that the community values science and mathematics
- a player in the transition from an industry-based economy to a knowledge-based economy
- the host of an incubator for new companies in the fields of information and computer technology, and the environment
- a facilitator of the transfer of innovation from research to new business activities
- a facilitator of technology transfer; for example, for the production of educational kits
- a supporter of teams of scientists involved in cutting-edge research, and a facilitator of interactions between the scientists and members of the public
- a link between universities and members of the public

Offering opportunities to various sectors of the community

- a provider of employment opportunities, particularly for students and other young people, including internships, vocational training, job guidance and start-up projects
- a provider of free or reduced-fee admission; for example, for all local residents with a public library card, or for low-income families
- a conduit for corporate philanthropy; for example, by creating inner-city school programs funded by corporate giving initiatives

- a provider of travelling exhibitions and outreach programs to other venues or to other communities, generating income for those as well
- a source of opportunities for local businesses to promote their products and services through association with the science center

Providing a meeting place

- a meeting place, particularly at weekends, for people in a wide range of age groups
- an organiser and host of cultural and educational events for the public, often in partnership with other community organisations
- a conference and events venue
- a community store

Being a source of pride for the local community

- a focus for generating pride in their region for local residents, resulting from the success and reputation of the science center.

Chapter 6 Assessing economic impact: case studies

6.1 Overview

This chapter provides an introduction to the case studies in Appendix 7, which contains outlines of 12 economic impact studies, each described under the following subheadings:

- Organisation
- Location
- Year studied and date of report
- Title and author/s of report
- Nature of study (including key issues explored by the study and data sources used)
- Region covered by the study (including an estimate of population of the region at the time of the study)
- Annual visitor numbers
- Annual operating budget
- Economic model/s used
- Conclusions reached

The 12 selected studies are from three countries—Australia, the United Kingdom and the United States—and each has a particular feature of interest: for example, the type of organisation that undertook the study, or the particular question that formed the basis of the study. However, it is beyond the scope of this project to provide detailed analyses or comparisons of the various studies presented here and the different approaches they have taken. For any study that seems particularly relevant to your own institution, more detail can be obtained by reading the full reports, several of which are available online. The outlines in Appendix 7 include authors and titles of the case study reports, and the bibliography has full publication details for each report, including internet addresses where relevant.

6.2 Economic impact of a group of institutions

The first three studies focus on groups of institutions, at the national, regional and city levels respectively. Data from within the institutions and from other relevant sources such as tourism studies are combined with an economic model relevant to the region where the study is taking place. In each case, the outcome is an estimate of the direct and indirect economic impacts that the institutions' combined operations have on the region's economy.

Case study 1: National museums and galleries throughout the United Kingdom

A study commissioned by the **United Kingdom's National Museum Directors' Conference** (NMDC) looked at the combined impact in 2003–04 of 29 national museums and galleries in various locations around the UK, including export income earned by the institutions.

The authors used desk studies, a major questionnaire and a number of round-table discussions with NMDC executives and directors. To estimate the spending by visitors to NMDC institutions, they used tourism data from several existing sources. To estimate the indirect and induced effects, they used multipliers ranging from 1.5 to 1.7, based on existing multipliers from several sources, including the British Arts Festival and the Treasury.

Case study 2: Museums and other institutions in the South West region of the United Kingdom

A study for the **United Kingdom's South West Museums Council** collated 1998–99 data from 153 institutions in the South West region of England and offered comparisons between different groups of institutions within the data set, as well as some comparisons with other sectors of the economy.

This study centered on data from a detailed questionnaire-based survey, which provided data for calculating the direct economic impact of the participating institutions. The number of tourist visits principally motivated by museum visiting, and the level of spending associated with these visits, were estimated using data from *Statistics and Tourism Research UK*. To estimate secondary economic impacts, the authors modified an existing input–output model developed for the region by the University of Plymouth's South West Economy Centre.

Case study 3: Nine museums in Chicago

A consortium of nine museums in one city—Chicago, Illinois, USA—commissioned a study of financial and visitor information for a three-year period 1996–1999 and used a regional input–output model to estimate the overall economic impact of the museums' activities.

As well as using attendance and financial data provided by the nine museums, the authors drew on data from the Chicago Convention and Tourism Bureau. To estimate secondary impacts, they used regional economic multipliers for the state of Illinois, developed by the US Economic and Statistics Administration and US Bureau of Economic Analysis.

6.3 Economic impact of a single institution

Case study 4: An attraction that is 'unique' within its region

The Tech Museum of Innovation in San Jose, California, USA is 'unique … within the region', to the extent that the authors of the study report believed that visits by local residents might replace trips outside the local region, so that their visit-related expenditure might be validly considered as 'new' to the region (though they did not take this approach in their calculations).

The authors used visitor surveys at The Tech to establish the proportions of resident and non-resident (or 'tourist') visitors and details of their spending in relation to visiting The Tech. They used this data, together with a localised input–output model (based on a nationwide model) to generate estimates of the overall impact of The Tech on its region. They also estimated tax collections in the Santa Clara County attributable to The Tech.

Case study 5: One of many attractions in a region

Questacon – The National Science and Technology Centre in Canberra, Australia, is one of a number of significant tourist attractions in the national capital. This study illustrates two approaches to apportioning tourist expenditure among a number of attractions in one region.

One approach involved asking visitors to Questacon if they would have come to Canberra if Questacon were not there. The other used the proportion of time spent at Questacon in comparison with other attractions to apportion total expenditure by out-of-region visitors. An input–output model, developed for the local region by the University of Canberra's Centre for Tourism Research, was used to estimate downstream expenditure patterns in a range of economic sectors, based on exit survey data about visitor spending.

Case study 6: A newly opened major attraction

The **Eden Project in St. Austell, Cornwall, England** is, like The Tech, 'unique' in its region. Since its opening in 2001, The Eden Project has carried out a series of economic impact studies, building a detailed picture of the impacts that a new center can have on its immediate and wider regional neighbourhood—including explicit consideration of negative impacts. The Eden Project is the only institution identified by the current study that has started with a 'before and after opening' comparison and then built up a regular series of studies to track the ongoing economic impact of the additional visitors that it attracts to its region.

Data sources for the studies included The Eden Project's employment and expenditure records, visitor surveys, a business survey of Eden Project suppliers and tourism-related businesses, and county and regional level visitor spend information collected by various national survey sources. The author adapted *The Cambridge Tourism Economic Impact Model* to calculate the economic impact of visitors to The Eden Project.

Impacts were reported at several levels: for the local region, for the rest of the administrative district, for the entire county, for a neighbouring county, and for the rest of the South West region. In general, both positive and negative impacts were strongest in the local region and were weaker when a more distant or larger region was considered.

Case study 7: Economic value as well as economic impact

In 2002, the **Children's Museum in Indianapolis, USA** looked at economic value rather than just economic impact and did not use any multipliers.

To understand the economic value of free and reduced-cost visits, the study used the marginal cost to the museum of providing admission tickets for these visits. This marginal cost to the museum was estimated by subtracting relevant admissions revenue from the overall cost per visitor of operating the museum multiplied by the number of free or reduced-fee admissions.

Other approaches to estimating the value of free or reduced-cost admissions were suggested. For free admission, visitor surveys could establish what people would have done if they had not come to the museum, and the expenses associated with these activities could be used as a 'proxy measure of the implied benefit of free admission'. For school groups, an estimate could be made of the marginal savings to schools of not having children in school for that day.

6.4 Economic impact of a major change in a single institution

Case study 8: Impact of a proposed construction project

The National Aquarium in Baltimore, USA analysed its current direct and secondary economic impacts and its fiscal impact on the Baltimore city economy, and also looked at these impacts in relation to a proposed construction project, which would add up to 70,000 square feet (about 750 square metres) to the aquarium's facilities.

Data were obtained from the aquarium itself and also from the Maryland Department of Business and Economic Development (Business Research and Analysis Unit). All indirect and induced impacts were estimated using a Maryland-specific input–output model from the University of Minnesota's IMPLAN group.

Case study 9: Impact of relocation

Sci-Quest, the North Alabama Science Center (USA), is limited in what it can achieve by its location and the size of its facility, and explored the added economic impact that might result from relocating to a larger and more central location.

The author used industry data from the Association of Science-Technology Centers, the American Association of Museums and the Association of Children's Museums to develop projections for likely visitor attendance at a new facility. Based on projections of attendance and profit for 2004–10, direct and indirect economic impact estimates were made.

Data pertinent to Hunstville, Alabama, were used to construct a *LOCI III* model (a model, developed by the Georgia Institute of Technology, that assumes six spending cycles) to create a set of multipliers for the study.

6.5 Economic impact of events-based organisations

Case study 10: A 10-day science festival

The Australian Science Festival is an organisation responsible for an annual 10-day festival of science-based events, including exhibitions, theatre, debates, lectures and workshops.

The authors evaluated the 2003 festival and assessed its direct economic impact by using extensive surveys of event organisers and audiences, together with Canberra Tourism and Events Corporation data about daily spending by visitors to the region, and multipliers provided by Australian Capital Tourism. They did not attempt to calculate the number of jobs supported by festival activities, or to explore indirect and induced economic impacts.

Case study 11: Arts organisations around the USA

Americans for the Arts, a non-profit organisation for advancing the arts in America, commissioned a study of the economic impact of arts activities carried out by 3,000 non-profit arts organisations in 91 communities in 33 states of the USA. The study produced estimates of total expenditures by the organisations and of events-related spending by their audiences. The researchers also developed an online calculator that US-based arts organisations can use to estimate the economic impact of their activities.

6.6 Economic impact of a university

Case study 12: An Australian university

Many universities have carried out economic impact studies, which can be of interest because of their attempts to value activities that are hard to quantify. One such study relates to **Curtin University of Technology in Western Australia**, and illustrates an attempt to ascribe an economic value to 'enhancing human capital' and providing research for industries to build on.

The authors estimated the direct and indirect economic and employment generated in Western Australia through the university's activities. They used multipliers developed for Western Australia by the Economic Research Centre of the University of Western Australia.

The study also looked at the enhancement of the state's (and the nation's) human capital through its education of university graduates, by considering their extra income over a lifetime; and the report discusses four methods for estimating the dollar value of the spill-over benefits of its research to industry.

6.7 Finding patterns in the case study outcomes

The science center and museum case studies presented here did not fit a common pattern. They addressed a range of issues under the 'economic impact' umbrella, and did not all report their data or their conclusions in directly comparable terms. Thus they cannot be used as the basis for any broad generalisations.

It appears that, where multipliers were used to estimate indirect and induced impacts, they ranged from about 1.1 to over 5, but a detailed analysis of the significance of this range (e.g. by comparing underlying assumptions or economic models) is beyond the scope of this study. Also, it must be noted that the case studies were from only three countries: Australia, the UK and the USA; and that within the UK and USA studies at least, there was some overlap between studies in the sources of the economic models used to estimate the secondary impacts. We did not locate any data to indicate whether or not similar patterns might apply in the economies of other countries.

It would have been very satisfying to be able to develop a broadly applicable formula for calculating the economic impact of a science center, perhaps like that developed by Americans for the Arts and available at <http://www.artsusa.org/economicimpact/calculator.asp>. However, it was clear from our early research for this project that such a general tool was an inappropriate goal—economic impact on a region's economy depends too heavily on the nature of the local economy, and on the specific circumstances of the institution in question. The development of the Arts USA calculator was possible only because of the vast amount of detailed and consistent data underpinning it (information from 3,000 non-profit arts organisations and 40,000 audience members in 91 communities, spread across the USA, with a locally-based economic model developed for each community) and because all participants operated within a common larger economy—that of the USA as a whole. Even so, the calculator is accompanied by strong warnings that economic impact estimates obtained by using it are just that—estimates only.

The Arts USA calculator was designed for arts organisations planning events with a defined timeframe and not for institutions such as science centers, which have year-round visitors. Nonetheless, the figures from a small number of the case studies presented in this study were used as input for the Arts USA calculator as an exploratory exercise—with predictable results. The economic impact figures produced by the calculator did not relate in any regular way to those resulting from the calculations by the authors of the studies concerned. In some cases they were much larger, in others significantly smaller; only rarely were they similar, and then only for some of the results produced.

Thus the guidelines on planning and carrying out an economic impact study, presented in Chapter 7 of this report, do not offer any formulae for direct application to everyday data. Rather, that chapter outlines the process for such a study, highlights the decisions that need to be made in defining the study, and offers suggestions for some of the steps in carrying it out.

Chapter 7 Planning and carrying out an economic impact study

7.1 Introduction

This chapter provides a brief summary of how to plan and carry out an economic impact study. In case you are reading it independently of the rest of the report, we repeat some definitions:

- The economic impact of a science center is the impact of the center's economic activity on a defined economic region over a specified time period.
- An economic impact study traces the flow and level of spending attributable to the science center's economic activity.
- The direct or primary economic impact of a science center refers to expenditure by the science center itself, plus expenditure in the region by those of its visitors who are not from the local region and whose primary reason for visiting the region was their visit to the science center.
- The secondary economic impact of a science center is a combination of indirect and induced impacts:
    - Indirect impact refers to 'supplier effects'—spending by the science center and its visitors injects new money into the local economy and stimulates the purchasing of goods and services to satisfy the needs of the center and its visitors.
    - Induced impact is the flow-on created by the combined effect of direct and indirect impacts—larger total wages and increased organisational revenues are, in part, returned to the local economy through further 'consumption' spending.
- The size of the secondary impact depends on the extent to which businesses and households in the region spend their 'extra' funds within the region.
- Multipliers describe the size of the secondary impacts—they are usually expressed as a ratio of total (direct + secondary) effects to direct effects. These need to be used with care—they are 'frequently misunderstood and misused' (two articles by Stynes—1997 and date unknown—discuss some of the common misuses).
- Fiscal impact on the local or wider economy (not explicitly addressed in this chapter) refers to changes in government revenues and expenditures, including tax payments and changes in demand for public services, which are generated as a result of the science center's activities.

Secondary impacts are estimated using a locally based economic model (e.g. an input–output table, which shows which goods and services are produced by each industry in the region, and how they are used). Input–output tables describe a region's economy at a particular time, and should not be used if the region's economy has changed significantly since the tables were developed. Multipliers can be estimated from input–output tables.

Some economists are sceptical about the validity and usefulness of multipliers and of secondary impact calculations in general, as they often ignore the costs of providing the extra goods and services, and take little or no account of possible negative impacts.

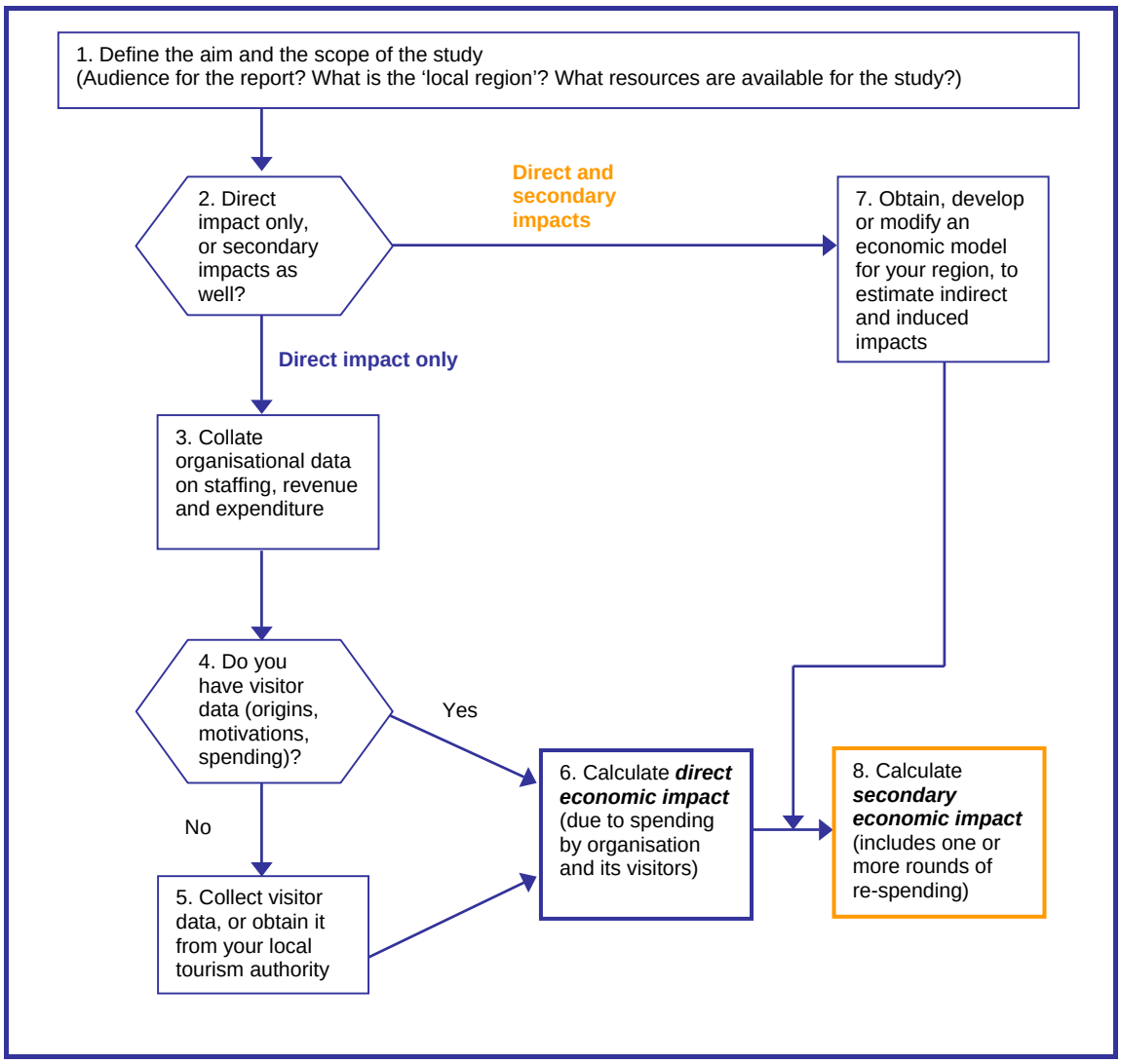
7.2 Stages in carrying out a study

To carry out an economic impact study, you need to:

- establish the scope of the study and any relevant constraints
- commission an external researcher or analyst if needed
- gather all the necessary information; collate and summarise any survey data
- combine organisational spending with relevant visitor spending to estimate the total direct impact
- identify the economic model to be used (if you also wish to consider secondary economic impacts) and any assumptions it makes about the local economy, and apply the relevant multipliers to the appropriate data to estimate the total economic impact.

Figure 7-1 is a flowchart showing the key stages and decision-making steps involved. The following discussion expands on this diagrammatic outline.

Figure 7-1 Planning and carrying out an economic impact study



7.3 Defining the scope of your study

(Steps 1 and 2 in Figure 7-1)

What is the purpose of doing the study and the context in which it will be carried out?

- How will it fit with other research or with existing information? Will it form part of an ongoing program of research? Will the results be used for a particular purpose?
- If the results of the study will be used to support a case for funding, the nature of the funding sought may influence your choice of 'local region': e.g. state government grants vs city or county government grants; or, for a private funding source, is there a particular region of interest?
- What is the prevailing view among key stakeholders about the validity and use of economic impact studies that use input–output models or industry multipliers to estimate secondary impacts?

When you have explored these 'context' issues, consider what information already exists and what you would need to collect through new research.

- What visitor data does your institution hold? What information could you obtain from other organisations, such as a local tourism authority? What visitor data would need to be collected through new surveys?
- Are there existing economic models, input–output tables or accepted industry-based multipliers for assessing secondary economic impacts, or would they need to be created for your study? Do you have access to individuals or organisations that could generate this information?
- If you need to generate new information, are resources available to do this? Are there other local organisations that would be interested in some or all of this information, and be willing to share the cost of collecting it?

- Or does your study need to be a more modest one in order to be feasible?

With this background, you can answer three key questions to define the scope of your study:

- What is the region for which you want to assess your institution's impact?
- What time period will the study cover?
- Will you explore only the direct impact, or extend the study to estimate indirect and induced impacts as well?

7.4 Direct impact of your institution's spending

(Step 3 in Figure 7-1)

The direct economic impact of your institution's spending is described in terms of the number of full-time equivalent jobs provided for local residents, the salaries paid to these people (providing household income which they can spend on goods and services in the region), and the value of non-salary payments to people and businesses in the region.

Your institution's records will provide information on:

- total number of staff—full time, part time and voluntary—and the corresponding full-time equivalent staff numbers for paid and voluntary staff
- total staffing expenditure: salaries and wages paid and all employee benefits (overtime, bonuses, employer's superannuation and insurance contributions, occupational pensions, expenses)
- other operational expenditure
- capital expenditure.

Payments to people, businesses or organisations outside your region do not contribute to the region's economy. If possible, these should be excluded from your calculations.

Some economic impact studies include an estimate of the value provided to the community by their volunteers, based on total volunteer hours multiplied by an average hourly wage for the type of work done by the volunteers.

7.5 Direct impact of expenditure by visitors to your institution

(Steps 4 and 5 in Figure 7-1)

Chapter 5.2 of this report discusses the types of information about visitors and their spending patterns needed to calculate the direct impact of their expenditure on your region's economy, and possible sources of this information. Briefly, you need to know:

- how many of your visitors are from outside your local region
  — from your own postcode surveys along with ticket sales, or as part of wider-ranging visitor surveys
- for how many of these out-of-region visitors was the visit to your science center the only or primary motivator for visiting the region
  — from your own surveys or from data held by your local tourism authority
- how the out-of-region visitors are divided among day visitors and those staying one or more nights in the region and, for the latter, the length of their stay in the region
  — from your own surveys or from data held by your local tourism authority
- spending patterns for the two groups of visitors (day visitors and holidaying visitors): what they spend money on (for example travel within the region, accommodation, food, retail purchases, visits to other attractions) and how much they spend
  — from your own surveys or from data held by your local tourism authority.

If you have very few visitors from outside your local region, it may not be worth gathering this data! However, if out-of-region visitors are a significant proportion of your audience, then gathering or estimating this data is more likely to be worth the resources required: you can use the data to develop a reasonable estimate of the 'new' money that visitors bring to your region.

7.6 Total direct economic impact

(Step 6 in Figure 7-1)

The total direct economic impact of your institution on your region's economy is the sum of the amounts resulting from the previous two steps: (a) the direct impact of your institution's own employment and spending patterns plus (b) that portion of spending by visitors from outside the region that can be attributed to your institution.

7.7 Finding a suitable economic model

(Step 7 in Figure 7-1)

As the case studies introduced in Chapter 6 (and described in Appendix 7) indicate, input–output tables have been developed in many regions to describe the flow of goods and services among industries within specific regions at certain times. However, some of these are not directly applicable to science centers or even to the broader category of 'museums', and may need modification. For example, Brand et al (2000; Case study 2 in Appendix 7) modified an existing model to separate museums from a broader industry category labelled 'recreation and welfare'; and Australia's Cultural Ministers' Council has published input–output tables showing 'libraries, museums and the arts' as a single industry (Australian Bureau of Statistics 2001) and used these to derive 'indicative' multipliers for 'libraries and museums'—multipliers that 'should be treated with caution'.

Potential sources of relevant economic models include universities, tourism authorities, and government departments of statistics and their tourism satellite accounts (in which interrelationships between economic sectors are worked out to develop a standard contribution of tourism to each economic sector).

7.8 Indirect and induced impacts, and overall economic impact

(Step 8 in Figure 7-1)

If you are estimating indirect and induced impacts using an existing, customised or newly developed economic model, the model or multipliers derived from it will need to be applied to relevant direct impact data to yield an estimate of the total economic impact of your institution's activities—the sum of the direct, indirect and induced impacts.

7.9 New or expanding institutions

Case studies 6, 8 and 9 in Appendix 7 provide examples of how institutions that have newly opened, or are undertaking or considering a significant change in their operations, have approached the economic impact question.

7.10 Points to consider

Stynes (1997) lists several key pieces of advice that he offers to people who ask about the economic impacts of tourism—advice that probably applies just as much to science center impact studies:

- A good estimate of the number of out-of-region visitors is vital.
- These visitors should be divided into distinct groups with distinct spending patterns—in this case, day visitors and overnight visitors.
- Most of the effort in the study should be focused on estimating the direct economic impacts of visitors' spending, as multiplier effects are often not nearly as important or as accurate.
- If multipliers are used, they must be well understood and used correctly. (For local impacts of tourism, Stynes usually recommends multipliers between 1.0 and 1.5, noting that a multiplier of 1.0 corresponds to direct impact only.)

Stynes also discusses a range of approaches to carrying out an economic impact study, from the 'quick and dirty' approach that relies mostly on expert judgement to determine activity, spending and multipliers, through to more rigorous studies that gather primary visitor data and use formal economic models. He points out that the cost of a study will depend on the size and scope of visitor activity to be considered, the size and complexity of the study region, and the amount of primary data to be gathered (and the level of detail and accuracy desired). Computer-based spending and regional economic models are increasingly available, but technical expertise for designing studies and analysing results can still be costly.

Weisbrod and Weisbrod (1997) list 'seven deadly sins of economic impact analyses carried out for facilities or projects':

- confusing the economic role (gross effect) of a facility with its net economic impact on the economy of a region
- adding together different measures of the same change (e.g. changes in business sales and personal income)
- confusing study areas (e.g. neighbourhood, city-wide, state and national effects)
- confusing time periods (e.g. immediate and eventual effects on economic growth)
- assuming that a facility's capacity and its actual level of activity are the same
- applying multipliers in situations where they do not apply

- ignoring market effects on wages and land/building costs, which can also affect the economic competitiveness of a region.

Other points to consider:

- Some researchers query the credibility and usefulness of multipliers (see discussion above and in Chapter 5.3).
- Local economic information is critical if you are estimating indirect or induced impacts (results and multipliers are not necessarily transferable from one location or institution to another).
- If yours is not the only major attraction in the region, then it may be difficult to work out how much spending by out-of-region visitors can be attributed to your institution (see case studies 3 and 5 in Appendix 7 for some approaches to this).

7.11 Impacts that are not readily quantifiable

Many reports on economic impact studies include reference to activities undertaken by the institution being studied that are considered to have an economic impact in its region, even where this impact cannot be readily quantified. Chapter 5.4 gives a variety of examples, based on information provided by participants in our survey. These include contributing to neighbourhood redevelopment, attracting tourists, providing an educational resource, promoting research and innovation, offering opportunities to specific sectors of the community, providing a meeting place, and being a source of pride for the local community. Identifying and describing such activities can only add weight to a science center's case for support.

Case study 7 in Appendix 7 outlines one institution's approach to putting dollar figures against two key activities in this category—providing free admission and offering reduced-fee admission to school groups.

Chapter 8 Data collected for this project

8.1 Summary of key findings

We received data relating to the economic activity of 199 institutions from 35 countries in the five regions covered by participating science center network organisations: North America (81 institutions or 41% of all responses), Latin America & the Caribbean (13 institutions—7%), Europe & the Middle East (50 institutions—25%), the Asia–Pacific region (54 institutions—27%) and Southern Africa (1 institution—0.5%). Overall, this represents more than 25% of the combined membership of the relevant regional network organisations.

The survey questions asked for data based on a single financial year. We received data relating to financial years ending at various times from 2001 to 2003. Thus the aggregates reported should be considered as indicative of recent annual figures rather than as an accurate picture of a particular year.

Participating institutions were predominantly (75%) science centers or science museums; this chapter uses the term 'science centers' for these institutions. Other respondent institutions included aquariums, botanic gardens, children's museums, natural history museums, planetariums and a zoo—we refer to these collectively in this chapter as 'other institutions' when providing data breakdowns by institution type.

Participating institutions ranged in size—total interior public floor space—from 50 square metres to 150,000 square metres (540 square feet to 1.6 million square feet), with a median size worldwide of 4,150 square metres (44,600 square feet). Nearly half (47%) of all respondents had some outdoor space for public use, with the size of this space ranging from 100 square metres to nearly 180,000 square metres (1,075 square feet to 1.9 million square feet). Larger percentages of institutions in the Asia–Pacific region (80%) and in Latin America & the Caribbean (85%) had outdoor space than in North America (25%) or Europe & the Middle East (35%).

Opening dates for participating institutions ranged from 1824 to 2004, with one respondent planning to open in 2008. Half of the respondent institutions have opened since 1985, and a quarter since 1994. Current patterns suggest that in all regions the growth in the number of such institutions, which began in the 1970s, is continuing.

A large majority (89%) of participating institutions reported that they charge an admission fee.

Worldwide, 191 respondents reported a total operating expenditure of more than US$1,100 million[4]; 169 respondents reported revenue totalling $1,010 million. The mean annual expenditure was $5.81 million, compared with mean revenue of $5.96 million. Median values for expenditure and revenue were $1.75 million and $1.74 million respectively.

Most respondents reported positive or break-even financial outcomes. Worldwide, 61% of respondents reported an excess of revenue over expenditure and another 13% reported expenditure equal to revenue.

Sources of revenue varied on a regional basis. Worldwide, 43% of revenue was earned income, 41% came from public funding sources and 15% was from private funding sources. The pattern in Europe & the Middle East and in Latin America & the Caribbean was similar, with 43–44% of revenue being earned income but with slightly less support from private funding sources (7% and 11 % respectively) and a correspondingly higher percentage of revenue being from public funding sources. In North America, earned income accounted on average for 50% of revenue and public funding for only 26%, with private funding sources supplying a higher percentage (24%) of revenue than in any other region. In the Asia–Pacific region on the other hand, public funding sources supplied the majority (74%) of revenue, with earned income making up most (21% of the total) of the remainder and private funding sources accounting for just 5% of revenue.

Capital expenditure for one year totalled $308 million in 128 institutions worldwide (excluding the reported cost of setting up a large new center).

Worldwide, 171 institutions had a total of 16,879 paid employees: 10,756 (64%) of them worked full time; and 6,123 (36%) of them worked part time in 135 of the respondent institutions. In addition, 119 institutions reported the involvement of a further 26,546 people as volunteers, making a total of over 43,400 people directly involved in the work of these institutions.

Institutions in North America made greater use of part-time staff than those in other regions—46% of all paid employees compared with around 30% in Europe & the Middle East and Latin America & the Caribbean, and with 21% in the Asia–Pacific region. North American institutions also made greater use of volunteers. The median number of volunteers in a respondent institution in North America was 266, compared with 77 in Europe & the Middle East, 61 in Latin America & the Caribbean, and 27 in the Asia–Pacific region.

[4] All financial data in this chapter are presented in US dollars.

On average—for all respondents taken together—54% of operating costs were devoted to staff-related expenditure. On a regional basis, only Europe & the Middle East varied noticeably from this pattern, with 45% of operating costs being for staff-related expenditure.

Worldwide, 193 institutions reported total attendances of nearly 77 million, with the mean number of visits being 398,337 and the median number being 259,694. Of these visits, 61.8 million were on-site visits, with the number of on-site visits ranging from 227 for an outreach-focused center to 2.85 million for a large capital city institution. The median number of on-site visits was 200,130 and the mean was 320,156.

Nearly two-thirds of respondents (62%, or 122 institutions) reported off-site visitors as well. Worldwide, the total number of off-site visits reported was over 15 million, with the numbers for individual institutions ranging from 100 visitors to 5 million. The median number of off-site visits was 51,980 and the mean was 123,689.

An important factor for an economic impact study is the number of visitors that an institution attracts from outside its local region (e.g. city, county or state), as spending by these visitors contributes 'new' money to the region's economy. For this project, 141 institutions provided estimates of the percentage of out-of-region visitors ranging from 5% to 98% (with a median value of 36% and a mean of 39%). While each institution would need to assess its own situation, these figures suggest that spending by out-of-region visitors would make a valuable contribution to the local economy for many of the respondent institutions.

As well as breaking down the data by region, we have also provided some breakdowns by institution type (science centers compared with all other institution types) and by size (using four size categories based on but not identical to those used in the ASTC 2004 member survey). Some comparisons are made on the basis of institution type or size, but these probably have limited validity because of the small sizes of several of the subgroups. We have not done any analysis of the statistical significance of differences between regional or other groupings of respondents.

We have calculated four 'performance ratios' for all respondent institutions worldwide, and for all respondent institutions in each region. Median and mean values for all respondents worldwide were:

- number of on-site visits per square metre of interior public space: median 51, mean 72
- number of visits per full-time equivalent employee, based on the total number of on-site plus off-site visits: median 5,390, mean 6,221
- operating cost per square metre of interior public space: median $760, mean $1,106
- operating cost per visit, based on total of on-site plus off-site visitors: median $12, mean $14.

8.2 The survey and the respondents

As part of this study, a survey questionnaire (see Appendix 3) was sent during April–June 2004 to over 700 institutions, to gather data on expenditure and visitor numbers as a baseline for related studies in the future. The questionnaire was distributed by the executive directors of a number of regional networks of science centers, and respondents have been classified according to geographical regions corresponding to these networks.

We received 103 direct responses, including one from the National Council for Science Museums in India, which provided aggregated data for 28 science centers. In addition, ECSITE-UK provided data for a further 20 science centers in the United Kingdom, and 49 ASTC members gave permission for data that they provided for the recent ASTC member survey (ASTC 2004a) to be used in this study. In total, then, we have 199 responses from 35 countries.

Table 8-1 shows the number of members on each network's mailing list when the survey was distributed, and the number of responses received from each region. The actual number of potential responses was fewer than the total of 771 shown in the table, as some institutions are members of more than one network organisation. The extent of this overlap is not known.

The collated data should provide a sound baseline for further research on a worldwide basis and within the regional networks, although we cannot be sure how representative the responding institutions are of the total membership of the regional networks; and there are many institutions that do not belong to any of these networks.

Table 8-1 Number of surveys distributed and responses received, by region

Region	Network	Number of surveys distributed	Number of responses received from region (and percentage return)	Countries represented in survey (and number of respondents)
North America	ASTC CASC	402	81 (20%)	Canada (4), United States (77)
Latin America & the Caribbean	Red-POP	39	13 (33%)	Argentina (2), Brazil (1), Chile (1), Colombia (1), Mexico (5), Panama (1), Venezuela (1), Trinidad and Tobago (1)
Europe & the Middle East	ECSITE ECSITE-UK	250	50 (20%)	Belgium (1), Denmark (2), Finland (2), France (3), Germany (2), Iceland (1), Israel (2), Italy (3), Portugal (1), Sweden (4), Switzerland (2), United Kingdom (27)
Asia–Pacific region	ASPAC ASTEN NCSM *	27 15 28	54* (77%)	Australia (6), Brunei (1), China (2), India (28), Japan (2), Malaysia (2), New Zealand (4), Philippines (3), Republic of Korea (1), Singapore (1), Taiwan (2), Thailand (2)
Southern Africa	SAASTEC	10	1 (10%)	South Africa (1)
TOTAL		771	199 (>25%)	

** One aggregated response was received, covering the 28 science centers in India's National Council of Science Museums. The total of 54 for the Asia–Pacific region represents these 28 centers plus 26 institutions in other countries in the region.*

Relationship between this survey and the 2004 ASTC member survey

Our data are essentially a subset of those collected by the ASTC in its 2004 member survey, with a different but overlapping respondent population. As far as possible, the data are presented here in a way that allows cross-referencing with the ASTC data.

The 2004 ASTC member survey attracted 185 responses: 154 were from institutions in the United States and the remaining 31 represented 20 other countries. Of the 185 ASTC respondents, 43 also replied to this project's survey, and a further 49 gave permission for data provided to the ASTC survey to be used here. Thus 92 institutions are represented in both surveys—roughly half of the respondents in each case.

Data in the ASTC survey report (ASTC 2004b) are in some cases broken out according to four dimensions:

- location—two categories: *US* and *Other countries*
- type of institution—two categories: *Science centers* and *All others*
- size of institution based on interior exhibit space—four categories, different from those used in previous ASTC surveys
- operating expenses—four categories.

These categories have been selected by the ASTC as most likely to help its members find information about 'other science centers like mine'.

Data in this report are presented using similar but not identical categories:

- location—four regions: North America, Latin America & the Caribbean; Europe & the Middle East; Asia–Pacific, as set out in Table 8-1
- type of institution—two categories: *Science centers* and *All others*, as used by the ASTC
- size of institution—four categories, using the same size groupings as used by the ASTC in 2004, which are different from those used in previous ASTC surveys (ASTC 2001, 2002), but based on total interior public space rather than total interior exhibit space
- operating expenses—four categories as used by the ASTC.

Different categories

This report and the 2004 ASTC survey report use different categories for the locations of surveyed institutions, and for their sizes.

8.3 How the data are reported

Institution sizes (total interior public space) are given in both square metres and square feet (1,000 square feet = 93 square metres).

Financial information is in US dollars. For the small number of institutions that provided data in other currencies, the conversion was done at the time the survey response was received (mid-2004).

Respondents were asked to provide data for the most recently completed financial year (assumed to be mostly 2003). However, data for some of the UK science centers, obtained directly from ECSITE-UK, were collected in 2002 and some may relate to financial years ending in 2001. ECSITE-UK has pointed out that the introduction of free entry to national museums and some others has increased attendance since those data were collected; on the other hand, for some of the centers that opened in the millennium period, early 'honeymoon' attendances reported in 2001 have since stabilised at lower levels.

Not all respondents provided answers to all questions. Thus the number of respondents varies from one data table to another—in each case, the number given represents the number of responses received to the particular question(s) under consideration.

The data from the one South African response are included in the *All respondents* figures in relevant tables, but are not shown separately in the region-based breakdowns, as the distribution analysis has no meaning for a single respondent.

Three of the respondent institutions, while involved in science communication activities, do not have exhibitions. These institutions are not included in the tables relating to operating revenues and costs, visitor numbers and staff numbers, as they are not directly comparable to institutions with exhibitions open to the public.

In general, mean (arithmetic average), minimum and maximum values are reported for the quantities surveyed. Where appropriate, median values and the 25th and 75th percentile values are also given. These values give a clearer picture of the spread of numbers across respondent institutions, since the mean can be distorted by a few very low or very high numbers among the responses. The median value (50th percentile) of, for example, total visitor numbers across all institutions is such that 50% of institutions have a larger number of visitors and 50% have a smaller number. The 25th percentile value is such that 25% of institutions have a smaller number of visitors; the 75th is such that 75% of institutions have a lower number of visitors (i.e. 25% of institutions have a higher number).

Percentile-based distribution patterns for the Asia–Pacific region probably do not accurately portray the spread of expenditures, revenues and visitor or staff numbers for the responding institutions. One response covered 28 science centers in India, providing aggregated answers to all the survey questions. The aggregated values have been divided by 28 and the mean allocated to each of 28 individual science centers. This provides a valid overall mean when combined with all other institutions, or with other institutions in the Asia–Pacific region, but would not give an accurate distribution picture unless the 28 centers were in fact identical in all respects—which is not the case. Distribution patterns for *All respondents* may also be slightly distorted as a result of this treatment of the Indian science centers.

> ***Asia–Pacific results: a caution***
>
> The data distribution patterns for the Asia–Pacific region are skewed by the averaging of data from the Indian science centers. Thus we generally report only mean, minimum and maximum values for the data from this region. Where median values are shown, these should be treated with caution.

Values corresponding to the 25th and 75th percentiles are not reported for Latin America & the Caribbean because of the small total number of responses.

While many of the tables and charts offer comparisons among respondent institutions grouped in various ways, we have not explored the statistical significance of any of the differences displayed. This gap in analysis, together with the lack of information on just how representative the respondents are of the industry as a whole, means that too much importance should not be placed on the comparisons.

8.4 About the respondents

Regional distribution of respondents

The regional distribution of respondents is set out above in Table 8-1.

Institution types covered by the survey

Institutions self-classified using six of the 13 categories that feature in the 2004 ASTC survey (the six explicitly science-based ones). The majority of respondents (149, or 75%) classified themselves as 'science center / museum'. Table 8-2 shows the institution types by region. Tables and charts in the rest of this chapter use only two categories—'science centers' and 'other institutions'.

Table 8-2 Respondents by institution type in each region

	Number of respondents					
Type of institution	**North America**	**Latin America & Caribbean**	**Europe & Middle East**	**Asia–Pacific region**	**Southern Africa**	**TOTAL: all regions**
Science center / museum	51	11	37	49	1	149
Aquarium	1	1	1	0	0	3
Arboretum / botanic garden	0	0	1	0	0	1
Natural history museum	8	0	2	1	0	11
Planetarium	1	0	0	1	0	2
Zoo	0	0	1	0	0	1
Other	20	1	8	3	0	32
TOTAL	81	13	50	54	1	199

Dates of opening to the public

Opening or planned opening dates reported by respondents ranged from 1824 to 2008. Table 8-3 shows the number of respondent institutions opening to the public for the first time in each region, by decade since the 1960s.

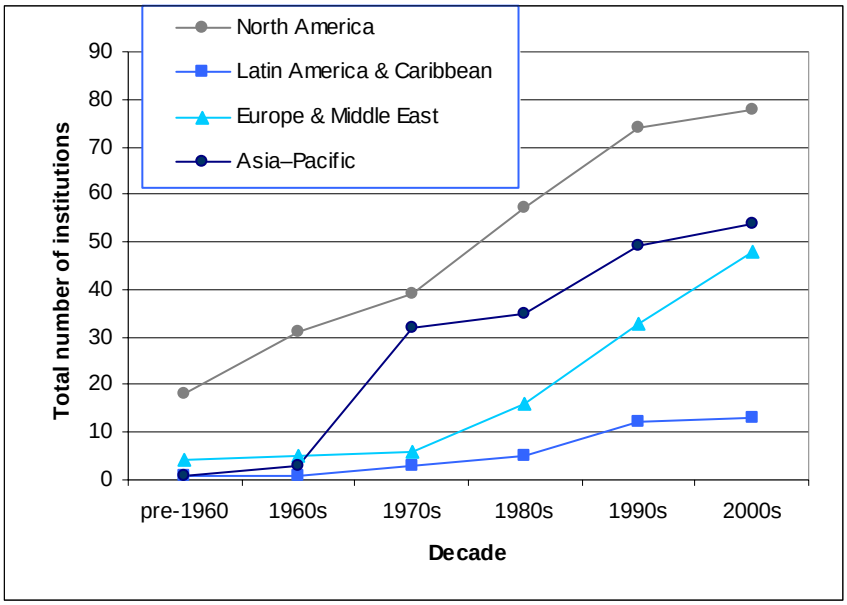
Half of the respondent institutions have opened since 1985, and a quarter since 1994. The growth pattern for each region is shown in Figure 8-1. Given that we are less than halfway through the 2000s decade, it appears that the growth in the number of science centers that started in the 1970s is continuing in all regions.

Table 8-3 Respondents by date of opening in each region

	Number of respondent institutions open to the public for the first time					
Decade	**North America**	**Latin America & Caribbean**	**Europe & Middle East**	**Asia–Pacific region***	**Southern Africa**	**TOTAL: all regions**
Before the 1960s	18	1	4	1	0	24
1960s	13	0	1	2	0	16
1970s	9	2	1	29	0	41
1980s	19	2	10	3	1	35
1990s	17	7	17	14	0	55
2000s	4	1	15	5	0	25
TOTAL	80	13	48	54	1	196

** All the science centers making up the National Council of Science Museums in India have been placed in the 1970s, when the Council was formed, even though some opened earlier and some later; individual dates were not provided*

Figure 8-1 Growth in the number of science centers and related institutions in each region, to 2004



Sizes of institutions (total interior public space)

Worldwide, respondents reported having over 1.44 million square metres (15.5 million square feet) of interior floor space available for public use. The total interior public space in an individual institution varied from 50 square metres to 150,000 square meters (540 square feet to 1.6 million square feet). The median size, worldwide, was 4,150 square metres (about 44,600 square feet) and the mean size was 7,575 square metres (81,450 square feet).

Table 8-4 shows respondents divided among the four size categories used in the 2004 ASTC member survey. For the 2004 ASTC survey, the choice of these four size categories allowed the responses to fall into four roughly equal groups (i.e. about 25% of respondents fell into each size category). Even for the North American group, respondents to our survey do not fall so neatly into the four categories, with a higher percentage falling into the 'large' category. A key reason may be the difference between the relevant questions in the two surveys: ASTC asked for 'total interior exhibit space', while our survey asked for the larger quantity 'total interior public space' (consistent with earlier ASTC surveys).

Table 8-5 shows a breakdown of respondents in each region by institution type as well as by size.

Small data sets

When respondents are separated into groups according to type or size of institution, some of the resulting groups are very small. Means and distribution patterns for these small groups are unlikely to be representative of the wider population of institutions in these groups. In particular, we do not report detailed information for the following groups (each containing only one or two institutions) in many of the tables, although their data are included in the calculations for 'all regions':

1. Latin America & the Caribbean: large institutions
2. Asia–Pacific region: small institutions
3. Latin America & the Caribbean: other institutions (i.e. not science centers / museums).

Table 8-4 Respondents by size (total interior public space) in each region

Interior public space	Number of respondents (and percentage within region)					
	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	Southern Africa	TOTAL: all regions
Very small 1,115 m^2 or less (12,000 ft^2 or less)	16 (21%)	5 (39%)	13 (27%)	4 (8%)	0	38 (20%)
Small 1,116–2,325 m^2 (12,001–25,000 ft^2)	17 (23%)	6 (46%)	4 (8%)	1 (2%)	1	29 (15%)
Medium 2,326–4,650 m^2 (25,001–50,000 ft^2)	14 (19%)	0	11 (23%)	6 (11%)	0	31 (16%)
Large More than 4,650 m^2 (>50,000 ft^2)	28 (37%)	2 (15%)	20 (42%)	42 (79%)	0	92 (48%)
	Total interior public space in square metres					
Mean size	7,508	3,038	7,914	8,589		7,575
Minimum size	93	100	50	160		50
25th percentile	1,212		1,000			1,491
Median size	2,750	1500	3,250			4,150
75th percentile	6,338		6,676			6,205
Maximum size	150,000	21,000	150,000	97,683		150,000
Sum	563,101	39,491	379,858	455,225		1,439,175
Number of respondents	75	13	48	53	1	190

Size distributions for respondents in North America were comparable to those in Europe & the Middle East, with respondents in Latin America & the Caribbean reporting smaller mean, median and maximum sizes—although this could be an artefact of the smaller sample size. The mean institution size, based on total interior public space, was greatest in the Asia–Pacific region.

Table 8-5 Respondents by size (total interior public space) and by institution type in each region

Category	Number of respondents					
	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	Southern Africa	All regions
Science centers*						
Very small	7	3	10	4		24
Small	11	6	3	1	1	22
Medium	8		8	4		20
Large	21	2	16	39		78
TOTAL	47	11	37	48	1	144
Other institution types						
Very small	9	2	3	0		14
Small	6		1	0		7
Medium	6		3	2		11
Large	7		4	3		14
TOTAL	28	2	11	5	0	46

Provision of outdoor space

Overall, nearly half (91 institutions, or 47%) of all respondents reported having some outdoor space for public use, with the amount of outdoor space ranging from less than 100 square metres (1,075 square feet) to nearly 180,000 square metres (over 1.9 million square feet). However, there were regional differences in the extent of provision of outdoor space. While 25% of North American and 35% of Europe & the Middle East respondents had outdoor space, the proportions were considerably higher in the other regions: 80% of Asia–Pacific region respondents and 85% of Latin America & the Caribbean respondents had outdoor space available for public use.

8.5 Financial information

Overview of revenue and expenditure patterns

All financial data are reported in US dollars. In the small number of cases where information was provided in other currencies, we carried out the conversion when the relevant survey response was received (mid-2004).

Based on operating expenditure data provided by 191 institutions in our survey, more than $1,100 million was spent worldwide by respondent institutions in one year. The mean annual expenditure was $5.81 million and the median expenditure was $1.75 million.

Only 169 institutions provided revenue data: together they reported total revenue of $1,010 million. The mean revenue for one year was $5.96 million; the median value was $1.74 million.

Figure 8-2 and Figure 8-3 are based on data from the 166 respondents who provided information about both total revenue and total operating expenditure. Figure 8-2 shows the total revenue and expenditure amounts for each region and for all regions taken together, while Figure 8-3 shows mean and median values.

Figure 8-2 Total revenue and total operating expenditure in each region

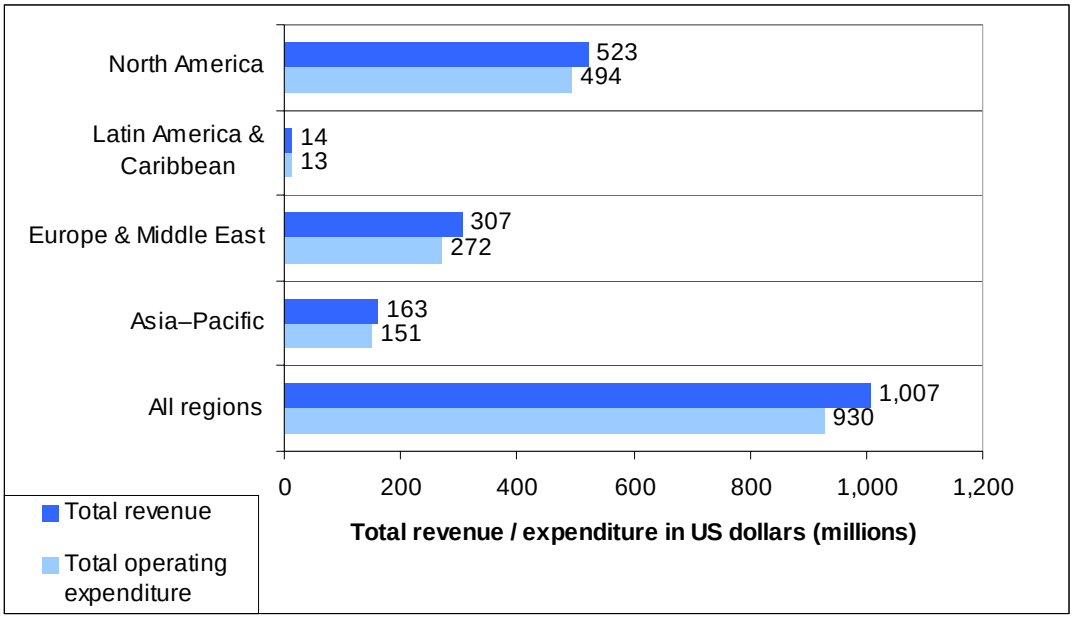
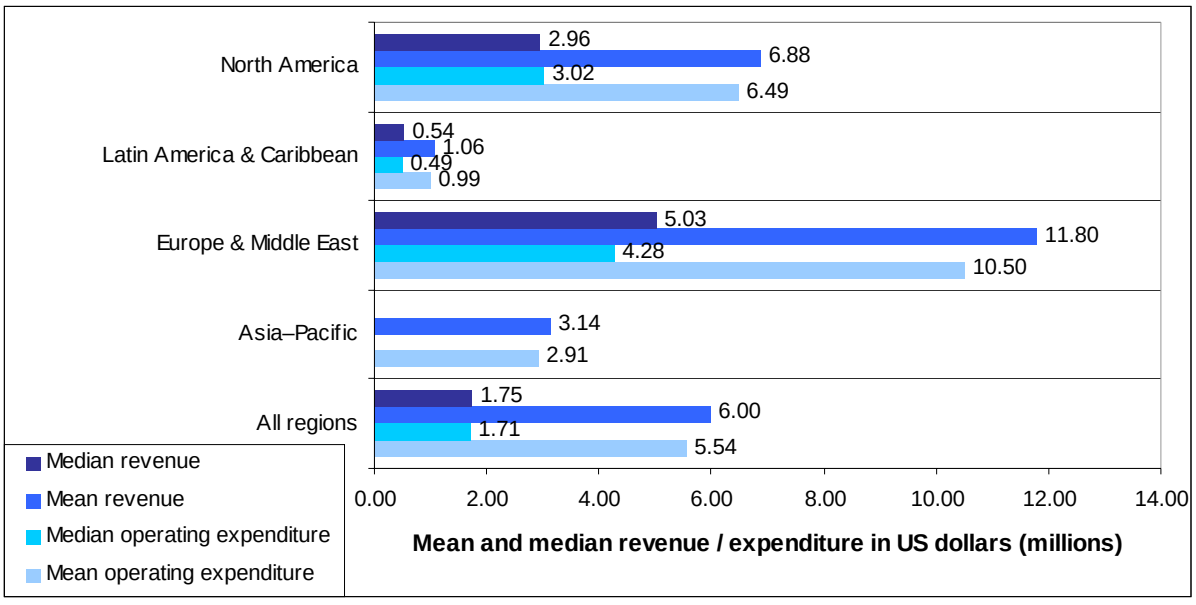


Figure 8-3 Mean and median revenue and operating expenditure in each region



Most respondents reported positive or break-even financial outcomes: 61% reported an excess of revenue over expenditure, and another 13% reported expenditure equal to revenue. Worldwide, the mean margin of revenue over expenditure was nearly $461,000; the median value was a little over $80,000. Table 8-6 shows the percentages of institutions in each region that reported an excess of revenue over expenditure, and mean and median values for the net excess in each region. The analysis is based on data from the 166 institutions for which we have both total revenue and total expenditure amounts.

Table 8-6 Revenue–expenditure analysis for each region

	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	Southern Africa	All regions
Mean operating excess (US$)	381,909	69,222	1,365,329	229,846		460,908
Median operating excess (US$)	14,561	0	0			80,269
Percentage showing excess	54%	46%	42%	83%	100%	61%
Percentage with zero excess	14%	8%	27%	4%		13%
Percentage showing negative 'excess'	32%	46%	31%	13%		27%
Number of respondents	76	13	26	52	1	168

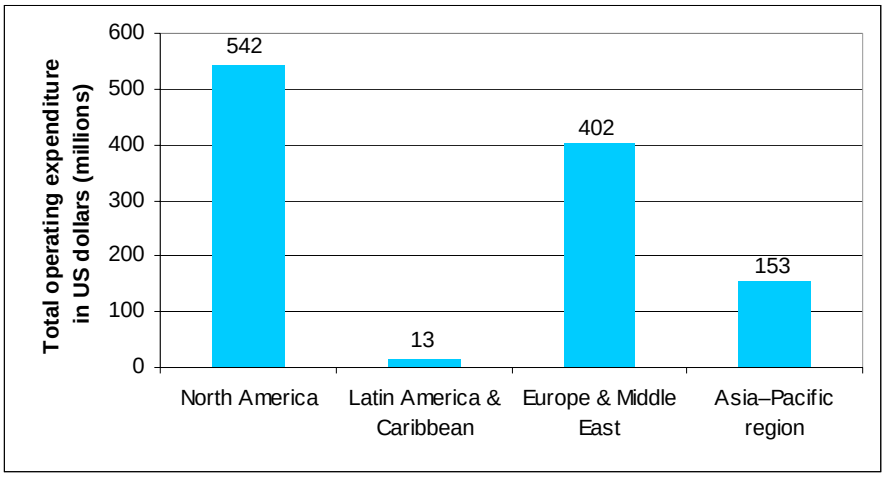
Admission fees

A large majority, 174 out of 195 respondents (89%), charged an admission fee. More than half (12 out of 21) of the non-charging respondents were in the United States; three were in the United Kingdom, four in different countries in Latin America & the Caribbean and one each in France and New Zealand.

Total operating expenditure

The total amount spent annually by 191 institutions responding to this survey was over $1,100 million, with nearly half (49%) of this in North America and a further 36% in Europe & the Middle East. Mean and median operating expenditures were highest in Europe & the Middle East and considerably lower in the Asia–Pacific region and in Latin America & the Caribbean. Figure 8-4 shows the total operating expenditure in each region, based on these 191 respondents.

Figure 8-4 Total operating expenditure for all respondents in each region



For comparability with ASTC data, institutions participating in this project have been grouped according to their operating expenditure. Table 8-7 show this breakdown for all respondents, and for respondents within each region.

The distribution of respondents among the four expenditure categories was fairly even for the North American group. This is not surprising, as the categories were selected on the basis of responses to the 2004 ASTC member survey (ASTC 2004a), for which 87% of respondents were in North America. Other regional networks might find different expenditure categories more useful for internal analysis.

Table 8-7 Respondents in each region, by four 'total operating expenditure' categories

Operating expenses (US$)	Number of respondents in expenditure category (and percentage within region)					
	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	Southern Africa	TOTAL: all regions
Under $1 million	19 (24%)	9 (69%)	12 (26%)	34 (64%)	1	75 (39%)
$1 million–$2.5 million	18 (23%)	2 (15%)	7 (15%)	6 (11%)		33 (17%)
$2.5 million–$6.5 million	19 (24%)	2 (15%)	17 (37%)	4 (8%)		42 (22%)
$6.5 million and above	22 (28%)	0	10 (22%)	9 (17%)		41 (21%)

Table 8-8 shows the total operating expenditure for respondent institutions in each region, by institution type and by institution size.

Table 8-8 Total operating expenditure by institution type and institution size in each region

Category	Total operating expenditure in US dollars				
	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	All regions
All respondents*					
Mean	6,945,008	988,684	8,728,011	2,894,351	5,809,464
Minimum	7,460	15,000	73,200	170,000	7,460
25th percentile	1,011,831		950,228		328,050
Median	3,021,040	494,575	3,682,100		1,753,000
75th percentile	8,121,348		5,873,438		5,775,903
Maximum	46,000,000	3,800,000	124,271,000	26,006,141	124,271,000
Sum	541,710,591	12,852,898	401,488,500	153,400,579	1,109,607,568
Number of respondents	78	13	46	53	191
Science centers*					
Mean	7,158,092	1,158,482	7,792,520	2,327,686	5,208,759
Minimum	7,460	77,000	73,200	170,000	7,460
Median	3,293,481	609,441	3,704,200		1,553,624
Maximum	32,355,000	3,800,000	124,271,000	26,006,141	124,271,000
Sum	357,904,620	12,743,298	272,738,197	111,728,913	755,270,028
Number of respondents	50	11	35	48	145
Other institution types					
Mean	6,564,499		11,704,573	8,334,333	7,702,990
Minimum	70,000		311,100	350,714	15,000
Median	2,831,613		2,745,000		2,708,073
Maximum	46,000,000		78,324,000	21,559,000	78,324,000
Sum	183,805,971		128,750,303	41,671,666	354,337,540
Number of respondents	28	2	11	5	46
Very small institutions					
Mean	1,055,998	122,720	1,099,856	773,003	913,510
Minimum	7,460	15,000	73,200	211,923	7,460
Median	951,895	94,600	825,413		750,000
Maximum	2,992,079	310,000	4,941,000	1,325,090	4,941,000
Sum	16,895,971	613,600	13,198,275	3,092,013	33,799,859
Number of respondents	16	5	12	4	37
Small institutions*					
Mean	999,281	1,119,389	2,619,400		1,686,767
Minimum	117,300	490,000	671,610		155,000
Median	1,562,712	629,721	2,157,994		1,245,636
Maximum	5,869,806	3,217,525	5,490,000		5,869,806
Sum	29,710,544	6,716,332	10,477,598		47,229,474
Number of respondents	16	6	4	1	28
Medium institutions					
Mean	3,586,381		3,840,987	2,184,408	3,405,375
Minimum	750,000		750,060	223,574	223,574
Median	2,212,073		2,846,000		2,745,000
Maximum	11,470,510		10,629,000	4,277,000	11,470,510
Sum	50,209,330		42,250,855	13,106,447	105,566,632
Number of respondents	14		11	6	31
Large institutions					
Mean	15,139,897		17,661,146	3,295,143	10,001,141
Minimum	149,888		915,000	170,357	149,888
Median	13,959,987		6,405,000		4,830,562
Maximum	46,000,000		124,271,000	26,006,141	124,271,000
Sum	423,917,128		335,561,772	135,100,851	900,102,717
Number of respondents	28	2	19	41	90

** 'All regions' values include the single South African respondent.*

Direct comparisons of expenditure amounts in different regions have limited meaning, because of the different economic circumstances in the regions concerned. A very simplistic 'levelling' can be done by considering the gross domestic product (GDP) per capita for the countries covered by the survey. Table 8-9 shows the range of GDP per capita values for the countries in each region that are represented in the survey, and also the median value for each region (based on merely listing the GDP values for each country in the region, without any adjustments for different populations).

Table 8-9 GDP per capita for regions covered by the survey

	GDP per capita for each region in US dollars					
GDP per capita (US$)	**North America**	**Latin America & Caribbean**	**Europe & Middle East**	**Asia–Pacific region**	**Southern Africa**	**All regions**
Lowest value in region	29,700	4,800	18,000	2,900		2,900
Highest value in region	37,800	11,200	32,800	28,900		37,800
Median value in region	33,750	8,300	27,550	17,700	10,700*	19,700**
Median operating expenses ÷ median GDP per capita for region	90	60	134	10		89

** GDP per capita for South Africa*
*** Median GDP per capita for the countries represented in the survey; GDP per capita for world as a whole is $8,200.*
Note: GDP per capita values are from <http://www.worldfactsandfigures.com/gdp_country_desc.php>; they are derived from purchasing power parity (PPP) calculations rather than from conversions at official currency exchange rates, and most are 2003 estimates.

The last row in Table 8-9 indicates that not only do median expenditures in their own right vary across the regions as shown in Table 8-8, but so do median expenditures in relation to GDP per capita. While it is beyond the scope of this study, more rigorous analysis of science center spending in relation to the economy of a country or a group of countries might lead to meaningful comparisons between geographical regions or individual countries.

Salaries and other staff-related expenditure

Respondents were asked to indicate their total expenditure on all staff-related items, including salaries and wages, overtime, bonuses, employer's superannuation and insurance contributions, occupational pensions and any other relevant expenses. Worldwide, respondent institutions spent nearly $445 million on these items; 57% of this expenditure was in North America and 27% in Europe & the Middle East. The mean value for staff-related expenditure per institution was nearly $2.73 million and the median value was $852,000.

Figure 8-5 shows the mean and median values of staff-related expenditure for institutions in each region.

Figure 8-5 Mean and median values of staff-related expenditure in each region

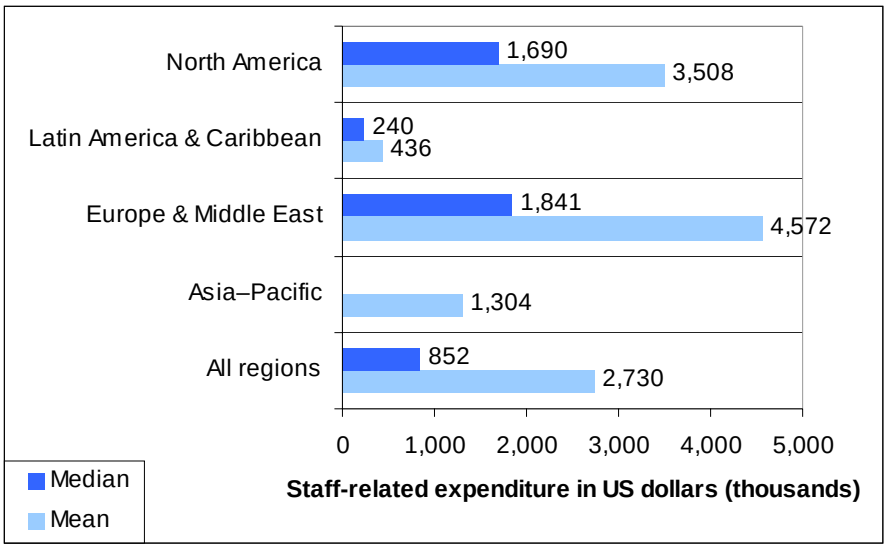


Table 8-10 shows staff-related expenditure amounts for institutions in each region, with breakdowns by institution type and institution size.

Table 8-10 Staff-related expenditure in each region, by institution type and by institution size

Category	Total staff-related expenditure in US dollars				
	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	All regions
All respondents*					
Mean	3,508,474	435,909	4,572,234	1,303,931	2,729,812
Minimum	4,500	12,000	373,900	95,567	4,500
25th percentile	589,308		1,006,344		131,139
Median	1,689,790	240,000	1,840,520		852,000
75th percentile	3,873,731		3,150,697		2,706,134
Maximum	17,735,000	1,205,600	58,072,000	12,377,719	58,072,000
Sum	252,610,100	5,666,822	118,878,086	67,804,409	444,959,417
Number of respondents	72	13	26	52	164
Science centers*					
Mean	3,837,576	506,847	4,650,567	988,683	2,634,478
Minimum	4,500	62,000	373,900	95,567	4,500
Median	1,806,000	266,365	1,943,020		774,590
Maximum	17,735,000	1,205,600	58,072,000	12,377,719	58,072,000
Sum	188,041,242	5,575,322	102,312,473	46,468,091	342,482,128
Number of respondents	49	11	22	47	130
Other institution types					
Mean	2,807,342		4,141,403	4,267,264	3,016,538
Minimum	66,000		1,043,613	127,383	12,000
Median	1,509,006				1,518,003
Maximum	15,293,000		12,000,000	10,620,355	15,293,000
Sum	64,568,858		16,565,613	21,336,318	102,562,289
Number of respondents	23	2	4	5	34
Very small institutions					
Mean	620,079	85,100	870,067	362,827	506,466
Minimum	4,500	12,000		115,999	4,500
Median	531,617				421,104
Maximum	1,573,579	195,000		490,000	1,573,579
Sum	8,681,104	425,500	2,610,200	1,451,307	13,168,111
Number of respondents	14	5	3	4	26
Small institutions*					
Mean	999,281	562,754			842,616
Minimum	117,300	134,894			85,000
Median	738,876	358,183			668,796
Maximum	2,727,100	1,205,600			2,727,100
Sum	15,988,500	3,376,524			21,908,024
Number of respondents	16	6	2	1	26
Medium institutions					
Mean	1,848,293		1,791,218	1,190,344	1,685,171
Minimum	352,244		496,658	95,567	95,567
Median	1,166,000		1,221,807		1,166,000
Maximum	5,641,378		3,845,200	2,146,000	5,641,378
Sum	24,027,810		14,329,746	7,142,062	45,499,618
Number of respondents	13	0	8	6	27
Large institutions					
Mean	7,469,205		7,660,011	1,441,733	4,326,284
Minimum	70,584		373,900	103,929	70,584
Median	7,071,977		2,712,268		1,932,699
Maximum	17,735,000		58,072,000	12,377,719	58,072,000
Sum	194,199,333		99,580,140	59,111,040	354,755,311
Number of respondents	26	2	13	41	82

** 'All regions' values include the single South African respondent.*

In North America and Europe & the Middle East, both mean and median values for staff expenditure by science centers were slightly higher than the corresponding values for other types of institutions. In the Asia–Pacific region, the values for 'other institutions' were strongly influenced by the fact that three of the five non-science-center respondents were large national museums, with large numbers of staff and thus large staff-related expenses.

Figure 8-6 shows the mean and median values of staff-related expenditure in each region, separated according to institution type, and Figure 8-7 shows a breakdown by institution size.

Figure 8-6 Staff-related expenditure by institution type in each region (mean and median values)

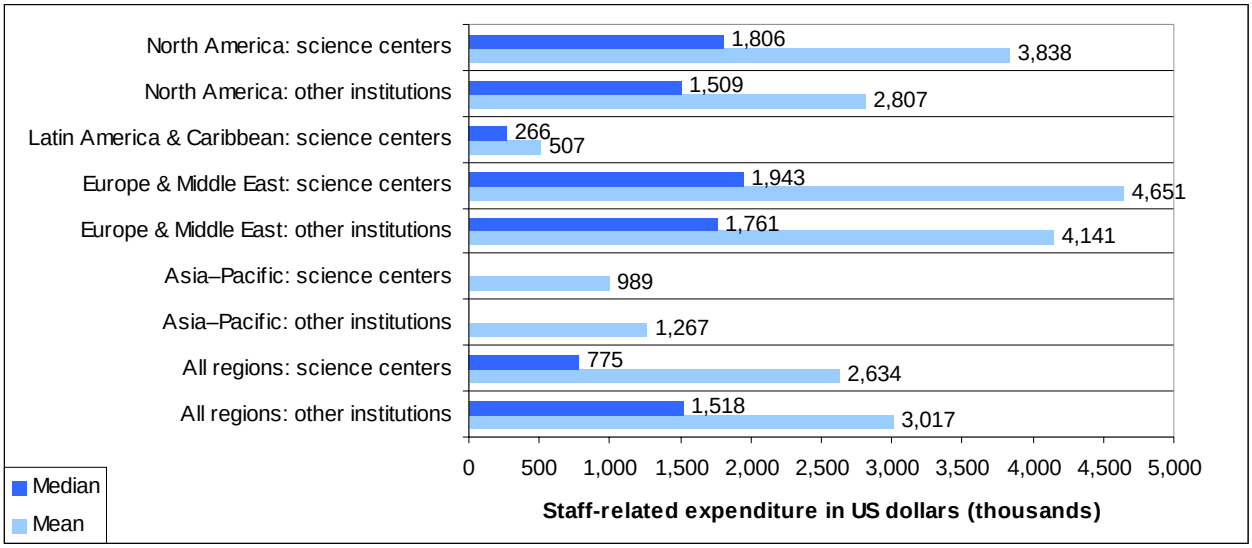
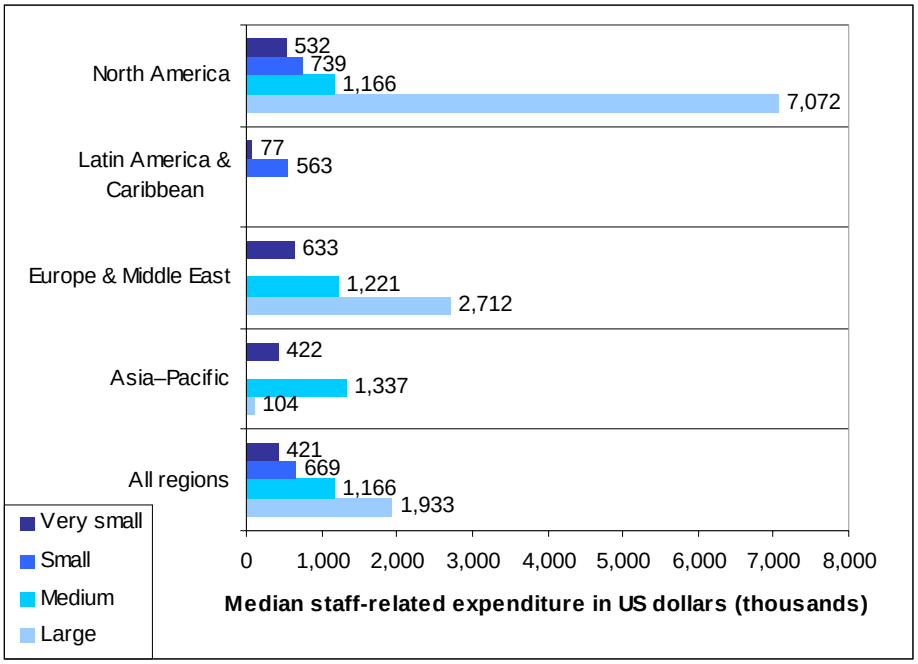


Figure 8-7 Median staff-related expenditure by institution size in each region



Worldwide, staff-related expenditure made up 54% of total operational expenditure. This pattern was reflected in three of the individual regions—North America, Latin America & the Caribbean and the Asia–Pacific region—where over 50% of total expenditure was used for staff-related costs. In Europe & the Middle East, however, staff-related expenditure was less than 50% of total operational expenditure. Figure 8-8 shows mean and median values of the percentage that staff-related expenditure contributed to total operational expenditure in each region.

Figure 8-8 Staff-related expenditure as a percentage of total operational expenditure

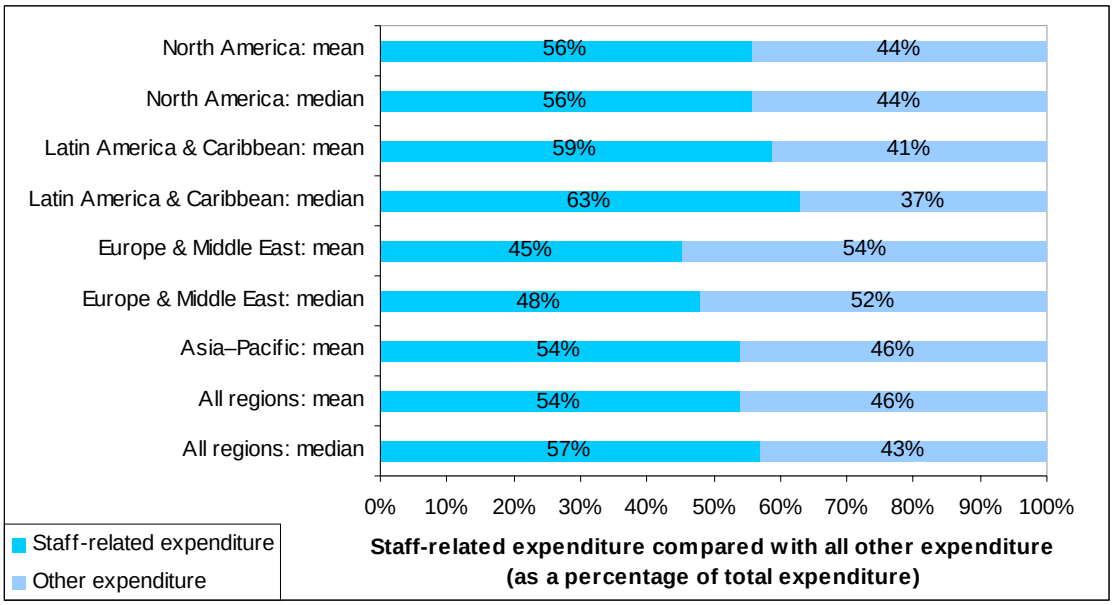


Table 8-11 shows the per-employee costs for all respondents in each region, i.e. the total staff-related costs divided by the number of full-time equivalent employees. (The 'Employees and volunteers' section later in this chapter explains the full-time equivalent concept.)

Table 8-11 Staff-related costs per full-time equivalent employee in each region

Category	Staff-related costs per full-time equivalent employee, in US dollars				
	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	All regions
All respondents					
Mean	37,713	10,354	30,391	12,223	26,991
Minimum	13,600	3,027	6,924	3,849	3,027
25th percentile	30,170	4,750	25,000		6,927
Median	36,719	6,522	30,100		30,000
75th percentile	46,869	13,072	34,375		37,872
Maximum	63,561	30,000	78,824	63,993	78,824
Number of respondents	69	8	17	45	139

Total revenue

For 169 survey respondents worldwide, the total revenue reported for one year was slightly over $1,000 million. Institutions in North America accounted for 52% of this income, those in Europe & the Middle East for 30%, those in the Asia–Pacific region for 16% and those in Latin America & the Caribbean for 1.4%.

Table 8-12 shows revenue patterns in detail: total revenue for all respondents by region, grouped by institution type and by institution size. A few respondents commented that their figure for total annual revenue might be inaccurate, because their institutions report some of their revenue against projects rather than by year of receipt. In these cases, the estimate provided by the respondent was used for the aggregated data, despite the qualifying comments.

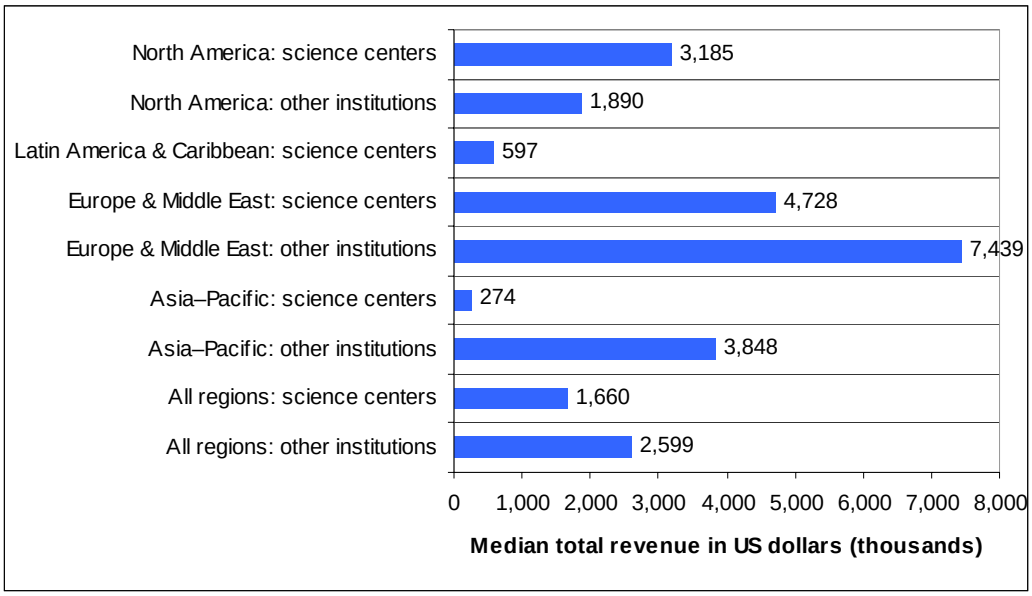
Table 8-12 Total revenue by institution type and institution size in each region

Category	Total revenue in US dollars				
	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	All regions
All respondents*					
Mean	6,795,556	1,057,906	11,823,457	3,142,717	5,964,815
Minimum	7,600	7,500	903,899	170,000	7,500
25th percentile	1,023,317		2,347,500		319,780
Median	2,898,296	537,221	5,029,077		1,741,964
75th percentile	7,945,629		8,594,956		5,728,000
Maximum	42,775,000	4,800,000	144,642,000	28,676,169	144,642,000
Sum	523,257,805	13,752,782	307,409,877	163,421,289	1,008,053,753
Number of respondents	77	13	26	52	169
Science centers*					
Mean	7,533,642	1,248,198	11,530,104	243,109	5,780,402
Minimum	7,600	15,000	903,899	170,000	7,600
Median	3,184,945	596,838	4,724,077		1,660,048
Maximum	30,395,000	4,800,000	144,642,000	28,676,169	144,642,000
Sum	378,682,077	13,730,182	253,662,290	112,946,140	757,232,689
Number of respondents	50	11	22	47	131
Other institution types					
Mean	5,428,731		13,436,897	10,095,030	6,600,554
Minimum	67,000		2,370,000	325,190	7,500
Median	1,890,000				2,599,403
Maximum	30,395,000		36,500,000	22,718,000	42,775,000
Sum	146,575,728		53,747,587	50,475,149	250,821,064
Number of respondents	27	2	4	5	38
Very small institutions					
Mean	1,008,749	86,920	1,460,350	861,899	866,462
Minimum	7,600	7,500		211,923	7,500
Median	1,009,889				711,216
Maximum	3,032,232	350,000		1,816,674	3,032,232
Sum	15,131,231	434,600	4,381,050	3,447,597	23,394,478
Number of respondents	15	5	3	4	27
Small institutions*					
Mean	1,791,326	1,104,803	2,146,752		1,546,550
Minimum	226,5008	511,600			170,000
Median	1,551,070	623,419			1,232,975
Maximum	5,630,071	2,754,500			5,630,071
Sum	30,452,536	6,628,817	4,293,503		41,756,856
Number of respondents	17	6	2	1	27
Medium institutions					
Mean	3,626,779		4,354,308	2,406,046	3,573,059
Minimum	917,000		903,899	172,119	173,119
Median	1,801,308		3,973,000		2,442,595
Maximum	11,474,073		9,879,700	4,450,000	11,474,073
Sum	50,774,900		34,834,467	14,436,273	100,045,640
Number of respondents	14	0	8	6	28
Large institutions					
Mean	14,980,507		20,300,066	3,545,547	9,884,715
Minimum	137,316		2,858,180	273,929	137,316
Median	14,516,000		8,392,325		4,596,942
Maximum	42,775,000		144,642,000	28,676,169	144,642,000
Sum	404,473,691		263,900,857	145,367,419	820,431,332
Number of respondents	27	2	13	41	83

** 'All regions' values include the single South African respondent.*

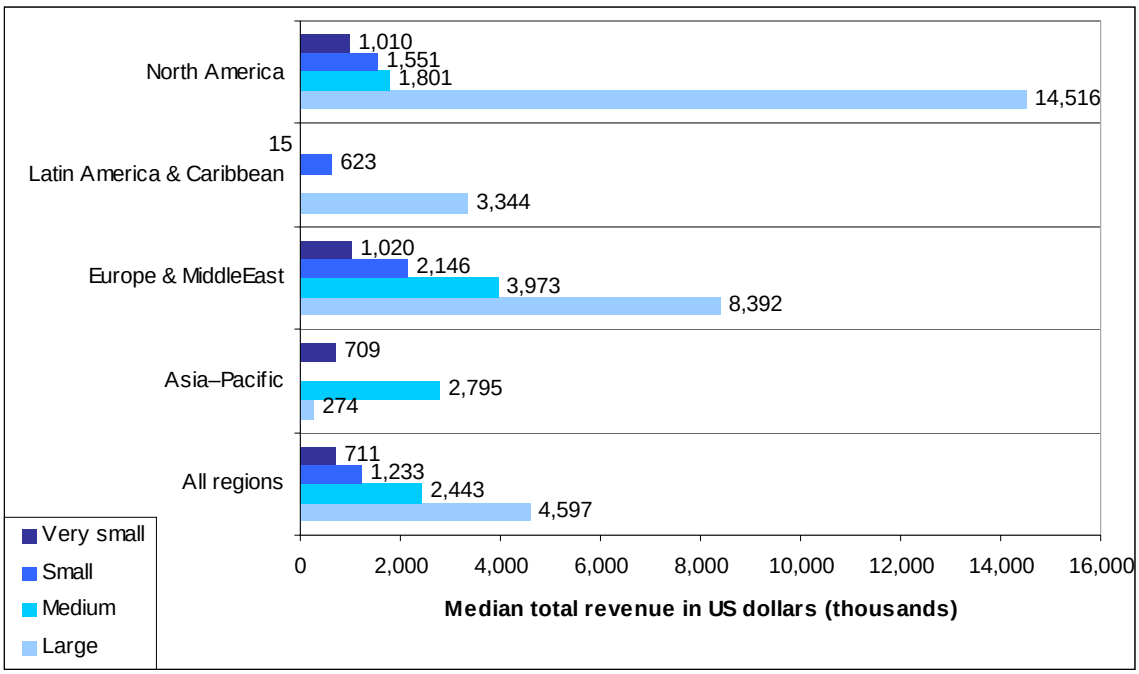
Figure 8-9 shows the median total revenue for each region, by institution type. In North America, Europe & the Middle East, and in all regions taken together, mean revenues for science centers were of a similar order of magnitude to those for other institution types covered by the survey. In the Asia–Pacific region several respondents in the 'other institutions' category were large national museums with correspondingly large budgets.

Figure 8-9 Median total revenue by institution type in each region



As might be expected, larger institutions had larger revenues, but the difference between 'large' institutions and those in the other three size categories with respect to median revenue amounts was more pronounced among North American respondents than among those in other regions. This is shown in Figure 8-10.

Figure 8-10 Median total revenue by institution size in each region



Sources of revenue

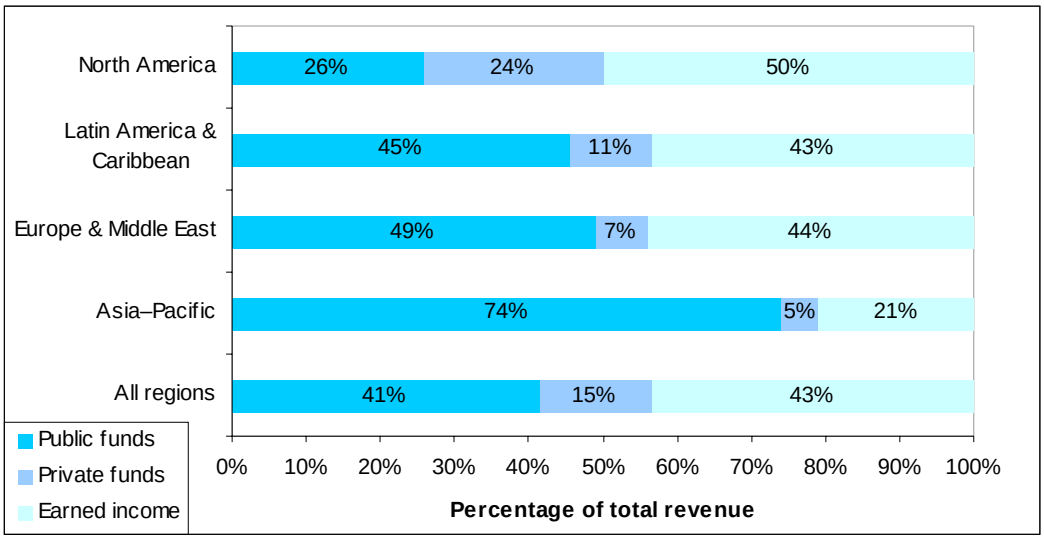
Respondents were asked to indicate not only their total revenue but also the breakdown of this revenue by source:

- public funding: funds from local, state and national government sources
- private funding: e.g. gifts, donations, sponsorship
- earned income: income from admission fees, educational events and fees, subscriptions and membership, retail sales (e.g. café, shop), other trading activities, interest and other investment income.

The ASTC survey also used the category 'endowment income'; where this was reported separately in our survey, it has been included with earned income.

Worldwide, earned income made up 43% of total revenue received by respondent institutions, public funding provided 41%, and private funding sources supplied 15%. North America and the Asia–Pacific region varied most from this pattern. In North America, science centers received a larger proportion of their revenue as earned income (50%) and received more private funding (24%) than centers in other regions. In the Asia–Pacific region, public funding made up a much higher proportion (74%) of total revenue, and private funding (5%) played a smaller role. Figure 8-11 shows the distribution of revenue sources for respondent institutions in each region.

Figure 8-11 Revenue sources for all respondents in each region



A more detailed picture of revenue sources is shown in Table 8-13, which shows amounts and percentages of revenue received from the three sources, for institutions in each region, broken down by institution type and size.

Table 8-13 Sources of revenue by institution type and institution size in each region

Category and revenue source	Mean revenue in US dollars (and percentage of total revenue)				
	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	All regions
All respondents*					
Public funds	1,729,932 (26%)	479,358 (45%)	5,789,731 (49%)	2,318,323 (74%)	2,438,008 (41%)
Private funds	1,608,896 (24%)	118,916 (11%)	860,907 (7%)	153,508 (5%)	914,157 (15%)
Earned revenue	3,406,059 (50%)	455,785 (43%)	5,173,056 (44%)	670,700 (21%)	2,579,626 (43%)
Total revenue	6,744,888	1,054,060	11,823,694	3,142,531	5,931,791
Number of respondents	75	13	26	52	167
Science centers*					
Public funds	2,174,885 (28%)	564,505 (45%)	6,227,591 (54%)	1,871,105 (78%)	2,598,560 (45%)
Private funds	1,735,028 (23%)	140,537 (11%)	921,713 (8%)	102,507 (4%)	859,560 (15%)
Earned revenue	3,771,542 (49%)	538,610 (43%)	4,381,081 (38%)	429,292 (18%)	2,364,098 (41%)
Total revenue	7,681,455	1,243,653	11,530,385	2,402,904	5,822,219
Number of respondents	49	11	22	47	130
Other institution types					
Public funds	891,366 (18%)		3,381,505 (25%)	6,522,178 (65%)	1,873,906 (30%)
Private funds	1,371,187 (28%)		526,475 (4%)	632,914 (6%)	1,105,982 (18%)
Earned revenue	2,717,266 (55%)		9,528,917 (71%)	2,939,938 (29%)	3,336,885 (53%)
Total revenue	5,428,731		13,436,897	10,095,030	6,316,554
Number of respondents	26	2	4	5	37
Very small institutions					
Public funds	297,420 (29%)	63,820 (73%)	323,133 (22%)	169,153 (20%)	235,730 (27%)
Private funds	287,578 (28%)	400	236,567 (16%)	203,451 (24%)	213,523 (24%)
Earned revenue	453,212 (44%)	22,700 (26%)	900,650 (62%)	486,796 (57%)	427,215 (49%)
Total revenue	1,038,210	86,920	1,460,350	859,399	876,469
Number of respondents	14	5	3	4	26
Small institutions*					
Public funds	442,623 (25%)	447,896 (41%)			401,100 (26%)
Private funds	466,931 (26%)	176,561 (16%)			436,930 (28%)
Earned revenue	881,772 (49%)	472,012 (43%)			706,668 (46%)
Total revenue	1,791,326	1,096,470			1,544,698
Number of respondents	17	6	2	1	27
Medium institutions					
Public funds	1,078,209 (30%)		1,918,384 (44%)	1,622,312 (67%)	1,439,352 (40%)
Private funds	1,125,293 (31%)		460,900 (11%)	155,498 (6%)	727,653 (20%)
Earned revenue	1,414,277 (39%)		1,975,025 (45%)	628,236 (26%)	1,406,053 (39%)
Total revenue	3,626,779		4,345,308	2,406,046	3,573,059
Number of respondents	14	0	8	6	28
Large institutions					
Public funds	3,900,778 (26%)		10,287,215 (51%)	2,685,179 (76%)	4,249,653 (43%)
Private funds	3,442,671 (23%)		1,179,366 (6%)	150,625 (4%)	1,359,773 (14%)
Earned revenue	7,567,272 (51%)		8,833,960 (44%)	709,751 (20%)	4,191,097 (43%)
Total revenue	14,980,507		20,300,066	3,545,555	9,800,523
Number of respondents	26	2	13	41	82

** 'All regions' values include the single South African respondent.*
Note: Some of the amounts in this table vary slightly from corresponding amounts in Table 8-8, because two institutions provided only total revenue amounts, without a breakdown by revenue source. These institutions are included in Table 8-8 but not in this table. Also, four institutions that provided a breakdown of revenue by source did not provide a floor area, so are included in this table in the 'institution type' section but not in the 'institution size' section.

Worldwide, and in each region, science centers received a slightly higher percentage of their total revenue from public funding sources than did other institutions. The 'other' institutions had a higher proportion of earned income, with the percentage of private support being sometimes greater and sometimes less for science centers compared with other institutions in the same region. Figure 8-12 shows the breakdown among funding sources for institutions in each region, by institution type.

Figure 8-12 Revenue sources by institution type in each region

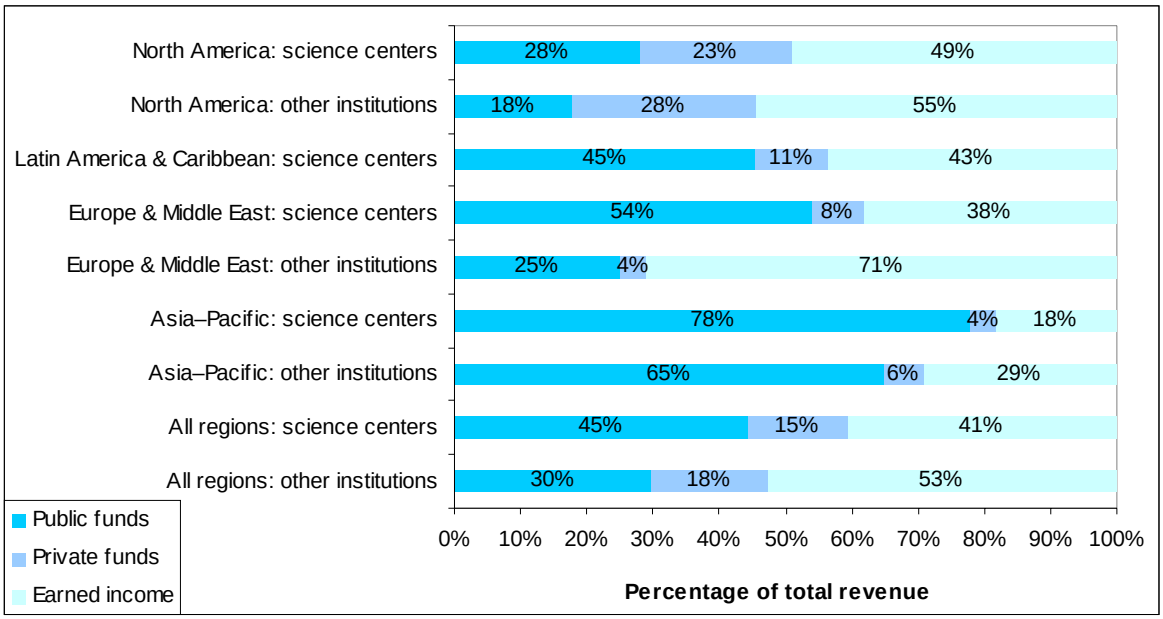
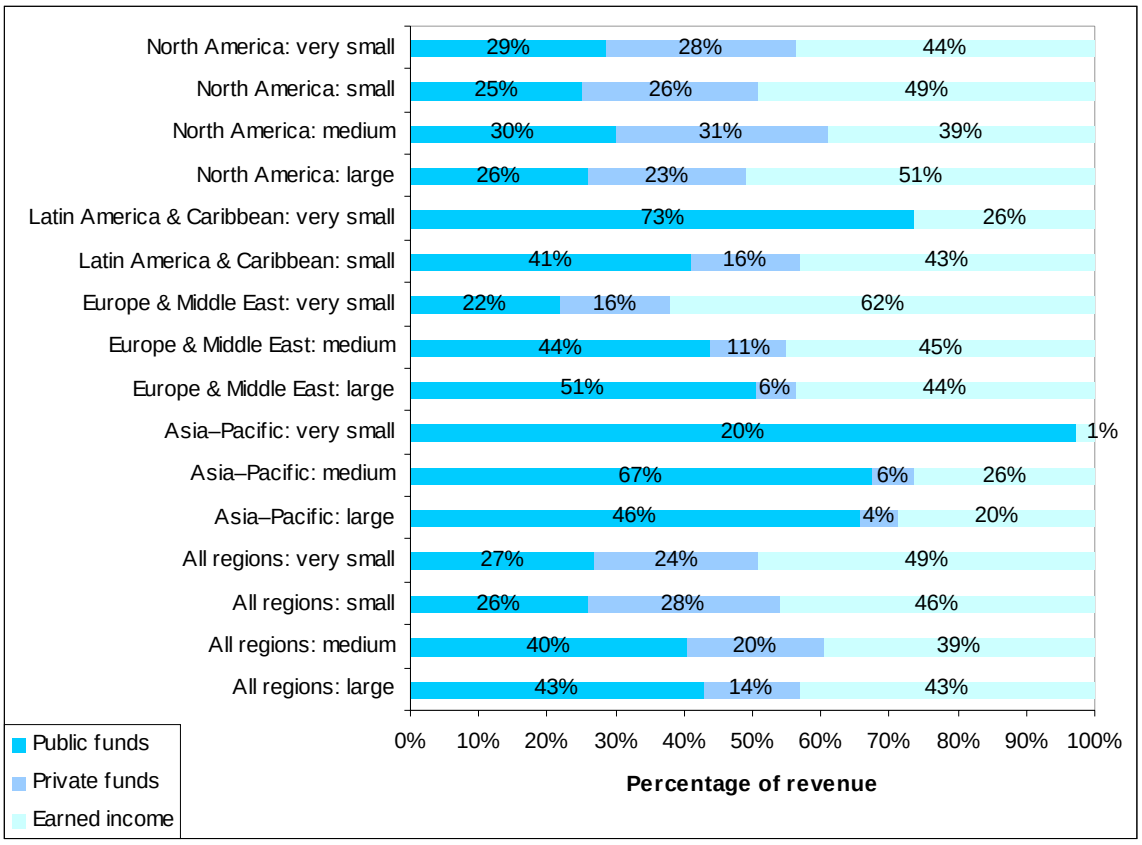


Figure 8-13 shows the pattern of funding sources for institutions of different sizes in each region. Worldwide, medium and large institutions received a higher proportion of total revenue from public funding sources (around 40%) than small and very small science centers (just over 25%). On a regional basis, this pattern was echoed in Europe & the Middle East, where the difference between smaller and larger centers was even more marked, but in North America there was little difference: science centers of all sizes received 25–30% of their funding from public sources. The patterns for Latin America & the Caribbean and the Asia–Pacific region are harder to interpret with any confidence: the sample sizes for Latin America were very small; and the averaging of data for the 28 science centers in India means that the division into size-based groups for the region as a whole may not be valid.

Figure 8-13 Revenue sources by institution size in each region



Capital expenditure

Worldwide, 128 respondents reported a total capital expenditure (for buildings, exhibitions and other fixed assets) of over $308 million. Figure 8-14 shows the total capital expenditure reported by institutions in each region. The costs of initial building and setting up one large new center in the Asia–Pacific region have been excluded in an attempt to reflect a more 'typical' annual capital expenditure pattern, although we recognise that this expenditure would have made a significant contribution to the local economy.

Figure 8-14 Total capital expenditure in each region

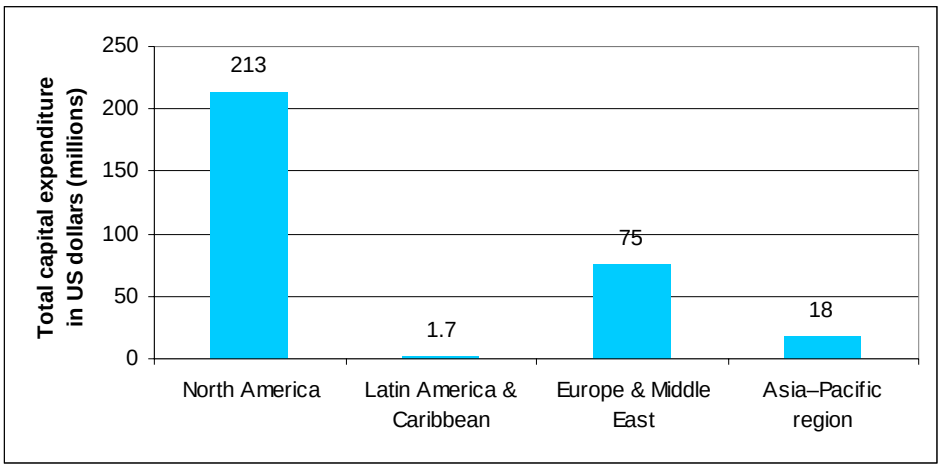


Table 8-14 shows the pattern of capital expenditure reported by respondents, by region.

Table 8-14 Capital expenditure by region

Category	Total capital expenditure in US dollars				
	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	All regions*
All respondents					
Mean	3,871,187	188,318	4,181,931	406,044	2,407,788
Minimum	300	11,700	89,950	18,000	300
25th percentile	112,271		260,355		93,571
Median	500,000	70,000	698,767		221,989
75th percentile	2,583,500		3,119,533		1,300,000
Maximum	49,306,530	1,000,000	38,148,634	3,153,661	49,306,530
Sum	212,915,262	1,694,862	75,274,754	18,271,965	308,196,843
Number of respondents	55	9	18	45	128

** 'All regions' values include the single South African respondent.*

8.6 Visitor numbers

Worldwide, 193 institutions reported total attendances of nearly 77 million, with the mean number of visits being nearly 400,000 and the median value being nearly 260,000. Of these visits, 61.8 million were on-site, with numbers of on-site visits ranging from 227 for an outreach-focused center to 2,850,000 for a large center in a capital city. The median value for on-site visit numbers was 200,130; the mean was 320,156.

Nearly two-thirds of respondents (122 institutions, or 62%) reported off-site visits as well as on-site visits. Worldwide, the total number of off-site visits reported was over 15 million, with the numbers for individual institutions ranging from 100 to 5 million. The mean number of off-site visits was 123,689; the median value was 51,980.

Figure 8-15 shows the total attendance figures reported by institutions in each region and Figure 8-16 shows mean and median attendance figures for each region.

Figure 8-15 Total visit numbers in each region (millions)

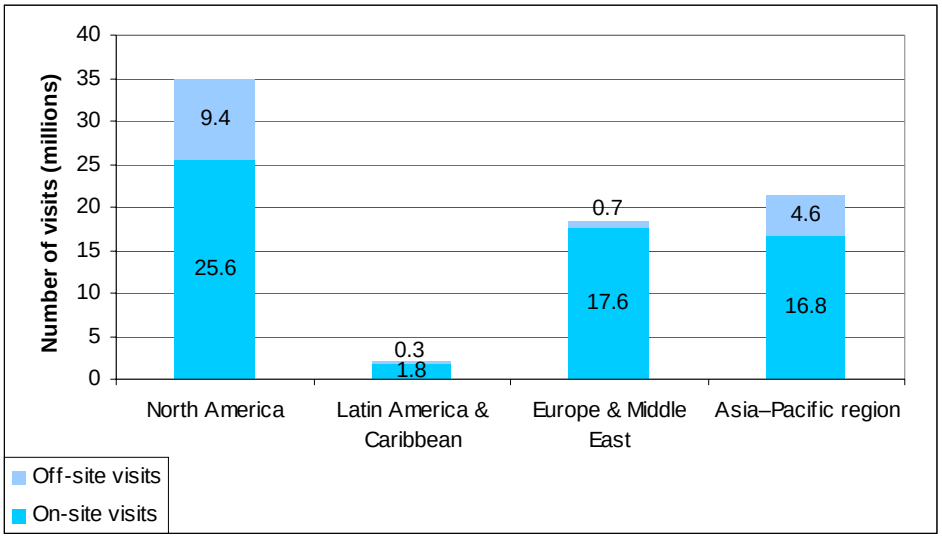


Figure 8-16 Mean and median visit numbers in each region

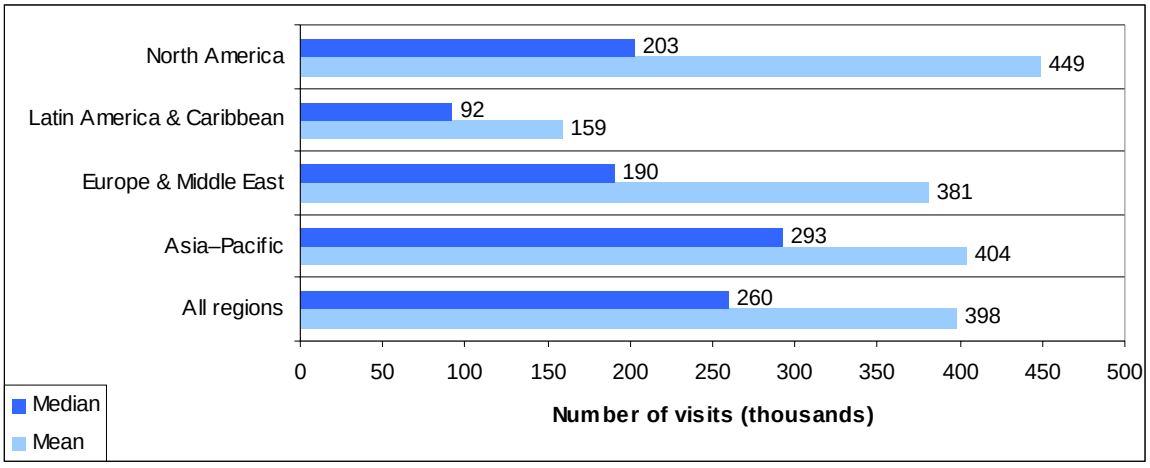


Table 8-15 shows attendance distribution patterns in detail for each region, broken down by institution type and by institution size.

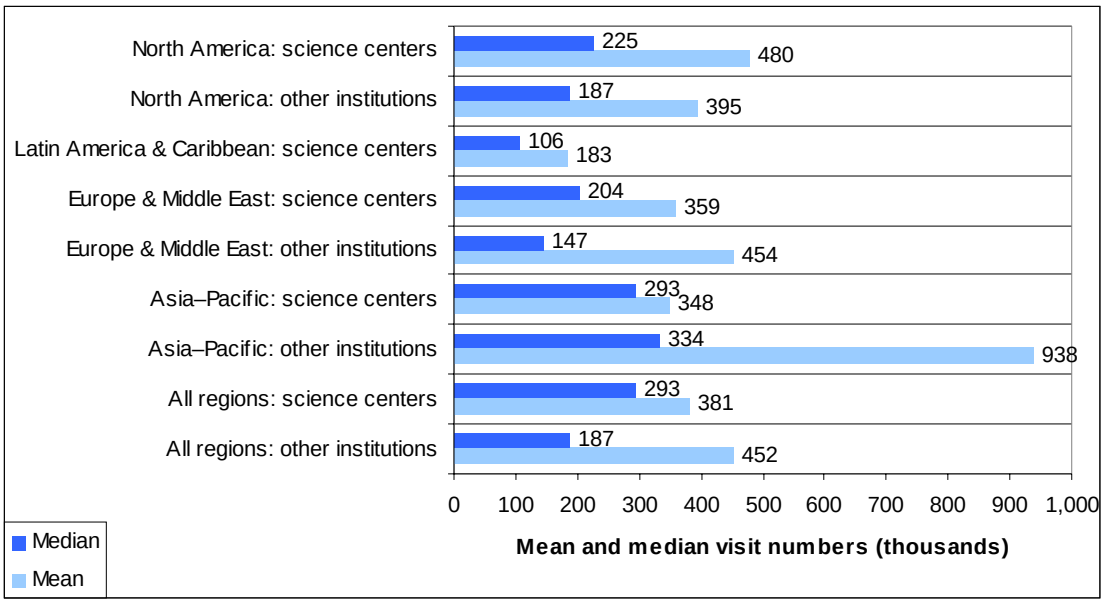
Table 8-15 Total visit numbers by institution type and institution size in each region

Category	Number of visits				
	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	All regions
All respondents*					
Mean	449,476	159,407	380,978	403,731	398,337
Minimum	4,750	5,200	3,000	14,760	3,000
25th percentile	74,836		91,750		99,871
Median	202,651	92,329	189,612		259,694
75th percentile	474,600		377,750		397,300
Maximum	5,515,000	571,478	2,850,000	2,588,770	5,515,000
Sum	35,059,107	2,072,288	18,286,933	21,397,723	76,879,051
Number of respondents	78	13	48	53	193
Science centers*					
Mean	479,835	183,112	359,122	348,087	381,393
Minimum	4,750	5,200	3,000	14,760	3,000
Median	224,530	105,500	204,224		292,771
Maximum	23,991,771	2,014,237	13,287,527	16,708,174	56,064,709
Sum	479,835	183,112	359,122	348,087	381,393
Number of respondents	50	11	37	48	147
Other institution types					
Mean	395,262		454,491	937,910	452,486
Minimum	5,000		40,000	128,727	5,000
Median	186,981		147,000		186,981
Maximum	2,720,327		2,136,000	2,588,770	2,720,327
Sum	11,067,336		4,999,406	4,689,549	20,814,342
Number of respondents	28	2	11	5	46
Very small institutions					
Mean	149,795	53,516	65,269	35,939	96,225
Minimum	4,750	5,200	3,000	14,760	3,000
Median	82,436		55,000		61,059
Maximum	1,110,819	112,000	211,000	71,261	1,110,819
Sum	2,396,725	267,580	848,500	143,756	3,656,561
Number of respondents	16	5	13	4	38
Small institutions*					
Mean	120,235	138,468	183,829		128,383
Minimum	23,000	34,484	55,000		23,000
Median	113,925	89,536			105,500
Maximum	300,021	436,989	435,000		436,989
Sum	2,043,989	830,809	735,316		3,723,114
Number of respondents	17	6	4	1	29
Medium institutions					
Mean	230,669		209,744	289,279	234,588
Minimum	36,809		55,000	94,232	36,809
Median	207,143		175,000		214,584
Maximum	642,000		530,000	402,000	642,000
Sum	3,229,367		2,307,189	1,735,676	7,272,232
Number of respondents	14	0	11	6	31
Large institutions					
Mean	958,742		719,796	467,519	671,379
Minimum	25,000		145,000	128,727	25,000
Median	850,538		378,500		364,913
Maximum	5,515,000		2,850,000	2,588,770	5,515,000
Sum	25,886,026		14,395,928	19,168,291	60,424,144
Number of respondents	27	2	20	41	90

** 'All regions' values include the single South African respondent.*

Figure 8-17 shows the mean and median numbers of visits to institutions in each region by institution type, for 193 institutions.

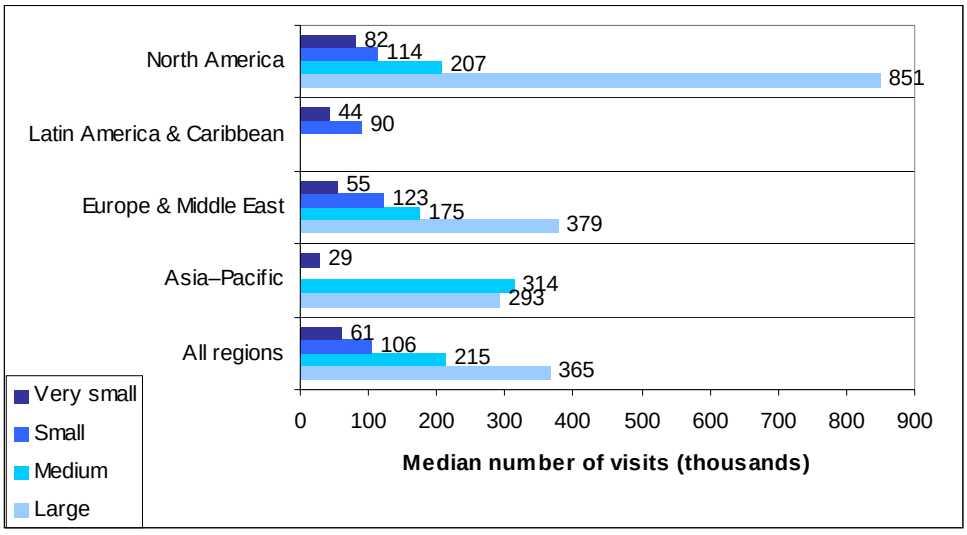
Figure 8-17 Number of visits by institution type in each region (mean and median values)



In the Asia–Pacific region, respondents classifying themselves as 'science center / museum' attracted fewer visits, on average, than 'other institutions'—a result influenced by the dominance of large national museums in the small 'other' category for this region. Elsewhere, visit numbers at science centers were higher than visit numbers at 'other' respondent institutions.

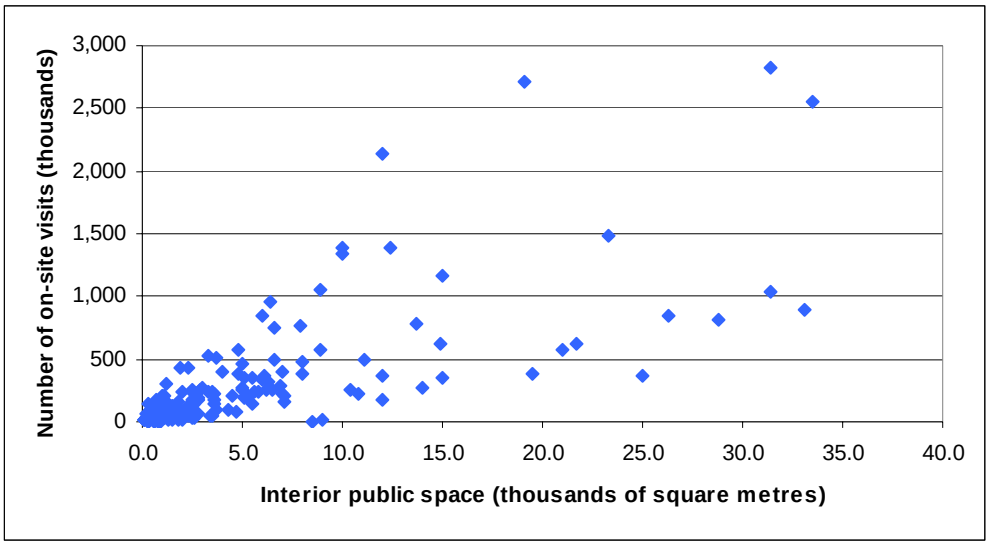
As might be expected, visit numbers were generally larger for larger institutions. Worldwide, the median number of visits to very small institutions was around 61,000, while the median number for large centers was 365,000. Figure 8-18 shows how median visit numbers related to institution size for the 188 institutions that provided both sets of information.

Figure 8-18 Median number of visits by institution size in each region



The correlation is of course only approximate, as there are many different sets of circumstances in which institutions of similar sizes operate. This is shown by Figure 8-19, which plots on-site visit numbers against institution size as measured by total interior public space. (Four institutions with very high values for either visit numbers or floor space have been excluded in order to maintain a useful scale for this scatter graph.)

Figure 8-19 Number of on-site visits compared to institution size for all respondents



Visitors from outside an institution's local region

The survey questionnaire asked respondents to provide an estimate of the percentage of visitors from outside the economic region in which their institution operates, e.g. city, county or state. Nearly three-quarters of respondents (141 institutions, or 73%) answered this question. The percentage of out-of-region visitors ranged from 5% to 98%, with a median value of 36% and a mean of 39%. This suggests that for a significant proportion of science centers, spending by out-of-region visitors probably makes a useful contribution to the economy of the region surrounding the center.

Table 8-16 shows that the distribution of values for 'percentage of out-of-region visitors' is similar in the four geographical regions we are considering.

Table 8-16 Percentage of visitors from outside each institution's local region

	Percentage of visitors from outside institution's local region				
	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	All regions
Mean	35%	45%	42%	41%	39%
Minimum	5%	5%	5%	5%	5%
Median	34%	49%	40%	40%	36%
Maximum	95%	85%	98%	85%	98%
Number of respondents	61	12	45	22	141

8.7 Employees and volunteers

A total of 16,879 people were employed in 171 respondent institutions. Of these paid employees, 10,756 (64%) worked full time and 6,123 (36%) worked part time; only 135 institutions reported having part-time employees. In addition, 119 institutions reported the involvement of a total of 26,546 volunteers.

Figure 8-20 shows the total numbers of paid full-time staff and paid part-time staff in each region, and Figure 8-21 shows the mean and median numbers of staff employed by respondent institutions in each region. Overall, North American institutions employed a larger proportion of staff on a part-time basis than institutions in other regions.

Note that different institutions reported staff numbers in different ways. Some reported only full-time and part-time staff numbers, some reported only full-time equivalent (FTE) numbers, and some reported both. While 137 institutions provided a value for their FTE staffing number, a further 30 reported zero part-time employees. For these 30 institutions, the reported number of full-time employees has been used as their full-time equivalent. The variations in reporting are reflected in the different sample sizes shown in Figure 8-21. Any comparisons should be made with care.

FTE staff number

The number of full-time equivalent (FTE) staff is calculated by (a) working out how many full-time employees would be needed if all part-time hours were divided among full-time employees and then (b) adding this number to the number of actual full-time employees.

Figure 8-20 Total numbers of paid employees in respondent institutions in each region

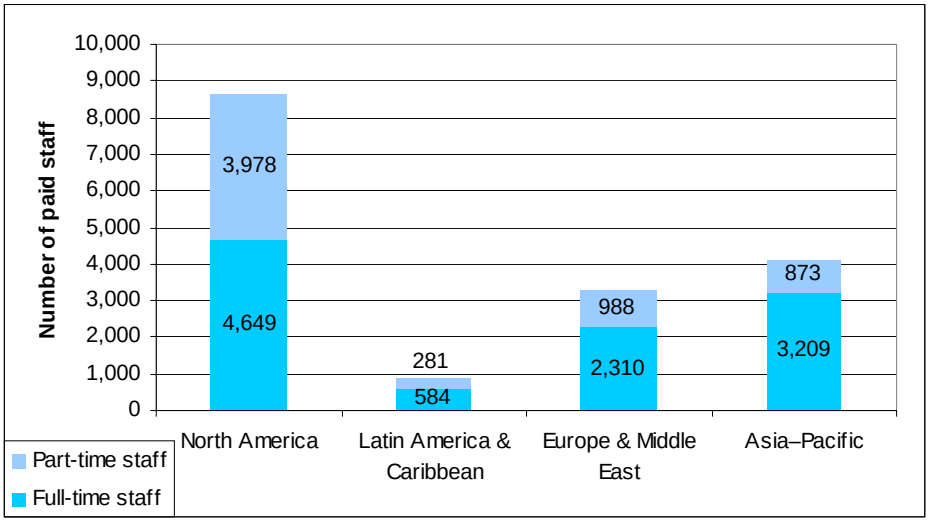
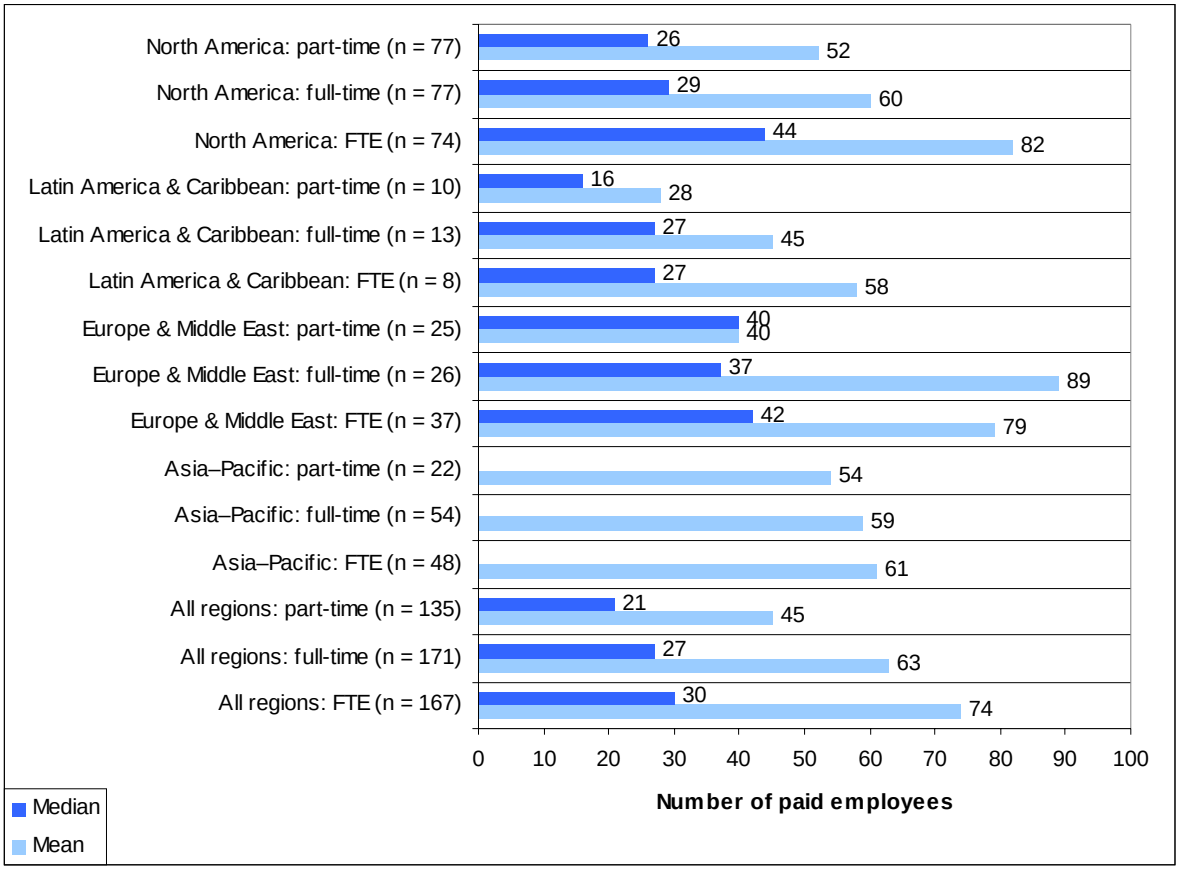


Figure 8-21 Mean and median numbers of paid employees in respondent institutions in each region



North American institutions made greater use of volunteers than institutions in other regions, as shown in Figure 8-22. The median number of volunteers in a North American institution was 200 (mean: 303), compared with 18 (mean: 29) in Latin America & the Caribbean, 13 (mean: 25) in Europe & the Middle East, and 90 (mean: 186) in the Asia–Pacific region.

Figure 8-22 Total number of volunteers in respondent institutions in each region

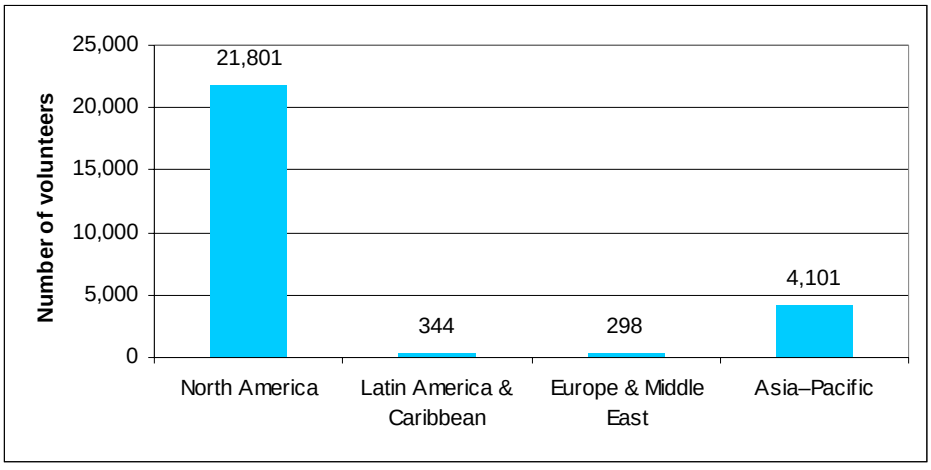


Table 8-17 shows details of the staffing patterns for respondent institutions in each region.

Table 8-17 Total staff numbers in respondent institutions in each region

Category of staff	Number of people in staff category				
	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	All regions
Full-time employees*					
Mean	60	45	89	59	63
Minimum	0	1	0	2	0
25th percentile	10		17		14
Median	29	27	37		27
75th percentile	75		66		72
Maximum	275	193	945	320	945
Sum	4,649	584	2,310	3,209	10,756
Number of respondents	77	13	26	54	171
Part-time employees*					
Mean	52	28	40	54	45
Minimum	1	1	5	1	1
25th percentile	6		15		8
Median	26	16	40		21
75th percentile	56		55		52
Maximum	307	72	142	350	350
Sum	3,978	281	988	873	6,123
Number of respondents	77	10	25	22	135
Full-time equivalent (paid staff)					
Mean	82	58	79	61	74
Minimum	0.2	3	2	4	0.2
25th percentile	16		16		18
Median	44	27	42		30
75th percentile	110		85		87
Maximum	362	193	700	335	700
Sum	6,087	463	2,923	2,946	12,420
Number of respondents	74	8	37	48	167
Volunteers*					
Mean	303	29	25	186	223
Minimum	6	2	1	9	1
25th percentile	84		5		20
Median	200	18	13		108
75th percentile	332		19		280
Maximum	1,861	180	125	793	1,861
Sum	21,801	344	298	4,101	26,546
Number of respondents	72	12	12	22	119
All paid and unpaid workers*					
Mean	395	93	139	152	254
Minimum	3	16	21	17	3
25th percentile	111		55		28
Median	266	61	77		108
75th percentile	483		108		315
Maximum	1,984	373	1,178	1,268	1,984
Sum	30,388	1,209	3,606	8,183	43,396
Number of respondents	77	13	26	54	171

** 'All regions' values include the single South African respondent.*

Table 8-18 shows FTE staff numbers by institution type and institution size in each region, expanding on the information about total FTE numbers in each region shown in Table 8-17 above.

Table 8-18 Full-time equivalent staff numbers by institution type and institution size in each region

Category	Full-time equivalent staff numbers				
	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	All regions
Science centers					
Mean	87	66	52	54	67
Minimum	0	4	2	6	0
Median	42	39	40		27
Maximum	362	193	156	308	362
Sum	4,162	460	1,414	2,387	8,423
Number of respondents	48	7	27	44	126
Other institution types					
Mean	74		151	185	100
Minimum	2		6	70	2
Median	44		51		48
Maximum	325		700	335	700
Sum	1,926		1,509	555	3,993
Number of respondents	26	1	10	3	40
Very small institutions					
Mean	18	15	19	13	17
Minimum	0	3	2	6	0
Median	13	4	14		12
Maximum	52	39	60	26	60
Sum	266	46	204	38	553
Number of respondents	15	3	11	3	32
Small institutions					
Mean	25	38	35		27
Minimum	5	11	10		5
Median	24	15	28		21
Maximum	86	88	73		88
Sum	423	114	139		681
Number of respondents	17	3	4	1	25
Medium institutions					
Mean	54		50	60	53
Minimum	16		16	51	16
Median	48		40		48
Maximum	130		103	70	130
Sum	757		450	179	1,386
Number of respondents	14	0	9	3	26
Large institutions					
Mean	173		164	62	116
Minimum	5		35	27	5
Median	182		101		68
Maximum	362		700	335	700
Sum	4,325		2,131	2,411	9,171
Number of respondents	25	2	13	39	79

Figure 8-23 and Figure 8-24 show the breakdown of paid FTE employee numbers by institution type and by institution size in each region.

Figure 8-23 Mean and median values of full-time equivalent staff numbers by institution type in each region

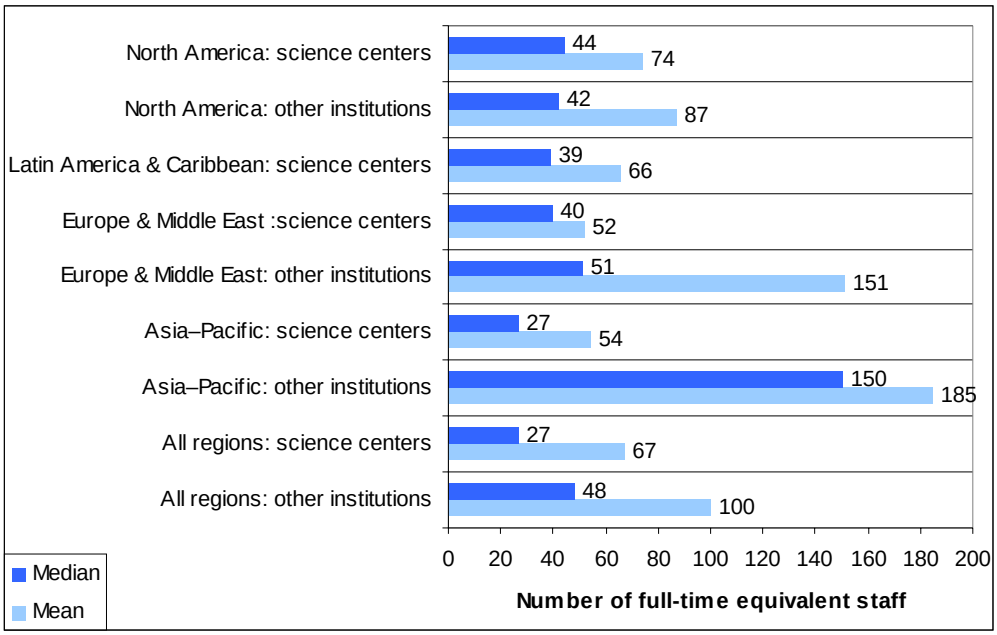
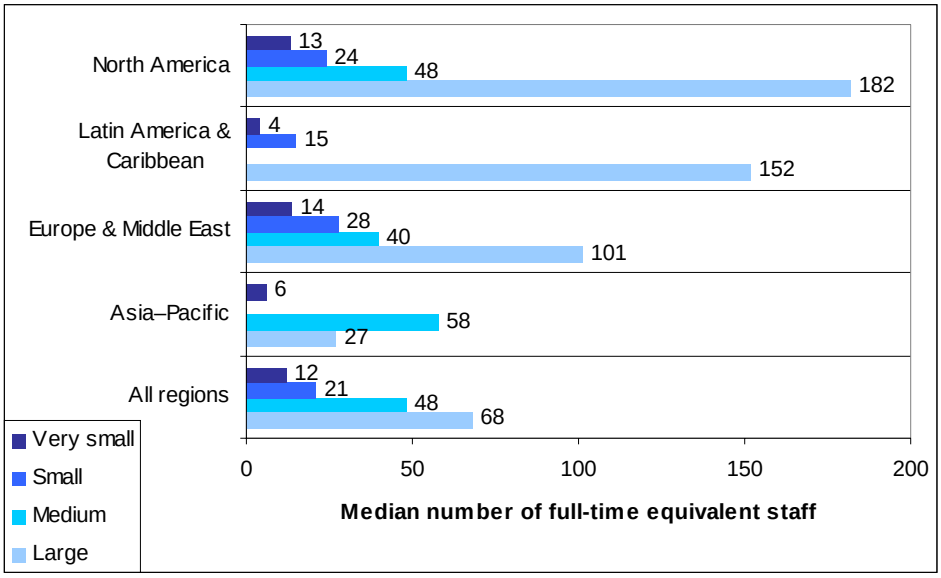


Figure 8-24 Median number of full-time equivalent staff by institution size in each region



8.8 Performance ratios

Various ratios comparing expenditure, staff numbers, floor space and visit numbers can be used to summarise respondent institution performance in different contexts.

Table 8-19 and Figures 8-25 to 8-28 set out four of these ratios for respondent institutions in each region. Table 8-11, showing operating cost per FTE employee, could also be considered in this context.

Table 8-19 Some performance indicators for respondents in each region

	North America	Latin America & Caribbean	Europe & Middle East	Asia–Pacific region	All regions*
			Number of on-site visits per square metre of interior public space		
Mean	86	72	79	48	72
Minimum	2	4	5	4	2
Median	64	55	62		51
Maximum	433	227	272	154	433
Number of respondents	74	13	48	51	187
			Total number of visits per FTE employee (including off-site visits)		
Mean	5,801	3,740	4,716	8,538	6,221
Minimum	780	1,246	1,133	858	780
Median	4,980	3,310	4,143		5,390
Maximum	23,750	7,033	10,400	10,843	23,750
Number of respondents	74	8	37	46	165
			Operating cost per square metre in US dollars		
Mean	1,479	434	1,450	459	1,106
Minimum	17	96	166	33	17
Median	1,100	307	992		760
Maximum	5,004	1,671	6,527	5,000	6,527
Number of respondents	74	13	46	52	186
			Operating cost per visit—based on total visit numbers—in US dollars		
Mean	17	7	20	6	14
Minimum	2	1	5	1	1
Median	14	6	15		12
Maximum	77	18	73	46	77
Number of respondents	77	13	46	53	190

'All regions' values include the single South African respondent.

On average, institutions in the Asia–Pacific region had a smaller number of on-site visits per square metre than institutions in the other regions, but a larger total number of visits per FTE employee.

Comparisons of operating cost per square metre of public space, or operating cost per visit, follow a similar pattern to comparisons of total operating expenditure (see discussion following Table 8-8). Amounts spent are considerably larger for institutions in North America and Europe & the Middle East than for institutions in Latin America & the Caribbean or in the Asia–Pacific region, possibly reflecting differences among the economies in different countries.

Figure 8-25 Number of on-site visits per square metre for each region

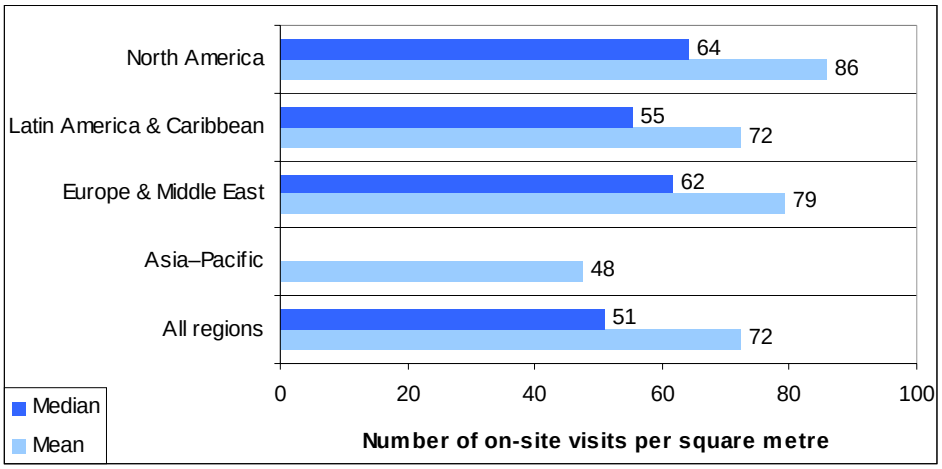


Figure 8-26 Number of visits per full-time equivalent employee for each region

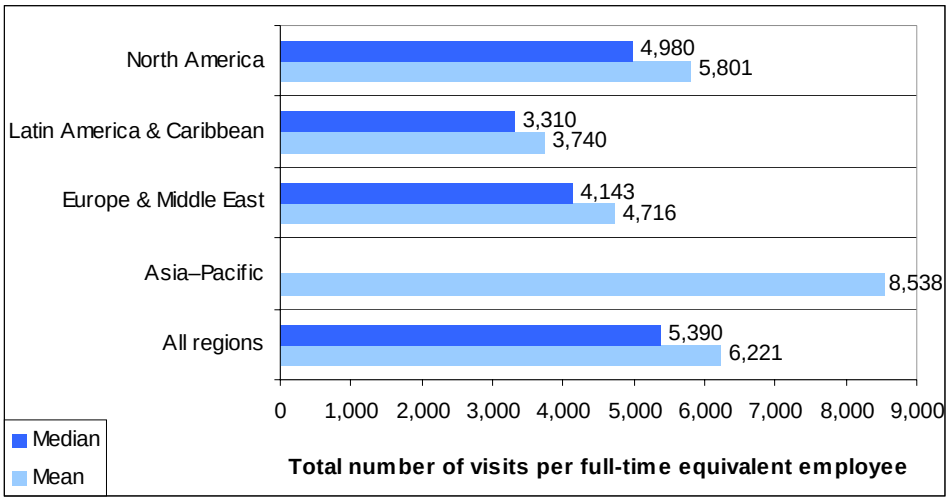


Figure 8-27 Operating cost per square metre of interior public space for each region

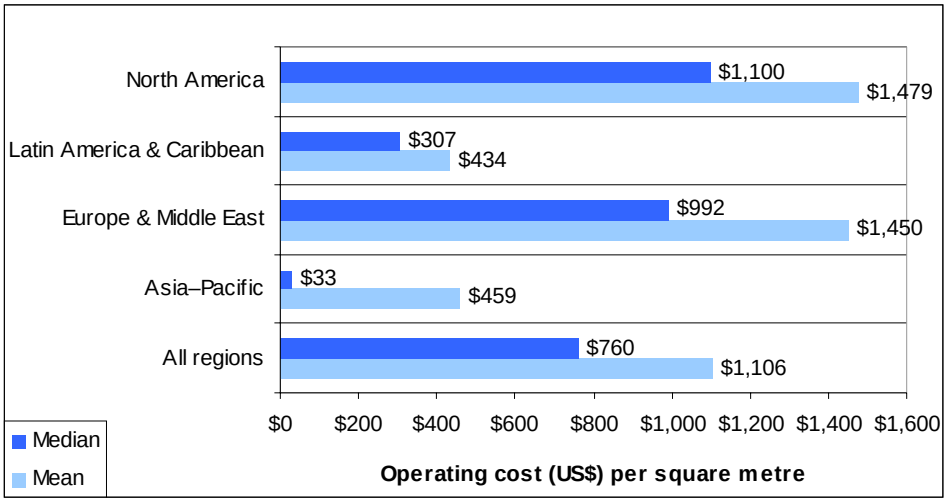
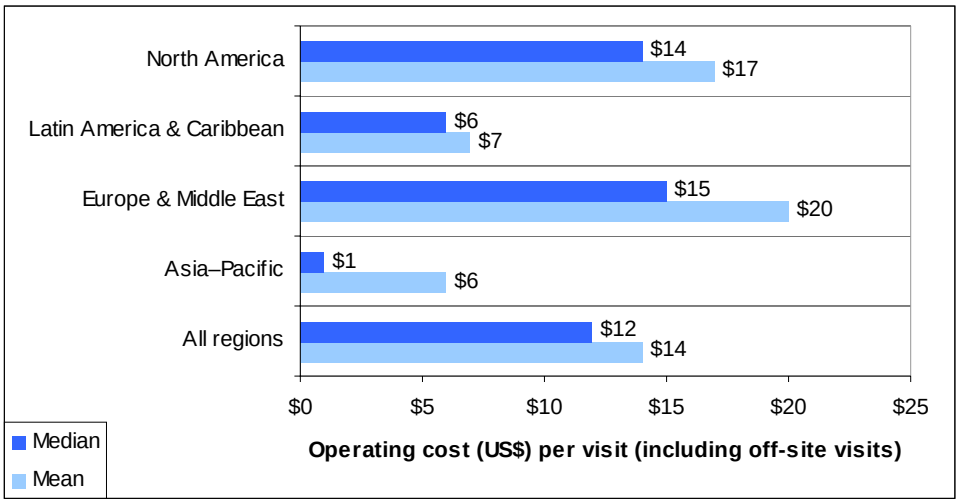


Figure 8-28 Operating cost per visit for each region, based on total number of visits



A final reminder: many of the comparisons that we have made of data by institution type and institution size have limited validity. This is partly because of small sample size in some of the groups. Also, the averaging of data for the Indian science centers distorted distribution patterns for this region's data and also, to a lesser extent, the patterns for 'all regions' data.

Appendixes

Appendix 1 Glossary

ASPAC	Asia–Pacific Network of Science and Technology Centres
ASTC	Association of Science-Technology Centers Incorporated
ASTEN	Australasian Science and Technology Exhibitors' Network
CASC	Canadian Association of Science Centres
direct economic impact	the combined impact on a region's economy of spending by an institution, the jobs provided by the institution, and the spending in the region by those of the institution's visitors who are not from the local region and whose primary reason for visiting the region was their visit to the institution
economic impact	the flow and level of spending, in a particular region and during a particular time period, that can be attributed to the activities of the institution/s under study
ECSITE	European Collaborative for Science, Industry and Technology Exhibitions
ECSITE-UK	The Science and Discovery Centre Network (United Kingdom)
fiscal impact	changes in government revenues and expenditures—including changes in tax payments and changes in demand for public services—resulting from an institution's activities
FTE	full-time equivalent—the number of full-time staff in an institution plus the number of full-time employees that would be needed if all part-time hours were dividing among full-time employees
IMPLAN	an economic impact assessment modelling system which grew out of work at the University of Minnesota and which can be used to build economic models for estimating the impacts of changes in states, counties or communities in the USA
indirect economic impact	the 'supplier effects' occurring when spending by an institution and its visitors injects new money into the economy of a region, stimulating the purchasing of goods and services by suppliers to meet the needs of the institution and its visitors
induced economic impact	the flow-on created by the combined effect of direct and indirect economic impacts, when larger wages and increased organisational revenues are, in part, returned to the local economy through further 'consumption' spending
I–O table	input–output table—a table that shows what goods and services are produced by each industry in a region, and how they are used, providing a detailed map of financial interactions within the region and identifying the flow of goods and services between industries, consumers and government
LOCI III (or LOCI 3)	software developed at the Georgia Institute of Technology (USA) to assist local governments and economic developers in assessing both costs and benefits of proposed projects at the city, county or school district level
mean	the arithmetic average of a set of numbers, obtained by dividing the sum of all the numbers by the number of items in the set
median	the middle number in a sequence of numbers arranged in order of size
multipliers	numbers that describe the size of the secondary economic impacts of an institution's activities, usually expressed as a ratio of total (i.e. direct + secondary) impacts to direct impacts (see Chapter 5.3 for a discussion of commonly used multipliers)
NCSM	National Council of Science Museums (India)

percentile	most easily explained using an example—for a series of numbers arranged in order, the 25th percentile is that number in the series which is 25/100 of the way along the list: 25% of all the numbers in the list are smaller than the identified one (and 75% of the numbers are larger)
Red-POP	Red de Popularización de la Ciencia y la Tecnología para América Latina y el Caribe
RIMS II	Regional Input–Output System, an economic impact model developed by the Bureau of Economic Analysis (BEA) in the USA, based on a USA-wide input–output table linking nearly 500 industries, and the BEA's regional economic accounts; RIMS II multipliers can be used to estimate economic impacts of changes in a regional economy in the USA
SAASTEC	Southern African Association of Science and Technology Centres
secondary economic impact	the sum of indirect and induced economic impacts
UK	United Kingdom
USA	United States of America

Appendix 2 Types of economic analysis

The descriptions below are those given by Stynes (1997, p. 2) in the context of tourism. The references provided by Stynes to other publications are not included here.

Economic impact analysis—What is the contribution of tourism to the economy of the region? An economic impact analysis traces the flows of spending associated with tourism activity to identify changes in sales, tax revenues, income, and jobs due to tourism. The principal methods here are visitor spending surveys, analysis of secondary data from government economic statistics, economic base models, input–output models and multipliers.

Fiscal impact analysis—Will government revenues from tourism activity from taxes, direct fees, and other services cover the added costs for infrastructure and government services? Fiscal impact analysis identifies changes in demands for government utilities and services resulting from some action and estimates the revenues and costs to local government to provide these services.

Financial analysis—Can we make a profit from this activity? A financial analysis determines whether a business will generate sufficient revenues to cover its costs and make a reasonable profit. It generally includes a short-term analysis of the availability and costs of start-up capital as well as a longer-range analysis of debt service, operating costs and revenues. A financial analysis for a private business is analogous to a fiscal impact analysis for a local government unit.

Demand analysis—How will the number or types of tourists to the area change due to changes in prices, promotion, competition, quality and quantity of facilities, or other demand shifters? A demand analysis estimates or predicts the number and/or types of visitors to an area via a use estimation, forecasting or demand model. The number of visitors or sales is generally predicted based on judgement (Delphi technique), historical trends (time series methods), or using a model that captures how visits or spending varies with key demand determinants (structural models) such as population size, distance to markets, income levels and measures of quantity and competition.

Benefit–cost (B/C) analysis—Which alternative policy will generate the highest net benefit to society over time?
A B/C analysis estimates the relative economic efficiency of alternative policies by comparing benefits and costs over time. B/C analysis identifies the most efficient policies from the perspective of societal welfare, generally including both monetary and non-monetary values. B/C analysis makes use of a wide range of methods for estimating values of non-market goods and services, such as the travel cost method and contingent valuation method.

Feasibility study—Can/should this project or policy be undertaken? A feasibility study determines the feasibility of undertaking a given action to include political, physical, social and economic feasibility. The economic aspects of a feasibility study typically involve a financial analysis to determine financial feasibility and a market demand analysis to determine market feasibility. A feasibility study is the private sector analogue of benefit–cost analysis. The feasibility study focuses largely on the benefits and costs to the individual business or organisation, while B/C analysis looks at benefits and costs to society more generally.

Environmental impact assessment—What are the impacts of an action on the surrounding environment? An environmental assessment determines the impacts of a proposed action on the environment, generally including changes in social, cultural, economic, biological, physical and ecological systems. Economic impact assessment methods are often used along with corresponding measures for assessing social, cultural and environmental impacts. Methods range from simple checklists to elaborate simulation models.

Appendix 3 Questionnaire and covering letter

Dear colleague

What economic contribution does your institution make to your local community?

I am writing to seek your help in exploring this question for science centers and museums on an international scale. Your input will be very valuable to a project funded by a consortium of science centers and ASTC, and supported by ASPAC, ASTC, ECSITE, RedPOP and SAASTEC science center networks.

Background

This project is part of the International Study of the Impact of Science Centers on their Communities. The first stage of this study was carried out in 2001–02 by Robin Garnett, who established that so far, most of the research on the impact of science centers and museums has explored impacts on individual visitors, by looking at learning, attitudes to science and technology, and career choices. You can download a summary report about the Garnett study from <http://ecsite.ballou.be/new/index.asp>

However, with increasing competition for resources and a growing emphasis on accountability and delivering value to our communities, an economic perspective is often being called for. The International Study has identified a need for more research in the area of economic impacts of science centers and museums.

Aims of this project

This project will provide a snapshot of economic data for science centers in the regions covered by the science center network organisations mentioned above. It will also provide a foundation for in-depth local studies should you wish to explore the economic impact of your institution on your community.

This project aims to:

1. collect, collate and summarise baseline economic data from science centers in participating networks around the world
2. outline what you need to do to carry out an economic impact study for your institution
3. present a small number of case studies to illustrate how some science centers have already approached the economic impact question.

Your contributions please

a) Please complete and return the attached one-page questionnaire, using data for the 12 months of your most recently completed fiscal year. Please provide financial information in US dollars.

The survey is provided both as a Microsoft Word document and as a PDF file. You can complete the Word version electronically and return it by email; or you can print either version and return it by fax or mail.

If you operate more than one site or building, please provide aggregated data for your entire institution.

If your institution has only recently begun operations or is not yet open to the public, we would still like to hear from you. Please complete as much of the survey as you can.

b) Please provide a list of ways in which you believe your institution contributes to your region's economy – even if there is no clear way to estimate the monetary value of these contributions. Examples might include: being a hub for urban redevelopment; serving as an educational resource center or having educational partnerships with schools; providing employment opportunities for disadvantaged young people; being a tourist attraction or a tourism partner with other attractions in your area; caring for a historic property if your building has heritage value. There are undoubtedly many more!

c) If your institution has previously carried out an economic impact study, please send a copy of a report on your study if you are willing for me to use it in one or more of the following ways: (a) provide background information relevant to the second aim above; (b) include it in the reference list for my

report; (c) summarise it as a case study in my report. If you provide a report, please tell me which of these uses you would be happy for me to consider.

d) A large study in the USA has led to a calculator which allows arts organisations to estimate the likely economic impact of an arts event on the basis of budget, audience numbers and community population (http://www.artsusa.org/economicimpact/calculator.asp). The steering group for the current study is interested in whether such a calculator is helpful in indicating the level of impact by science centers, and invites you to enter your data into this online calculator and compare the calculator result with economic impact information for your institution from other sources. While recognising that the Arts USA calculator was designed for arts *events* in the USA and not for science-based institutions offering year-round visits and programs in other countries, I would welcome any feedback you can provide on this.

Use and dissemination of the information gathered in this project

The report on this project will be published online and disseminated via participating science center networks in late 2004. Two versions of the report will be produced:

- A summary report will present the key findings of the survey, without any detailed data. It will also outline briefly the key elements of a full economic impact study.
- The full report will include data tables with selected information for specific institutions (along the lines of the tables in the annual ASTC Sourcebooks). If you have concerns about how provided information will be used, please contact the project officer, Ilze Groves (ilzegroves@ozemail.com.au).The full report will also include guidelines for carrying out economic impact studies, with illustrative case studies.

The project team

The project is being guided by a steering group chaired by Dr Per-Edvin Persson, ASTC President and Director of Heureka — The Finnish Science Center. The project is being coordinated by Ilze Groves, Project Officer, Questacon, Australia's National Science and Technology Centre.

Expert advice is being provided by the University of Canberra's Centre for Tourism Research, experienced in carrying out economic impact studies in the area of educational tourism.

Where and when to send your contributions

Please forward your completed questionnaire, together with any other material relevant to items (b), (c) and (d) above **to Ilze Groves by 11 June 2004**, by:

email:	ilzegroves@ozemail.com.au
facsimile:	+61 2 6273 4346 (for the attention of Ilze Groves)
mail:	Ilze Groves Questacon – The National Science and Technology Centre PO Box E28 Kingston ACT 2604 Australia

I look forward to receiving your completed questionnaire and any other information that you can contribute to this exciting project.

Yours sincerely

Ilze Groves
Evaluation Project Officer

Survey: Economic Data for Science Centers and Science Museums

This survey is part of an international project exploring the economic impact of science centers on their communities.
The project is supported by ASPAC, ASTC, ECSITE, Red-POP and SAASTEC.

Your institution

Institution name:
Address:
City: State: Zip: Country:
Main contact name: Position:
Phone: + Facsimile: + Email:

1. Please tick which ONE of the following BEST describes your organisation:

[ ] 1. Aquarium [ ] 2. Arboretum / botanic gardens [ ] 3. Natural history museum
[ ] 4. Planetarium [ ] 5. Science center / museum [ ] 6. Zoo
[ ] 7. Other: _____

2. In what year was your institution first opened regularly to the public? ____OR: Plan to open in: _____

3. Does your institution charge a general admission fee? [ ] 1. Yes [ ] 2. No

4. How much floor space in your institution is devoted to public use? (Exclude all staff-only areas such as offices, workshops and storage space.)

Interior: _____square metres *Out of doors*: _____square metres

NOTES

1000 sq feet = 93 sq metres

If your institution has more than one building / site, please show **combined** *floor area.*

Your staff (at the end of your most recently completed fiscal year)

5. How many staff, including 'active friends' and volunteers, worked for your institution?

	Category of staff	Number of staff
5.1	Total paid full-time staff	
5.2	Total paid part time staff	
5.3	**Total FTE paid staff**	
5.4	Unpaid staff—volunteers and 'active friends'	
5.5	**Total FTE unpaid staff**	

5.1, 5.2 and 5.4: *Please provide the total number of people employed / working in each category.*

5.3, 5.5: *FTE = full-time equivalents*

Your visitors (total attendance for your most recently completed financial year)

6. On-site attendance? _____

7. Off-site attendance? _____

8. What percentage of your visitors come from outside your 'local' area? _____

7 Off-site visitors: *please exclude visitors to your exhibitions or programs in other science centers or museums.*

8 Your 'local' area: *the economic entity within which you operate eg city, county, state*

Financial information (for your most recently completed financial year)

9. TOTAL INCOME: Your institution's total annual revenue and capital funds received

	Income source	Amount (US dollars)
9.1	Public funding	US$
9.2	Private funding (gifts, donations, sponsorship)	US$
9.3	Earned income	US$
9.4	**TOTAL INCOME**	**US$**

9.1 Public funding: *funds from local, state and federal government sources.*

9.3 Earned income *includes income from admission fees, educational events and fees, subscriptions & membership, retail sales (e.g. café, shop), other trading activities, interest and investment income.*

10. OPERATING COSTS: Value of costs associated with your institution's day-to-day operation

	Type of payment	Annual cost (US dollars)
10.1	Staff salaries and wages	US$
10.2	All other operating costs	US$
10.3	**TOTAL OPERATING EXPENDITURE**	**US$**

10.1 '**Staff salaries and wages**' *includes all employee benefits (overtime, bonuses, employer's superannuation and insurance contributions, occupational pensions, expenses) and regularly contracted services such as security and janitorial.*

11. TOTAL CAPITAL EXPENDITURE / INVESTMENT: **$US**_____

11 Capital expenditure: *payments during the year for buildings, exhibitions, other fixed assets.*

Appendix 4 Notes on the questionnaire

The approaches described here are those agreed by a group of regional network executive directors (ASTC, ASPAC, ECSITE, RedPOP) in Rio de Janeiro in February 2004.

What is a science center?

- Respondent institutions were asked to self-classify, using a number of categories consistent with those used in ASTC surveys.
- Multi-campus institutions were asked to provide aggregated data.
- Institutions were grouped into four size categories on the basis of public floor area, for consistency with reporting in the ASTC Sourcebooks (ASTC 2001, 2002).

Distribution of survey questionnaire

- The questionnaire, with covering letter, was distributed by email by regional network executive directors, and also through other contacts in India, Japan and China.

Different currencies

- Respondents were asked to provide financial data in US dollars, for their most recently completed financial year. Where data were provided in local currencies, the project officer used the conversion rate at the time of receipt of the questionnaire (mid-2004) to obtain a value in US dollars.
- It was recognised that the data aggregations emerging from the survey would be only approximate, because of currency fluctuations and different financial year arrangements as well as the fact that the survey would not capture data from all existing science centers.

Data aggregation

- 'Total' figures for incomes, visit numbers, employee numbers etc were aggregated for science centers and museums around the world, or by region, with other groupings used where appropriate, e.g. by type or size of institution.

Sensitivity of data and confidentiality issues

- Initially, our intention was to publish data to about the same level of detail as the ASTC Sourcebooks (ASTC 2001, 2002). The covering letter accompanying the survey stated this, and invited any respondents with concerns or queries about this approach to contact the project officer. About 10% of respondents provided data for aggregation only, but not for detailed publication, and individual data items were missing in a number of other cases. We decided to include only the names and locations of participating institutions in this report, without all the detailed data that they supplied.

Audience for and dissemination of the final report

- Unlike the report on the Phase 1 study (Garnett 2002), the report on this study will be in the public domain.

Appendix 5 List of participating institutions

Data from the following institutions have been used in this study. The institutions are grouped by region, and arranged alphabetically by name within each group.

North America

Arizona Science Center, Phoenix AZ, USA
Avampato Discovery Museum, WV, USA
Bay Area Discovery Museum, CA, USA
Buffalo Museum of Science, NY, USA
Calgary Science Centre, Calgary, Canada
California Science Center, Los Angeles CA, USA
Canadian Museum of Nature, Ottawa, Canada
Chicago Children's Museum, IL, USA
Children's Discovery Museum of Central Illinois, IL, USA
Children's Discovery Museum of San Jose, San Jose CA, USA
Christa McAuliffe Planetarium, NH, USA
COSI, Toledo OH, USA
Cranbrook Institute of Science, MI, USA
Denver Museum of Nature and Science, Denver CO, USA
Discovery Center of Springfield Inc, MO, USA
Discovery Center Science Museum, CO, USA
Discovery Center Museum of Rockford, Rockford IL, USA
Edgerton Explorit Center, Aurora NE, USA
EdVenture Inc, SC, USA
Exhibit Museum of Natural History, MI, USA
Exploration Place Inc, KS, USA
Exploratorium, San Francisco CA, USA
Fort Worth Museum of Science and History, Fort Worth TX, USA
Gulf Coast Exploreum Science Center, AL, USA
Hands On! Regional Museum, Johnson City TN, USA
Humboldt State University Natural History Museum, CA, USA
Impression 5 Science Center, MI, USA
Kalamazoo Valley Museum, MI, USA
Kidspace Children's Museum, CA, USA
Kitt Peak National Observatory, Tucson AZ, USA
Lemelson Center Smithsonian Institution, DC, USA
Lexington Children's Museum, KY, USA
Liberty Science Center, NJ, USA
Lindsay Wildlife Museum, CA, USA
London Regional Children's Museum, London, Canada
Louisville Science Center, Louisville KY, USA
Maryland Science Center, MD, USA
McWane Center, Birmingham AL, USA
Montshire Museum of Science, VT, USA
MOSI (Museum of Science and Industry), FL, USA
Museum of Discovery and Science, Fort Lauderdale FL, USA
Museum of Discovery, AR, USA
Museum of Science, MA, USA
National Aquarium in Baltimore, Baltimore MD, USA
National Geographic Museum, Washington DC, USA
National Radio Astronomy Museum, NM, USA
Nauticus, The National Maritime Center, Norfolk VA, USA
New Mexico Museum of Natural History and Science, NM, USA
New York Hall of Science, Corona NY, USA
North Carolina Museum of Forestry, Whiteville NC, USA
Ontario Science Centre, Toronto, Canada
Oregon Museum of Science and Industry, OR, USA
Orlando Science Center, Orlando FL, USA
Pacific Science Center, Seattle WA, USA
Peggy Notebaert Nature Museum, IL, USA
Roper Mountain Science Center, SC, USA
Science Central, IN, USA
Science Discovery Center of Oneonta, NY, USA
Science Museum of Minnesota, MN, USA
Science Museum of Virginia, VA, USA
Science Station–McLeod/Busse IMAX Dome Theater, Cedar Rapids IA, USA
SciCentr.org, Ithaca, USA
Sciencenter, NY, USA
Sci-Tech Discovery Center, TX, USA
SciTech Hands-On Museum Science and Technology Interactive Center, IL, USA
SciWorks, Winston-Salem NC, USA
SD Discover Center and Aquarium, Pierre SD, USA
South Florida Science Museum, West Palm Beach FL, USA
St Louis Science Center, MO, USA
The Children's Museum of Houston, Houston TX, USA
The Children's Museum of Indianapolis, Indianapolis IN, USA
The Children's Museum of Utah, UT, USA
The Discovery Museums Inc, Acton MA, USA
The Franklin Institute, PA, USA
The New Mexico Museum of Space History, NM, USA
The North Alabama Science Center, Huntsville AL, USA
The Science Factory, OR, USA
The Science Place, Dallas TX, USA
The Tech Museum of Innovation, San Jose CA, USA
Utah Museum of Natural History, Salt Lake City UT, USA
Virginia Discovery Museum, VA, USA

Latin America & the Caribbean

Centro de Ciencias Explora, Leon, México
Centro de Ciencias y Artes A.C. (Planetario Alfa), San Pedro Garza Garcia, México
Centro de Divulgação Cientifica e Cultural, São Carlos, Brazil
Explora Centro de Ciencias y Arte, Panama, Panama
Fundacion Museo de Ciencias, Caracas, República Bolivariana de Venezuela
La Burbuja Museo del Niño A.C., Hermosillo, México
Mundo Nuevo, Programa de Divulgación y Enseñanza de las Ciencias. UNLP, La Plata, Argentina
Museo da la Luz, México, México
Museo de la Ciencia y el Juego, Bogotá, Colombia
Museo Interactivo de Ciencias 'PuertoCiencia', Paraná, Argentina
Niherst/NGC National Science Centre, D'Abadie, Trinidad and Tobago
Programa Valoraciencia, Coquimbo, Chile
Universum, Sciences Museum, México, México

Europe & the Middle East

Alimentarium – Food Museum, Vevey, Switzerland
Associazione Festival della Scienza, Genova, Italy
At-Bristol, Bristol, UK
Bloomfield Science Museum, Jerusalem, Israel
Centre for Alternative Technology, Machynlleth, UK
Cité de l'Espace, Toulouse, France
Cité des Sciences et de l'Industrie, Paris, France
Clore Garden of Science, Rehovot, Israel
Curioxity, Oxford Trust, Oxford, UK
Danish Museum of Electricity, Bjerringbro, Denmark
Eden Project, Saint Austell, UK
Eureka! The Museum for Children, Halifax, UK
Experimentarium, Hellerup, Denmark
Fjölskyldu- og húsdýragarðurinn, Reykjavik, Iceland
Fondazione IDIS - Città della Scienza ONLUS, Napoli, Italy
Glasgow Science Centre, Glasgow, UK
Heureka, the Finnish Science Centre, Vantaa, Finland
Inspire, Norwich, UK
Jodrell Bank Visitor Centre, Macclesfield, UK
Life Science Centre, Newcastle upon Tyne, UK
London Wetland Centre, London, UK
Look Out, Bracknell, UK
Lusto, Punkaharju, Finland
Magna Science Adventure Centre, Rotherham, UK
Mathematikum, Giessen, Germany
Museum of Science and Industry, Manchester, UK
Museuo Tridentino di Scienze Naturali, Trento, Italy
National Marine Aquarium, Plymouth, UK
National Space Centre, Leicester, UK
National Stone Centre, Wirksworth, UK
Natural History Museum, London, UK
Office de Coopération et d'Information Muséographiques, Dijon, France
Our Dynamic Earth, Edinburgh, UK
Pavilion of Knowledge — Ciência Viva, Lisboa, Portugal
Satrosphere, Aberdeen, UK
Science Museum, London, UK
Sensation, Dundee, UK
Snibston Discovery Park, Coalville, UK
Stiftung Jugend und Wissenschaft Heidelberg gGmbH, Heidelberg, Germany
Techniquest, Cardiff, UK
Technopolis, Mechelen, Belgium
Technorama The Swiss Science Center, Winterthur, Switzerland
Teknikens Hus, Luleå, Sweden
Tekniska museet (National Museum of Science and Technology), Stockholm, Sweden
The Making Place, London, UK
The Observatory Science Centre, Hailsham, UK
Thinktank, Birmingham AL, UK
Tom Tits Experiment AB, Södertälje, Sweden
Universeum, Gothenburg, Sweden
W5 (whowhatwherewhenwhy Ltd), Belfast, UK

Asia–Pacific region

Discovery World (in Otago Museum), Dunedin, New Zealand
Hong Kong Science Museum, Hong Kong, China
Imaginarium Science Centre, Devonport, Australia
Monash Science Centre, Melbourne, Australia
Museo Pambata (Museum for Children) Foundation Inc, Manila, Philippines
Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand
Nagoya City Science Museum, Nagoya, Japan
National Council of Science Museums—aggregated response for 28 science centers, Nagar, India
National Museum of Emerging Science and Innovation, Koto-Ku, Japan
National Museum of Natural Science, Taichung, Taiwan
National Museum, Manila, Philippines
National Science and Technology Museum, Kaohsiung, Taiwan (ROC)
National Science Centre for Education, Bangkok, Thailand
National Science Centre Malaysia, Kuala Lumpur, Malaysia
National Science Museum, Daejeon, Republic of Korea
National Science Museum, Khlong Luang, Thailand
Oil and Gas Discovery Centre, Seria Town, Brunei
Petrosains Sdn Bhd, Kuala Lumpur, Malaysia
Philippine Science Centrum, Manila, Philippines
Questacon – The National Science and Technology Centre, Canberra, Australia
Science Alive!, Christchurch, New Zealand
Scienceworks, Melbourne, Australia
Scitech Discovery Centre, Perth, Australia
Shifu Road Science & Technology Museum, Wenzhou, China
Singapore Science Centre, Singapore
Tasmanian Museum and Art Gallery, Hobart, Australia
Te Manawa Museum, Gallery, Science Centre, Palmerston North, NewZealand

Southern Africa

Unizul Science Centre, KwaDlangezwa, South Africa

Appendix 6 Activities that contribute to the economic health of a local community

The letter accompanying the survey questionnaire asked respondents to list ways in which they believed their institution contributes to its region's economy—even if there is no clear way to estimate the monetary value of these contributions. The following responses were received; they are summarised in Chapter 5.4.

American Zoo and Aquarium Association

- The public trusts the conservation message of zoos and aquariums. In a recent Pew Charitable Trust poll, the public ranked zoos and aquariums among the most powerful and trusted sources on the environment today.
- Many endangered species survive because of zoos and aquariums
- Zoos and aquariums take conservation action all over the world
- Effective wildlife conservation is rooted in science

Canadian Museum of Nature

- Hub for urban development (current renovations will increase this)
- Schools rely on museum programs as educational resources
- Major tourist attraction in the region
- Designated national historic site

Centro de Divulgação Cientifica e Cultural (São Carlos, Brazil)

- Educational resource center and educational partnerships with schools
- Providing employment opportunities for students
- Tourism partner with other attractions in the area
- Production and sales of educational kits
- Transferring technologies for industrial production of educational kits

Centro de Ciencias Explora (Léon, Gto, México)

- Since 1994, a significant hub for urban redevelopment, e.g. the construction of a large park and a huge Convention Center including a large Cultural Complex (perhaps the largest in México)
- The main tourist attraction in the Léon region, and an important tourism partner with the local zoo, the Metropolitan Park and other city attractions
- Explora's educational influence has helped to aim pre-college students' career choices towards scientific and technological areas of study; the effect will be noticed in the re-shaping of the professional labour force

Discovery Center Museum (Rockford IL, USA)

- Local and regional attraction resulting in over 50,000 out-of-town visitors coming into the community for day trips or overnight visits
- Partner with several local hotels in packaging offers
- Featured in the state tourism summer promotion package
- Located on a campus with the art museum and the natural history museum and is planning a joint capital campaign to raise $12 million for expansion
- Located in the downtown area of the community; part of city redevelopment plans
- Location on the Rock River is significant in the park district river plans for beautification
- Selected as the fourth best children's museum in the nation by Child Magazine, bringing notice to the community on a national level

Discovery World (Dunedin, New Zealand)

- Part of a major tourist attraction (Otago Museum); attracts school groups and visitors by bringing interactive exhibits to the museum
- Offers opportunities for youngsters to learn valuable leadership and life skills through a scheme where young people assist in the operation of the science center
- Educational partnerships with schools throughout the region
- Offers after-school clubs, holiday programs, science shows and activities such as the Discovery World Chemistry Club

- Connects the science center to business groups in the town and to the University of Otago, through an external Science Advisory Group

Explora Centro de Ciencias y Arte (Panama City, Panama)

- Hub for urban redevelopment
- Serves as an educational resource
- Contributes to the development of the country, preparing the future generation
- Tourist attraction
- Source for contribution of private corporations in the educational process
- Guides are youngsters who serve as an educational resource and at the same time increase their knowledge
- Provides employment opportunities

Exploratorium (San Francisco, USA)

- Partnerships with 15 science centers worldwide to develop exhibit-based teaching programs
- Teacher workshops for 10,000 teachers from 37 states
- Intensive professional development for 400 teachers annually
- National model program designed to improve beginning teacher retention and classroom success
- Free workshops for 5,000 under-served children and families
- Explainer program hires and trains a diverse group of 150 high school students each year
- 'Resident' program for scholars, scientists, educators and artists
- Visitor Research and Evaluation Department studies museum exhibits and learning

Fondazione IDIS—Città della Scienze ONLUS (Naples, Italy)

- The first science center in Italy—business innovation center—high level training center—congress center
- In a building with industrial heritage value, which has been restored and restructured as the first stage in renewing an important part of the city
- Hub for urban development, including assisting the transition from an industry-based economy to a knowledge-based economy
- Educational resource center in science education, vocational guidance and training
- Educational partnerships with schools e.g. science activities pack, science labs in schools
- Providing employment opportunities for young people, graduates and unemployed people through vocational training, job guidance and start-up projects
- Being a tourist attraction or tourism partner with other attractions in the area—member of Regional Touristic System Card ARTECARD
- Partner of local institutions for economic and local development
- Sustaining business start-up: includes an incubator for 30 new companies in the fields of ICT and environment
- Facilitating transfer of innovation from research to new business activities (spin-off, club start-up etc)
- Conference and events venue

Museums In the Park (Chicago IL, USA)

- Educational resources: teacher development materials, distance learning opportunities, virtual exhibits on the internet.
- *Museums and Public Schools* (MAPS), an educational partnership between Museums In the Park and the Chicago Public Schools, brings museum curriculum into the classroom, as well as providing free museum admissions and annual museum memberships to Chicago Public School teachers involved with the MAPS program. In the 1999–2000 school year, 240 teachers at 60 schools participated in the MAPS program.
- Area residents with Chicago Public Library cards can obtain free museum passes at all library branches. More than 176,000 families have used these free passes since 1995.
- In collaboration with 54 local parks within the Chicago Park District, the Park Voyagers program has introduced more than 1,000 children and their families to the learning opportunities available at the nine museums through museum field trips and free admission passes.

National Geographic Museum at Explorers Hall, National Geographic Society (Washington DC, USA)

- Serves as an educational resource, through the society's Geography Outreach division. Nearly 5 million students participate in the overall National Geography Bee program. The finals, held in DC each spring, bring in international competitors and press focused on NGS and DC.
- The society offers internships to geography students three times a year

- Tourist destination not only for National Geographic members, but also for tour groups, VIPs, schools etc
- Member of the DC Cultural Tourism group
- We have 23 museum docents and 110 other volunteers, thereby supporting our local community
- Offer cultural and educational events to the public: hold lectures, musical evenings, films etc in our auditorium
- Facilities—museum, auditorium, dining hall—are available for rental for special events
- Driven in part by its resource-conservation mission, the NGS's three-building headquarters complex in Washington DC became the first facility to achieve the Leadership in Energy and Environmental Design for Existing Buildings (LEED-EB) certification in November 2003. Created by the US Green Building Council, LEED-EB certification focuses on the upgrade and operations of existing buildings to improve their performance and overall impact on the environment.

National Museum of Emerging Science and Innovation—MeSci (Koto-ku, Japan)

- Supports four project teams engaged in cutting-edge research, with the Research Area located in spaces independent of exhibition spaces. All the laboratories are lined with glass walls so that visitors can see the experimental activities. The 'Research Area Tour' is conducted by MeSci volunteers every Saturday: more than 500 visitors including kids and adults participate each year, learning about what the research is in an easy-to-understand way, and meeting and talking to researchers in person.
- Super Science High School: Selected high schools nationwide have visiting experts such as active scientists, engineering and other specialists to bring real-life science to the student. MeSci plans and organises projects such as special classes and seminars.
- MeSci is part of the 'Grutt Pass' program, which is operated by the Tokyo Metropolitan Foundation for History and Culture to allow people free or discounted admission to 44 facilities in Tokyo: art museums, science museums, zoos etc. The pass is valid for two months from the date of the first admission. Since joining the Grutt Pass program, MeSci has had a significant increase in visitors—a 2003 survey showed that 508 Grutt Passes were sold at MeSci and 7,602 people visited MeSci with the pass.
- The Stamp Rally is held in cooperation with five other museums in the local community. Participants get a stamp sheet and go to six museums over 16 days, getting the form stamped at each. Each museum also provides give-away merchandise such as key rings. Over 400 visitors come to MeSci on this program.
- 'One Day Science Pass'—a discounted pass offered in association with the local railway company and Sony ExploraScience, offering a one-day railway travel card and discounted admission to the two science museums.
- Some travel agents promote 'travelling to the museums and theme parks in Tokyo' in summer, targeting parents and children. The tour fee includes each museum's admission fee plus the cost of transport.
- MeSci is located in a popular tourist spot, with shopping malls, restaurants and hotels. Each facility, including MeSci, contributes to the cost of a free shuttle bus for the tourists.

Natural History Museum (London, UK)

- Scholarship—the NHM's research is highly regarded, with particular strengths in classification and taxonomy. The NHM probably has a quality and quantity of published research output that stands comparison with the better university departments.

Nauticus, The National Maritime Center (Norfolk VA, USA)

- Indirect revenues: parking revenue; cruise operations (docking fees, head taxes, water etc); regional retail sales, local restaurants, hotels, services (taxis, tailors, pharmacies etc)
- Urban redevelopment: Due in large measure to the success of Nauticus, Norfolk itself has enjoyed an explosion of urban renewal in our downtown. New restaurants, retail establishments, gyms and fitness spas and most importantly, people, are all pouring into the downtown. At nights the city streets are bustling with people where only a few years ago the streets were quiet by sunset.

Science Alive! (Christchurch, New Zealand)

- Provides educational resources to schools and preschools
- Serves local education community—including polytechnics, language schools and community groups—with science and technology programs on-site and as outreach
- Occupies a heritage-listed building
- Export industry constructing interactive science exhibits and exhibitions
- Venue for meetings
- To a minor extent, a local tourist attraction: mainly for domestic tourists with young families

Scitech Discovery Centre (Perth, Australia)

- Scitech aims to increase interest and participation in science with a view that encouraging students to pursue careers in science has a long-term economic impact.

- Attraction of customers to the CityWest precinct (shopping centre) generates sales opportunities for other retail tenants, including furniture, home office, electrical, clothing and apparel, kitchen, whitegoods and food suppliers. A visit to Scitech is often combined with a shopping expedition.
- Visitors to Scitech usually travel 15–45 minutes by either public or private transport, contributing the cost of the fuel or the transport to the economy.
- Improving the public's awareness of science improves their collective understanding of science, hence improving the state's ability to improve its economic situation through informed debate and decision making about science policies and issues.
- Scitech pays about US$1,823,000 annually in salaries—this is invested back into the local economy.
- Scitech is a tourist attraction, with approximately 9% of its visitors coming from interstate or overseas. The attraction of visitors to CityWest and the metropolitan region brings with it increased expenditure in the local area.
- Scitech spends approximately US$700,000 annually on exhibit construction, with payments going directly to contractors and suppliers in the local area.
- Scitech has six travelling exhibitions that are rented around Australia and overseas. These exhibitions generate revenue for both Scitech and hosts in the local region, including other Australian states and territories, South-East Asia and New Zealand. While generating revenue, these exhibitions also promote Western Australia and Australia as communities that value science education and so may influence goodwill and investment in the economy.
- Scitech attracts US$330,000 annually in private funding, which it uses to deliver programs and exhibits. These sponsorships are often acknowledged and promote individual businesses (usually in the mining industry), hence promoting Western Australia as a community that values industry.
- Scitech delivers professional development to over 1,000 teachers annually, thereby promoting the value of science. In the long term, this impacts on students' uptake of science and their likelihood of taking on a career in science.
- Scitech provides outreach programs in remote and regional areas that draw people from local communities on day trips. The cost of travel and expenditure in these local communities can be seen as an economic impact.

Tekniska museet—National Museum of Science and Technology (Stockholm, Sweden)

- Important educational resource for the Stockholm region: informal learning
- Agreement with the Stockholm community about education
- Contribution to teachers' learning about science and technology
- Very successful projects on technology and science for teenagers
- Regional partnerships: events on science and technology, and also on other subjects of interest to society e.g. drinking and driving
- The only Swedish national museum on the history of technology
- Meeting place: young people, researchers, old experts and veterans, families on Sundays etc
- Possibilities for universities to introduce their research to the public

The Children's Museum of Houston (Houston TX, USA)

- Helps to draw more than 6 million visitors to the heart of Houston each year
- Admit 40% of on-site visitors free of charge and 19% at a reduced fee
- Provide all outreach services targeting low-income families at no cost to participants

The Children's Museum of Indianapolis (Indianapolis IN, USA)

- Tourism. The museum is the state's largest non-sports attraction. Many visitors also visit other museums and retail outlets. The direct economic impact of out-of-town museum tourists is an estimated $10,211,000 (2002), which grows to over $18 million when more local tourists are included. The museum's reputation as a tourist destination actually grew after the attacks of 11 September, as more families looked to vacation regionally.
- Hub for neighbourhood revitalisation. The museum has built a strong relationship with the surrounding neighbourhood and community development corporations. One program provides revolving loan funds for home repairs; others provide free museum memberships for area residents. Recently the museum undertook a $3 million revitalisation of the Northwest Corridor Gateway (major point of entry into the city for museum visitors and other guests), which includes new sidewalks, lighting, traffic signal fixtures, landscaping and a new bus shelter. Currently under development is a plan to create a Children's District in the area surrounding the museum, building an urban village and bringing new economic development opportunities to the neighbourhood.
- An educational resource. All school groups (public and private) who visit the museum receive a reduced admission rate at an annual value of $2.1 million (2002). In addition to offering programs and tours that are designed to meet the Indiana Academic Standards, the museum also offers professional development opportunities in the form of workshops, previews, open houses and teacher institutes. Other resources are

on-line interactive activities, artefact-based kits that are designed to support broad themes and interactive learning, and a teacher club.

- Reaching out to young people. The museum has long run a variety of programs whose goal is to reach out to youth. The Museum Apprentice Program allows youth to run activities and interact with visitors. The Neighbours / Starpoint Program runs workshops and activities for area residents, some of whom may eventually be hired as junior staff during summer vacations. The museum also provides rehearsal space for the Metropolitan Youth Orchestra and (until very recently) the Indianapolis bureau for Y-Press, a children's new organisation.
- Free and reduced admission. There was and is a concern that has been with the museum ever since it started charging admission in the 1980s: how to ensure that admission charges to not make the facility inaccessible to any family. The result has been monthly free evenings, four free days throughout the year, a program for area residents to have free memberships (with unlimited visiting privileges) and a new program that allows participants in state programs for low-income families to pay $1 per person for admission.

And from the Rosentraub economic impact study report:

- The Children's Museum is seen as the central element in the cultural identity of Indianapolis and Central Indiana.
- In a typical period, more than half of the visitors to the museum were not residents of the Indianapolis metropolitan area. More than three-quarters of the visitors to the museum in the summer months spent at least one night in an area hotel, motel or bed & breakfast facility. This represented an increase of more than 5% from 2000 in the proportion of visitors who stayed in hotels, motel or bed & breakfast facilities.
- Links with other tourist destinations in Indianapolis. Tourists who came to the Children's Museum often visited the Indianapolis Zoo and regional shopping centers including Circle Center Mall. As a result these three assets in the downtown Indianapolis region are linked together and have an important opportunity to capitalise on the patterns of visits established by tourists.
- An important entertainment and educational asset for residents of the adjacent community and school children across the state. Through free admissions on certain days of the week, area residents and families are able to visit the museum and enjoy its assets. The museum also provides reduced admission to all visitors from public and private schools (total value of free and reduced admission is $2.1 million annually).

Six components of economic value:

- Annual budget and expenditures represent jobs for employees, contractors and suppliers.
- Popular tourist destination: Spending by visitors to the museum results in new business for hotels, restaurants, retail centers and their suppliers.
- Educational experiences for school children from throughout the region and the state—see extended discussion in the report.
- 'free entertainment': no admission charged on certain holidays and evenings.
- The museum's presence can generate economic value for local businesses and for the museum's neighbours who receive an implied advertising benefit from being able to exhibit their name to the museum's visitors. The traffic generated for the area provides opportunities for neighbouring businesses to exhibit their names before potential customers.
- The success and reputation of the Children's Museum creates the potential for generating substantial pride in the region for area residents. While this benefit is somewhat intangible, it is quite important in terms of establishing the economic value of the Children's Museum in Central Indiana.

whowhatwhenwherewhy, known as W5 (Belfast, Northern Ireland)

- The only purpose-built interactive science centre in the area
- Objective is the advancement of public education in science: 'to fire the spirit of discovery by unlocking the scientist in everyone'
- Development of experimental learning in science
- One of the top five visitor attractions in the region
- Support to educational establishments in the delivery of the National Curriculum through workshops etc
- Provision of programs targeting problems such as social need and social inclusion

Appendix 7 Case studies: economic impact of museums and science centers

The following pages provide brief descriptions of 12 economic impact studies that have been carried out in recent years by institutions, or groups of institutions, in three countries: the USA, the UK and Australia.

Each case study is described under the following subheadings:

- Organisation
- Location
- Year studied and date of report
- Title and author/s of report
- Nature of study (including key issues explored by the study and data sources used)
- Region covered by the study (including an estimate of population of the region at the time of the study)
- Annual visitor numbers
- Annual operating budget
- Economic model/s used
- Conclusions reached

The currency quoted in each case study is that of the country where the institution or group of institutions is located. In some cases, the case study report did not provide all of the above data; where necessary, information on the population of the region was sourced elsewhere, and figures for an institution's annual operating budget or visitor numbers were obtained from the surveys submitted for the current project.

Case study 1 National museums in the United Kingdom

Organisation	National Museum Directors' Conference (NMDC), whose 29 members are national museums and galleries based in various locations around the UK
Location	United Kingdom
Year studied: **Date of report:**	Visitor data for 2002; financial data for 2003–04 March 2004
Title and author/s of report	*Valuing Museums. Impact and innovation among national museums* Tony Travers, London School of Economics and Stephen Glaister, Imperial College
Nature of study	The authors used desk studies, a major questionnaire and a number of round-table discussions with key NMDC executives and directors. Their report summarises economic data for the 29 member organisations and goes on to estimate the total spending by visitors, the 'export' income earned and the overall impact, including indirect and induced effects. The report compares funding patterns for museums with those for the performing arts. It considers cultural and wider impacts of museums on the community as well as performance measures used to assess their 'success'.
Region covered by the study	United Kingdom (focusing on the 29 NMDC member organisations and their regions) Population of the United Kingdom: 59,231,900 in 2002[5]
Annual visitor numbers	6.1 million children visited NMDC institutions in 2002; and 3 million people participated in formal learning activities on-site, with a further 5.6 million learners off-site.
Annual operating budget	NMDC institutions had a combined turnover of £715 million in 2003–04.
Economic model/s used	The authors used data from a variety of sources: some were provided directly by NMDC institutions; figures for expenditure by UK museum visitors from a previous UK study based in the South West of England were adjusted to allow for higher costs in London; data on expenditure by overseas visitors were obtained from the Office of National Statistics. To estimate the effect of the direct expenditure on the wider economy, the authors 'err[ed] on the side of caution' and used 'multipliers of 1.5 to 1.7 to generate a range of plausible indirect and induced effects', based on multipliers suggested by the British Arts Festival Association (1.99), the Treasury (1.7) and the Wyndham Report for the Society of London Theatre (1.5).
Conclusions reached	Spending generated by NMDC visitors was estimated to be at least £565 million. The overall annual impact of the NMDC 'sector', including indirect and induced effects, is in the range £1.83 billion to £2.07 billion. The overseas 'export' of NMDC institutions is some £320 million a year. The report compares the rate of increase of grant-in-aid funding for NMDC institutions between 1997–98 and 2003–04 (under 19%) with growth in average earnings (34%) and growth in overall UK public expenditure (41%) and points to the gap between expected grant increases (5.2% for larger NMDC members) and projected overall government spending growth (13.9%) for the period to 2005–06. The report also considers the very wide range of roles and activities expected of the national museums and galleries—e.g. rejuvenation and regeneration, touring and exhibitions, creativity and innovation, academic excellence and education, good government and civic engagement—and provides examples of how individual institutions are meeting some of these expectations.

[5] <http://www.statistics.gov.uk/cci/nugget.asp?id=6> accessed 29 July 2004

Case study 2 Museums, libraries and archives in South West England

Organisation	South West Museums Council (now South West Museums, Libraries and Archives Council), covering 202 museums and other institutions throughout the South West region
Location	Taunton, Somerset, England
Year studied: **Date of report:**	Financial and visitor data for 1998–99 or calendar year 1998 May 2000
Title and author/s of report	*The Economic Contribution of Museums in the South West* Steven Brand, Peter Gripaios and Eric McVittie, South West Economy Centre, University of Plymouth Business School
Nature of study	The study centered on data from a detailed questionnaire-based postal survey distributed to 202 institutions within the region. The survey achieved a 76% response rate. The survey information allowed an analysis of the indirect impact of museums etc on the South West regional economy, and provided a basis for modification of the University of Plymouth's South West Economy Centre's 'input–output' model for the region's economy. The authors also collated responses on expansion prospects, barriers and proposed solutions; and, where possible, compared the contribution of the museum sector with that of other 'industries' within the region.
Region covered by study	The South West region of England (Cornwall, Devon, Dorset, Gloucestershire, Somerset and Wiltshire; and Bristol, South Gloucestershire, North Somerset and Bath and North East Somerset) Population: about 4.8 million
Annual visitor numbers	Over 4.8 million to all institutions covered by the survey
Annual operating budget	Operating expenses (excluding goods for resale) totalled nearly £10.3 million; wage and salary payments totalled nearly £13.3 million; and capital expenditure reached over £4.8 million.
Economic model/s used	Direct economic impact data were collated from the information provided by institutions in their survey responses, and led to figures for total revenue, full-time equivalent (FTE) employment, household income (total of wages and salaries), and gross domestic product (GDP). The number of tourist visits principally motivated by museum visiting, and the level of spending associated with these visits, were estimated using data from *Statistics and Tourism Research (STAR) UK* as a starting point. The authors estimated secondary economic impacts by modifying an existing input–output model developed for the region by the South West Economy Centre.
Conclusions reached	South West museums received total income of around £29.1 million, of which the largest proportion (39%) was from UK public sector grants. About 71% of museum operating expenditure and about 63% of capital expenditure accrued to suppliers within the region. Every £1 output from South West museums generated an additional £0.74 output in other South West industries and each FTE job in museums supported 0.43 additional jobs elsewhere in the region Each £1 of GDP generated £0.61 of GDP in other sectors of the regional economy. Total museum-related tourist spending in the South West was £27.5 million, which supported around 680 FTE jobs and contributed about £13.5 million to the South West's GDP.

Case study 3 A consortium of nine museums in one city

Organisation	Museums In the Park—a consortium of nine museums
Location	Chicago, Illinois, USA
Year studied: **Date of report:**	Financial data for 1996–99 and visitor data for 1996–2000 Winter 2001
Title and author/s of report	*Museums & the Economy: an Economic Impact Study of Museums In the Park* Metro Chicago Information Center (MCIC)
Nature of study	The authors analysed attendance and financial data provided by the nine museums for the period 1996–99 and also drew on parallel data for Chicago sports teams and Chicago tourism from the Chicago Convention and Tourism Bureau.
Region covered by study	City of Chicago and the State of Illinois (a high percentage of overall statewide economic activity is generated in Chicago) Population of Chicago: 2,896,000 in 2000[6]; population of Illinois: 12,419,300 in 2000[7]
Annual visitor numbers	8.7 million visitors in 2000
Annual operating budget	Direct spending by the nine museums in 1999 totalled $206.3 million.
Economic model/s used	The authors used regional economic multipliers for the State of Illinois developed by the US Department of Commerce, the US Economics and Statistics Administration and the US Bureau of Economic Analysis, a model known as the Regional Input–Output System or RIMS II.
Conclusions reached	In 1999, $206 million in direct spending by the nine museums generated approximately $456 million in total output (direct spending plus successive rounds of re-spending) and $180 million in personal earnings; and supported 10,900 jobs, of which 6,800 were in the museums themselves. In each of the four years covered by the study, the nine museums consistently attracted over 1 million more people than attended all major Chicago sports teams combined.

[6] <http://www.chipublib.org/004chicago/chifacts.html> accessed 29 July 2004

[7] <http://www.census.gov/census2000/states/il.html> accessed 29 July 2004

Case study 4 An individual science center—'unique' in its region

Organisation	The Tech Museum of Innovation
Location	San Jose, California, USA
Year studied: **Date of report:**	1999 May 2001
Title and author/s of report	*Economic Impact Analysis of The Tech Museum of Innovation on Santa Clara County* Morey and Associates Inc
Nature of study	The authors used visitor surveys at The Tech to establish the proportions of resident and non-resident (or 'tourist') visitors and details of their spending in relation to visiting The Tech. They treated non-visitor revenues received by The Tech—interest income, public funding and other contributions—as additional expenditures on entertainment and attractions by non-visitors, on the basis that a substantial fraction of these funds come from outside the county. The study treated expenditure by visitors in a conservative manner, attributing to The Tech expenditure by visitors only on the day of their visit, even if they were visiting Santa Clara County for more than one day. The above data were used to generate estimates of the overall economic impact of The Tech on its region. The authors also estimated tax collections in Santa Clara County attributable to The Tech, relating to revenue from both visitors and non-visitors.
Region covered by study	Santa Clara County Population: 1,682,600 in 2000[8]
Annual visitor numbers	Total 599,032, including 340,147 (nearly 57%) from outside Santa Clara County
Annual operating budget	Non-visitor revenues totalled $6.7 million and visitor-related revenues were under $6 million.
Economic model/s used	The authors used a localised input–output model to estimate the indirect and induced economic impact of The Tech on the Santa Clara County economy. Their model was based on a nationwide model that shows the flows of goods and services from each of 469 industries to all other industries. The Santa Clara County version included 374 of these industries, and incorporated location quotients to allow for variations in concentration of each industry in the county as compared to the whole nation. The localised input–output model yielded output and income multipliers to allow calculation of indirect and induced economic impacts based on the data collected from visitors and from The Tech's records. These multipliers ranged from 0.05 for the induced effect income multiplier for car rental to 28.17 for the indirect effect employment multiplier for restaurants.
Conclusions reached	The authors concluded that, subject to their explanations and caveats, the impact of The Tech and its almost 600,000 paying visitors on Santa Clara County was $44.2 million in economic output, $14.8 million in personal income and 802 jobs.

[8] <http://www.fedstats.gov/qf/states/06/06085.html> accessed 29 July 2004

Case study 5 An individual science center—one of a number of attractions in its region

Organisation	Questacon – The National Science and Technology Centre, one of a number of significant attractions in Australia's capital city
Location	Canberra, Australia
Year studied: **Date of report:**	2002 September 2002
Title and author/s of report	*Questacon Research Project: Economic Impact Analysis* Brock Cambourne and Michele Cegielski, Centre for Tourism Research, University of Canberra
Nature of study	The focus of the study was to estimate how much of visitor expenditure in the region could be directly attributed to Questacon. Two approaches were used: (a) Visitors to Questacon were asked whether they would have come to Canberra if Questacon were not there: all of those who would definitely cancel their trip and 50% of those who would reconsider their trip were taken as having Questacon as their primary motivator for visiting the region. (b) The proportion of time spent at Questacon in comparison to other attractions was used to apportion total expenditure by out-of-region visitors. For both methods, expenditure by local visitors was not considered, on the assumption that these people would spend their money in the region anyway. Information about how much 'external' visitors spent during their visit to the region, and on what, was obtained from exit survey data. Visitors coming in school groups or for organised functions were excluded from consideration.
Region covered by study	The Australian Capital Territory (ACT) Population: 322,000 in 2002[9]
Annual visitor numbers	350,000 in 2001
Annual operating budget	Not mentioned in the study (the current project's survey form reported operating expenses of nearly $11.2 million in 2003–04)
Economic model/s used	The University of Canberra's Centre for Tourism Research has developed an input–output model for the ACT economy. This was used to estimate downstream expenditure patterns in a range of economic sectors, based on the exit survey data about visitor spending.
Conclusions reached	The authors estimated that Questacon can be considered to have a minimum visitor expenditure impact of $1.94 million (approach (a) above) and a maximum visitor expenditure impact of $9.02 million (approach (b) above), taking into account only visitors who had independently purchased tickets, i.e. excluding school groups and visits for organised functions.

[9] <http://www.abs.gov.au/Ausstats/abs@.nsf/0/0ee487ad495671a9ca256e8a0077a3c1?OpenDocument> accessed 29 July 2004

Case study 6 A newly opened center

Organisation	The Eden Project, a 110,000 m^2 'Living Theatre of Plants and People' which opened in 2001
Location	St Austell, Cornwall, England
Year studied: **Date of report:**	The first six months of the financial year in 2002–03; business survey carried out in 2001 October 2002 (This report follows an earlier study of the first eight months of the 2001–02 financial year.)
Title and author/s of report	*The Economic Impact of the Eden Project 1st April to 1st October 2002* Andrew Jasper (produced for The Eden Project in association with Geoff Broom Associates)[10]
Nature of study	The authors explored the impact of the influence that the Eden Project had on visitors' choice of holiday destination and calculated impact based on visitor spending at Eden; external effects arising from spending off-site by visitors to Eden; effects generated by the spending of wages by employees whose jobs are directly or indirectly supported by the visitor spending; the degree to which visitors were influenced by the Eden Project in their choice of holiday location; the degree of displacement caused by the project in attracting visitors away from existing leisure facilities. Data sources used for the report were the Eden Project's employment and expenditure records; visitor surveys carried out at Eden over several months during 2002; a business survey in 2001 of Eden suppliers; and regional or country-wide information from various national survey sources. The report includes detailed descriptions of the methodology and calculations used to assess a variety of impacts of the Eden Project on the South West region of England.
Region covered by study	The authors report on additional impacts at several levels: the local area (St Austell—population: 36 000 'today'[11]); the rest of the Borough of Restormel (Newquay area total population 91,000—census 2001); the rest of the county of Cornwall (population: 501,267 in 2001[12]); the neighbouring county of Devon; and the rest of the South West region. Population of the entire South West region: 4,928,434 in 2001[13]
Annual visitor numbers	1.39 million, of whom 85% were from outside the local area (data from this project's survey, as the economic impact study did not cover a complete financial year)
Annual operating budget	US$28 million (also from this project's survey)
Economic model/s used	Geoff Broom and Associates 'created and utilized a computer based economic model (*The Cambridge Tourism Economic Impact Model*) to calculate the value, quantity and economic impact of visitors to The Eden Project'. The model has been used for other tourism-based impact studies, and has been independently validated by Bournemouth University. The model uses information from a number of business surveys carried out in various locations in England on the relative impact of different forms of tourism expenditure.
Conclusions reached	For the South West region as a whole, during six months of the 2002-03 financial year the Eden Project has stimulated additional tourism activity (over 2.5 million visitor days); extra business turnover (nearly £177 million) and employment (nearly 5,500 jobs) and income (over £81 million) for local residents. The report provides economic impact figures for the local area and for the county of Cornwall as well as for the entire South West region. The business survey measured potential positive and negative effects on local tourism-related businesses, both increases and reductions in the number of customers and turnover; also improvements and a positive effect on the image of Cornwall, a worsening of traffic in some areas, and some increased difficulties of recruitment. However, the positive effects were, overall, stronger than the negative ones, and arguably the most significant effect was a lengthening of the tourist season.

[10] The summary on this page also draws on 'The Eden Effect. A snapshot of economic impact locally and regionally' (17 July 2003), a PowerPoint summary provided by Tony Kendle.

[11] <http://www.localhistories.org/austell.html> accessed 29 July 2004

[12] <http://www.statistics.gov.uk/census2001/pyramids/pages/15.asp> accessed 29 July 2004

[13] <http://www.statistics.gov.uk/census2001/pyramids/pages/k.asp> accessed 29 July 2004

Case study 7 Going beyond economic impact to consider economic value

Organisation	The Children's Museum
Location	Indianapolis, Indiana, USA
Year studied: **Date of report:**	2002 March 2003
Title and author/s of report	The Economic Value of The Children's Museum to Central Indiana's Economy and Identity: 2002 Results Professor Mark S Rosentraub, Cleveland State University
Nature of study	The study focused on the direct economic value of the museum to the community, without using any multipliers. It evaluated six components of the museum's value: (1) direct expenditure by the museum, representing jobs for employees, contractors and suppliers; (2) spending by visitors to the museum, for example in hotels, other attractions, stores and restaurants; (3) the benefits relating to the educational experiences that the museum provides for school children and their teachers; (4) the 'free entertainment' provided for families and children on occasions when admission is not charged; (5) the economic value for local businesses and the museum's neighbours—an implied advertising benefit resulting from museum-related traffic in the area; and (6) the potential for generating substantial pride in the region for residents of the area. Data were obtained from the museum's records and from an August 2002 visitor survey.
Region covered by study	Central Indiana Population: in the 800,000s
Annual visitor numbers	985,922
Annual operating budget	$26 million; plus $3.25 million in capital expenditure
Economic model/s used	Data from the visitor survey were combined with information from the Indiana Convention and Visitors' Bureau on spending by tourists to generate estimates of the total direct spending attributable to museum visitors. To estimate the economic value to the community of free or reduced-fee admissions, the marginal cost to the museum of these admissions was calculated by subtracting relevant admissions revenue from the overall cost per visitor of operating the museum multiplied by the number of free or reduced-fee admissions. Two other methods were mentioned as possible ways to estimate the economic benefit of free and reduced admissions: (1) use visitor surveys to establish what people would have done if they had not come to the museum, and use the expenses associated with those activities as a 'proxy measure of the implied benefit of free admission'; (2) for school groups, estimate the marginal savings to schools of not having the children in school that day.
Conclusions reached	Expenditure by tourists, related to visits to The Children's Museum, was estimated at over $18 million. The free admission programs (47,517 free admissions) and the reduced-fee school admission programs (126,122 admissions) were estimated to provide an economic benefit of over $3 million (using 2000 figures). The museum earned $385,000 in fees from its travelling exhibits, generating income to help support the programs provided for residents of Central Indiana. Also, visitors see The Children's Museum as the central element in the cultural identity of Indianapolis and Central Indiana, and residents include it among reasons for pride in living in the area. The report comments that 'The reputation … and the pride produced for an area's residents by a civic asset can be as important or in some instances more robust that the economic benefits.' The reputation of the region is also enhanced by the display, in other parts of the country, of the museum's name on its travelling exhibits.

Case study 8 A science center planning to expand its facilities

Organisation	National Aquarium in Baltimore
Location	Baltimore, Maryland, USA
Year studied: **Date of report:**	2001 April 2003
Title and author/s of report	*The Economic Impact of the National Aquarium in Baltimore* Dr Massoud Ahmadi, Executive Manager, Business Research and Analysis, Maryland Department of Business and Development
Nature of study	The study focused on the aquarium's expenditure during 2001 and on visitor spending outside the aquarium for transportation, lodging, food and other travel-related incidentals. Data were obtained from the aquarium itself and from the Department of Business and Economic Development, Business Research and Analysis unit.
Region covered by study	The state of Maryland Population: 5,386,000 in 2000[14]
Annual visitor numbers	1,630,000
Annual operating budget	$30 million in operational expenditure plus $14 million in employee income; about 301 full-time-equivalent (FTE) jobs.
Economic model/s used	All indirect and induced impacts of the aquarium were estimated using a Maryland-specific input–output model from the University of Minnesota's IMPLAN group. This model describes the inter-industry flow of goods and services within Maryland and with the outside economy.
Conclusions reached	The author estimated that the total—direct plus secondary—statewide impact of the aquarium in 2001 was about $132 million in expenditure; $53 million in employee income; and about 1,928 FTE jobs. The construction of the proposed Center for Aquatic Life and Conservation was projected to generate $33 million in direct expenditure, $10 million in direct employee income, and about 265 FTE jobs. The corresponding projections for total (direct plus secondary) impacts were $55 million in expenditure, $18 million in employee income and about 540 FTE jobs statewide. The direct annual fiscal impact of the aquarium was estimated at $6.2 million in selected state and local tax receipts, and the secondary fiscal impact at $1.2 million—a total of $7.4 million. The total fiscal impact of the proposed construction project was estimated at nearly $1.24 million in state and local tax receipts.

[14] <http://www.areaconnect.com/population.htm?s=MD> accessed 29 July 2004

Case study 9 A science center considering relocating its facility

Organisation	Sci-Quest, the North Alabama Science Center
Location	Huntsville, Alabama, USA
Year studied: **Date of report:**	2003, with projections to 2010 May 2004
Title and author/s of report	*The Economic Effects of a Science Center. An in-depth study on the economic impact of Sci-Quest to the City of Huntsville's economy* Wesley Wright, Chief Development Officer, Sci-Quest
Nature of study	The author explored various factors associated with a proposed relocation to a more central downtown site, including strategies for attracting more visitors. Industry data from the Association of Science and Technology Centers, the American Association of Museums and the Association of Children's Museums were used to develop two predictions for likely visitor attendance at a new downtown facility. Attendance and profit projections for the period 2004–10 were developed, and direct and indirect economic impact estimates calculated.
Region covered by study	The city of Huntsville Population: 290,000[15]
Annual visitor numbers	53,749 in 2003
Annual operating budget	$1.052 million
Economic model/s used	The study used data pertinent to Hunstville, Alabama to construct a LOCI III model (developed by the Georgia Institute of Technology) to create a set of multipliers for the project. Data for the model were provided by the US Bureau of the Census, Madison County Tax Assessor and Tax Collectors offices, the State of Alabama Department of Revenue and the City of Huntsville. The author noted that the multipliers generated by the LOCI III model assume six spending cycles, 'sometimes making the multipliers more robust than the actual effects.' Projections to 2010 assumed a market growth rate of between 4% and 7% annually, based on data from the US Bureau of the Census, and took into account traffic count data and daily capture information for Sci-Quest's current location.
Conclusions reached	A multi-regression model showed that for large centers, attendance tends to be proportional to interior public space, but that this relationship is less useful for small centers (like Sci-Quest). A market penetration analysis suggested that Sci-Quest's performance was generally comparable to that of other similar centers/museums, and the author identified a number of ways in which the capture ratio could be improved to increase visitor numbers if Sci-Quest were in a downtown location. The economic impact analysis resulted in an estimated secondary impact of nearly $1.21 million, i.e. a total economic impact of about $2.26 million (with a multiplier of 1.1475 for each of the six rounds of spending considered in the model). The overall conclusion was that while Sci-Quest 'will never become self-sustaining, a larger facility would allow for more earned income, near or at 60% of annual cost of services [compared with the current 50%], in addition to an added annual economic impact of over $500,000.'

[15] Personal communication: Wesley Wright, November 2004

Case study 10 Economic impact of a science festival

Organisation	Australian Science Festival (ASF) Canberra, which organises an annual 10-day festival of science events in and around Australia's national capital. The 2003 festival comprised 142 events with over 190 organisations participating in and/or sponsoring festival activities.
Location	Canberra, Australia
Year of study: **Date of report:**	2003 December 2003
Title and author/s of report	*2003 Australian Science Festival—An Analysis of Surveys of Stakeholder Groups and Visitors* Professor Des Nicholls and Christina Jankovic, School of Finance and Applied Statistics, Faculty of Economics and Commerce, Australian National University[16]
Nature of study	The study used data from eight surveys: face-to-face interviews with audience members at two major festival events; and survey forms completed by event holders, school teachers, 'expo' exhibitors, workshop participants, theatre managers and participating panellists/performers. The survey questions sought qualitative feedback on festival events and festival staff (both 'front-of-house' and management), festival facilities and timings, event budgets and advertising awareness among audiences, and also explored audience demographics and expenditure patterns.
Region covered by study	Australian Capital Territory (ACT) Population: 322,800[17]
Annual visitor numbers	100,615 in 2003, of whom about 17% were from outside the ACT
Annual operating budget	$AU1.3 million (ASF budget; does not include expenditure by organisers of individual events)
Economic model/s used	Together with direct expenditure data from the surveys, the authors used information from the Canberra Tourism and Events Corporation about daily spending by visitors to the ACT; and multipliers provided by Australian Capital Tourism.
Conclusions reached	The authors concluded that the total expenditure by festival event organisers and audiences within the ACT was nearly $AU6.5 million. They did not attempt to calculate the number of jobs supported by festival activities, or to explore indirect and induced economic impacts. For nearly 77% of respondents at one event, the festival was a factor in choosing to visit Canberra.

[16] This summary also draws on an information kit provided by festival organisers.

[17] <http://www.abs.gov.au/Ausstats/abs@.nsf/0/06d43402866a696bca256ec300029ce5?OpenDocument> accessed 29 July 2004

Case study 11 Economic impact of arts organisations in the USA

Organisation	Americans for the Arts, a 'non-profit organisation for advancing the arts in America'
Location	Washington DC
Year studied: **Date of report:**	Financial data for 2000; audience spending data collected during 2001 2003 (date of publication of full report)
Title and author/s of report	*Arts & Economic Prosperity. The Economic Impact of Nonprofit Arts Organizations and Their Audiences* Americans for the Arts
Nature of study	The study collected data from 3,000 non-profit arts organisations and 40,000 audience members in 91 communities, spread across the USA. The organisational survey identified organisation type, attendance figures, expenditure (salaries, payments to artists and operating/overhead expenses; facilities-related expenses; and capital and asset acquisition costs), amount and type of volunteer work, and sources and values of in-kind support received. The audience survey covered travel, accommodation and spending details, and also explored some of the demographics of those surveyed.
Region covered by study	USA: 33 states and the District of Columbia; the communities studied ranged in population from 4,000 to 3 million.
Annual operating budget	Total spending during fiscal year 2000 by non-profit arts organisations within one community ranged from $489,000 (community population 31,392) to nearly $249 million (community population 951,000).
Economic model/s used	The project economists, from the Georgia Institute of Technology, customised input–output models for each of the 91 communities 'to provide specific and reliable economic impact data about their non-profit arts industry.' The starting point was a table showing inter-industry purchase patterns for the US economy for 1992. This was reduced to reflect the size and mix of industries in the local economy of each participating community, using county and regionally based information, and was adjusted to show only local transactions in the inter-industry part of the table. The final tool used was an aggregation reflecting the activities of 32 industries plus local households. (Page 16 of the report details the calculations needed to arrive at total impact figures using this 33 x 33 matrix.)
Conclusions reached	'Because of the variety of communities surveyed and the rigor with which the study was conducted, national estimates of the impact of the nonprofit arts industry can be extrapolated.' This extrapolation led to estimates for: • total expenditures ($134 billion) by arts organisations ($53.2 billion) and event-related spending by their audiences ($80.2 billion) • the number of full-time equivalent (FTE) jobs supported by the activities of arts organisations (4.85 million) • household income generated ($89.4 billion) • total government revenue delivered to local, state and federal governments ($24.4 million). Another product of the study was the *Arts & Economic Prosperity* calculator at <http://www.artsusa.org/economicimpact/calculator.asp>, which allows arts organisations in the USA to estimate the likely economic impact on their communities of their activities, based on the size of the community's population, the organisation's annual budget, and the size of the audience. The calculator produces estimates for total audience expenditure, number of FTE jobs supported, and revenues flowing to local and state governments. See Chapter 6.7 of this report for further discussion of the *Arts & Economic Prosperity* calculator.

Case study 12 Economic impact of a major Australian university

Although this case study does not relate to a science center or museum, or to a specifically science-focused activity, it is included here as an illustration of an attempt to quantify some of the more 'qualitative' impacts of an educational institution, including the increase in human capital resulting from education at the tertiary level.

Organisation	Curtin University of Technology
Location	Perth, Western Australia (WA), Australia
Year of study: **Date of report:**	Financial data for 1996; student and staff survey carried out in 1997 June 1999
Title and author/s of report	*Contributing to the Community Through Education and Research. Quantifying the Economic Impact of Curtin University of Technology on the WA Economy* H Cabalu, T Desai, N Doss, Professor P Kenyon, P Koshy and J Trotter, The Institute for Research into International Competitiveness, Curtin University of Technology
Nature of study	The authors considered three aspects of the university's impact on the state of Western Australia: • the direct and indirect income and employment generated in the state through its activities, including the generation of export income • the enhancement of the state's (and the nation's) human capital through its education of university graduates • the creation of wealth through the spill-over effects to government and business of its research and development activities. University records provided data on staff numbers, total operating revenues and total expenditure. Postal surveys elicited information about expenditure by students (local, international and external), and consultancy income earned by staff. WA Tourism Commission and *WA Travel Survey* data were used to help estimate living expenses for overseas and interstate students and their visitors.
Region covered by study	The state of Western Australia Population: 1,871,000 in 1999[18]
Student numbers	About 24,500 students and about 2,500 staff
Annual operating budget	$24.3 million for staff costs, non-wage purchases and net capital expenditure
Economic model/s used	To calculate the indirect impacts of the university's activities, the authors used multipliers developed for WA by the Economic Research Centre of the University of Western Australia. The multipliers used were 1.58 for expenditure and 1.73 for employment.
Conclusions reached	Expenditure by students totalled about $63.8 million, international visitors contributed about $5.1 million, and staff contributed about $1.71 million as consultancy income. The total direct contribution of $274.9 million translated to a total direct-plus-indirect contribution of $434.3 million to the state's economy. The university's activities generated 2,364 jobs directly and a further 1,617 jobs indirectly, elsewhere in the economy. The study also analysed the benefits of a university education in terms of extra income over a lifetime, and concluded that 'for every dollar that the government contributes to a student's education, it gets back $1.15 in additional (discounted) tax revenue from the enhanced salaries achieved as a result of a Curtin University education.' The authors noted that 'for every dollar invested in their education, [Curtin University graduates] will receive an additional (discounted) lifetime return of $3.16'. The authors also estimated that, over and above the direct and indirect impacts already mentioned, the university generates a further $65 million in spill-over benefits of its research to industry. The report discusses four methods for making this estimate, and presents a number of illustrative case studies.

[18] <http://www.abs.gov.au/Ausstats/abs@.nsf/0/866b65f503456282ca2569b600016750?OpenDocument> accessed 29 July 2004

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Bonnie VanDorn—Executive Director ASTC
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Regional networks of science centers

ASPAC	Asia–Pacific Network of Science and Technology Centres
ASTC	Association of Science-Technology Centers Incorporated
ASTEN	Australasian Science and Technology Exhibitors' Network
CASC	Canadian Association of Science Centres
ECSITE	European Collaborative for Science, Industry and Technology Exhibitions
ECSITE-UK	The Science and Discovery Centre Network (United Kingdom)
NCSM	National Council of Science Museums (India)
Red-POP	Red de Popularización de la Ciencia y la Tecnología para América Latina y el Caribe
SAASTEC	Southern African Association of Science and Technology Centres

Suppliers of data on the economic activity of science centers

All the respondent institutions
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Sci-Quest, The North Alabama Science Center (Wesley Wright)
The Australian Science Festival (Maryanne Waldren)
Curtin University of Technology (Peter Kenyon)

The project team

Project co-ordinator: Brenton Honeyman

Brenton Honeyman is the Manager of Questacon's Executive Operations. In addition to his roles in coordinating the Centre's involvement in professional networks, international cooperation and evaluation projects, Brenton is the Secretary of the Asia–Pacific Network of Science and Technology Centres (ASPAC), facilitating regional projects between science centers and museums. He continues to play a leading role in several international projects, including a new project to assess personal, societal, economic and policy-development impacts of science centers and museums in APEC economies, and collating information about best practice and innovative approaches across the APEC region.

Project officer: Ilze Groves

Ilze has a background in secondary science teaching followed by 15 years in science center exhibition development in Australia and in the UK; she has specialised in research, content development and writing, as well as project coordination and management. She has also devised and carried out audience research and evaluation projects related to exhibition development, and has developed teacher resource materials to support exhibitions.

Her formal qualifications include a Bachelor of Science degree with first-class honours in chemistry, a postgraduate Diploma in Education, and a Graduate Certificate in Public Sector Management.

She is based in Canberra, and for the last four years has worked, mostly on a freelance basis, on exhibition projects and on other writing and editing tasks. For this project, she was a short-term employee of Questacon.

Project adviser: Dr Brent Ritchie

Dr Ritchie is the Director of the University of Canberra's Centre for Tourism Research, where he is currently carrying out a study of the economic impact of cultural institutions in the Canberra region which may be extended—subject to funding arrangements—to institutions throughout Australia. He has previously carried out economic impact studies for a variety of organisations and events in New Zealand, Australia and the UK. His book *Managing Educational Tourism* was published in the UK in 2003.

His formal qualifications include a Bachelor of Arts in Geography, a Graduate Diploma in Tourism and a PhD in Tourism.

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