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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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

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The project team

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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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