Financial Models of Large-Scale Scientific Instruments and Organizations

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June 11, 2022

Speeding Research on the Information Environment
researchaccelerator.org

Abstract

We analyzed the financial and funding models of 24 large-scale scientific instruments and organizations from diverse fields of study.[1] These included telescopes, space agencies, space missions, observatories, research institutes, and repeated long-running surveys, among others. All observations in our data set were funded in part or whole by either a single country's government or by multiple governments. Other funding sources included universities, foundations, investment incomes, and corporations. Funds were used for instrument development and maintenance, personnel costs and benefits, and administering grants. 46 percent of the instruments and organizations administered grants to researchers that were either project-based or for institution-wide purposes, like setting up research centers. We highlight the National Bureau of Economic Research, National Human Genome Research Institute, Sloan Digital Sky Survey, and American National Election Studies as case studies of diverse funding models. We recommend a potential multi-source funding model that the Institute for Research on the Information Environment (IRIE) could adopt that includes government and foundation funding, an endowment, and institutional buy-in. In addition, we recommend that IRIE explore developing proprietary data and tools to gain and encourage partners and funders.

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[1] The financial and funding models examined are not exhaustive of the models for all instruments. However, the financial models in this study provide *options* for the Institute for Research on the Information Environment to learn from and possibly imitate.

Funding: This research was generously supported by Microsoft, Craig Newmark Philanthropies, the John S. and James L. Knight Foundation, and the William and Flora Hewlett Foundation. This work was initiated as part of a joint project between the Partnership for Countering Influence Operations at the Carnegie Endowment for International Peace and the Empirical Studies of Conflict Project at Princeton University. **Author contributions:** KY collected the data, drafted the manuscript, and co-wrote the report. AW provided oversight over the research process and co-wrote the report. **Data and materials availability:** All data required to evaluate the conclusions are present in the paper or the Supplementary Materials. Additional data related to this paper may be requested from the authors.

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Executive Summary

1. We collected data on 24 large-scale scientific instruments and organizations to understand their financial and funding models. These included space agencies, telescopes, space missions, social science surveys, and research institutions.
2. Data collected on each instrument and organization came from publicly available information on each instrument and organization's website, news articles, and semi-structured email interviews.
3. The field of study, type of work, and organizational size greatly influenced how they allocated their income. Few similarities emerged within our set due to the diversity of instruments and organizations. However, we found three common models:
    - 3.1. Government: We found that government funding was common for instruments and organizations across various fields of study. A government or multiple governments either partly or wholly funded all the organizations studied.
    - 3.2. Institutional buy-in: Here, academic institutions and individuals can buy into the instrument for early data access and contribute to the instrument's construction, management, and operation. Both the Sloan Digital Sky Survey and part of the Dark Energy Spectroscopic Instrument use the institutional buy-in model.
    - 3.3. Blend: Other funding sources included foundations, universities, private corporations, and investments. In addition, half of the instruments and organizations were supported by some combination of government(s), charities, universities, and other funding.
4. We highlight four instruments and organizations as case studies: the National Bureau of Economic Research, National Human Genome Research Institute, Sloan Digital Sky Survey, and American National Election Studies. These were chosen for their varied funding models, scale, and scope of operations and fields of study.
5. Once IRIE's research mandate and scope of operations are decided, a more nuanced financial plan can be confirmed. For now, we propose the following as a potential multi-source funding model for IRIE:
    - 5.1. Secure government funding.
    - 5.2. Develop proprietary data and tools as a value proposition, gaining partners and funders.
    - 5.3. Explore an investment portfolio or endowment as a way of securing income that is less labor-intensive than active fundraising.
    - 5.4. Further research growth pathways and their aligned funding models, including institutional buy-in.

Introduction

In this report, we review financial models[2] of a set of large-scale scientific instruments and organizations in order to help scope the Institute for Research on the Information Environment (IRIE). We examine diverse funding models in order to understand the range of options that have been successfully employed by instruments and organizations in various fields of study. From our data set of funding models, we draw out recommendations for one that could work best for IRIE.

To examine the range of relevant financial and funding models, we collected data on 24 instruments and organizations between March and June 2022. These covered the fields of astrophysics, data sciences, economics, social sciences, and climate sciences. Whenever available, we captured each organization's funding sources, annual revenues and budgets, and the distribution of funds within the instrument or organization.

We found that government funding is important for instruments and organizations across various fields of study. All the observations in our data set were either partly or wholly funded by a government or multiple governments. Other funding sources included foundations, universities, private corporations, and investment incomes. Instruments and organizations used funds to develop instruments, pay personnel costs, or administer internal and external project-based or institutional grants.

In the subsequent sections, we discuss our methodology for data collection, provide an overview of the instruments and organizations in our data set, and highlight trends in the sources and distribution of funding within an instrument and organization. We provide four case studies with varying funding models across fields and highlight key takeaways for creating a potential funding model for IRIE.

Methodology

Instruments and organizations in the data set had to fulfill the following criteria to be included:

1. Measurement carried out by the instrument and organization was sufficiently complex that it was not simply scaling what an individual researcher could do; and
2. Data collection was made available to researchers who did not participate in building it in some processed form; or
3. The organization maintained the instrument's physical and computational infrastructure, which independent researchers could then use.

We wanted to ensure that the instruments and organizations on our list covered a range of fields: astrophysics, social sciences, life sciences, climate sciences, etc. In the case of astrophysics, all the

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[2] We use the terms "financial models" and "funding models" interchangeably in this report.

observations in our data set were chosen through internet searches on the major telescopes, observatories, and space agencies around the world. For non-astrophysics instruments and organizations, we relied on internet searches and team knowledge of the fields. While our data set is not exhaustive, we believe it provides helpful information about the range of common funding models for shared scientific instruments.

The information collected in the data set came from three sources:[3]

1. **Publicly available information on each instrument and organization's website:** We looked at information about the instrument or organization, their funders and budget, grants, annual reports, and press releases.
2. **News articles:** We also relied on news articles about some astrophysics instruments, such as the Sloan Digital Sky Survey (SDSS) and Dark Energy Spectroscopic Instrument (DESI).
3. **Outreach and interviews:** We contacted administrative teams and researchers at different instruments and organizations to gather more information about funding models.

Overview of Instruments and Organizations

The data set had two types of observations: instruments and organizations. The wide range of instruments studied included telescopes, space missions, observatories, and surveys. Some organizations hosted instruments; for instance, we include both the organization (space agencies) and an example of an instrument (space mission or telescope) for NASA, the Indian Space Research Organization, and the European Space Agency. We collected information on both organizations and instruments to obtain a broad spectrum of funding models.

Most of the organizations and instruments in the data set were located in the United States (62.5 percent). The rest were in Europe, North America, and Asia. 62.5 percent of the instruments and organizations were from the fields of astrophysics and astronomy. Others were a combination of social science, data science, climate science, and life sciences. Table A1 in the appendix lists the instruments and organizations in our data set, with the corresponding country and field of study they belong to.

Sources of Funding

Each instrument and organization in our data set was either partially or wholly funded by a government or multiple governments. Instruments and organizations that were funded by a single country's government were either funded by one or multiple government agencies or departments. Nearly 71 percent of the instruments and organizations were funded by a single country's government;

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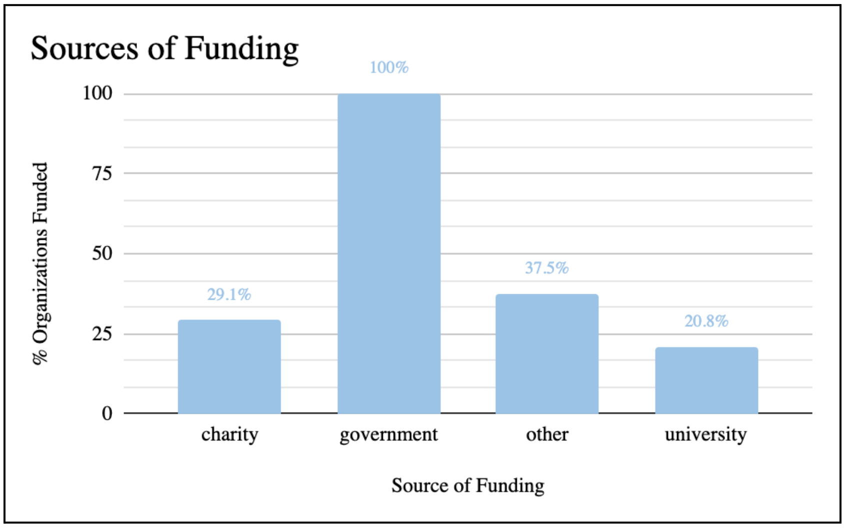
[3] At times, we were unable to find information on some of the instruments and organizations. In those cases, cells have been left blank in the data set. Instead of dropping those observations from the data set, we chose to keep them, as the lack of available information is itself informative. It highlights the difficulty of finding information on how large-scale scientific instruments are funded, given that this information is often sensitive and not publicly available.

the remaining 29 percent were funded by multiple countries. Moreover, 33 percent of all of the instruments and organizations were exclusively funded by a single government.

Other funding sources included charities or foundations, universities, investment incomes, industry contributions, and private contracts. Figure 1 breaks down what percentage of instruments and organizations in our data set were funded by each source. Half of the instruments and organizations were funded by various sources–some combination of government(s), charities, universities, and other funding.

Figure 1: Sources of Funding for Instruments and Organizations



Note: An instrument or organization can have multiple funding sources, so the percentages do not add up to 100 percent.

Investment income is a promising route for IRIE, as it creates a revenue stream that does not require additional fundraising efforts This could take the form of a raised endowment or a smaller investment portfolio based on savings. All investments are subject to market movement, however, and would require either internal or outsourced management. The organizations studied here vary in their investment approaches. The Carnegie Observatories was founded in 1904 with a $22 million endowment; in FY19-20, 68% of its funding still came through this endowment. Conversely, the National Opinion Research Center (NORC) at the University of Chicago did not appear to have an endowment based on publicly available information, but in 2020 had an approximately $30 million investment portfolio and an annual net investment return of about $3.8 million. The National Bureau of Economic Research (NBER) had an investment portfolio but did not list any investment-focused staff or job openings on its website, and so likely outsourced fund allocation.

Institutional buy-in is another interesting funding model found primarily in astrophysics instruments and organizations. Academic institutions and individual researchers can buy into the instrument in exchange for early access to data and contribution to the instrument's construction, management, and operation. The Sloan Digital Sky Survey (SDSSS) relied heavily on funds raised from the institutional buy-in model. Part of the Dark Energy Spectroscopic Instrument's (DESI) funding also came from institutional buy-in. We elaborate on this model in our case studies section.

Distribution of Funding

How instruments and organizations chose to distribute the funds they receive varied significantly across the observations in our data set. The field of study, organizational size, and stage of development seemed to shape these decisions. For the astrophysics instruments examined, a significant portion of funds was used to construct, develop, maintain, and operate the instruments themselves. This included the costs associated with personnel to maintain and operate the instrument. For social science instruments, such as surveys, funds were primarily used for data collection. For research institutions, such as NBER and the National Human Genome Research Institute (NHGRI), most funds were given out as project grants or to cover personnel costs. Approximately 46 percent of the organizations and instruments in our data administered grants to researchers. These grants were either project-based or for institutional purposes.

Out of the twelve organizations with publicly available budgets, seven showed that the largest percentage was spent on their tool or instrument. Three listed personnel costs as part of their budgets, and one each listed grants and research. Table 1 lists the mean rank order of funding allocation for all expenditure categories.

Table 1: Mean Rank Order of Spending

Expenditure Category	Rank Order
Tool	1
Personnel	1
Communications	2
Data Management	2
Dissemination	2
Grants	2.25
Research	2.6
Operations	3
General Infrastructure	3.2
Training	4

For example, as stated above, seven instruments listed their tool or instrument as the number one most expensive category; five did not list the tool/instrument, and so the mean is one.

Using the Instrument

Researchers used instruments and organizations in three ways:

1. **Project-based grants**: Researchers were expected to propose a research project and received grants from instruments and organizations to carry out their proposed research.
2. **Institutional grants**: Organizations sometimes offered grants to develop institutions and research centers. This sort of funding was usually offered by larger organizations, not instruments, with bigger budgets. For instance, NHGRI dedicated 1 percent of its annual funding to setting up research centers.
3. **Self-funded use**: Some instruments and organizations expected researchers to arrange their own funding to use the instrument or data offered by the organization. Only two organizations in our data set fell into this category. For instance, NOIRLab's Cerro Tololo Observatory offered full funding support for doctoral students using the observatory for thesis research, but visiting researchers were required to pay to use the observatory with their own funds.[4]

Most instruments and organizations in our data set didn't require researchers to fund themselves because, in most cases, they were not using restricted data; additionally, researchers were applying for grants to carry out research that aligned broadly with the mission of the organization or fell within one of its programs or projects.[5] We did not include instruments that used institutional buy-in, such as SDSS or DESI, in the self-funded category. Institutional buy-in allowed for more than just early access to data that was eventually made publicly available; it allowed organizations to help plan the surveys and contribute to the development and management of the instrument from start to finish.

Analysis of Fit

In our data set, the funding was shaped by the mandate and scope of the instrument or organization. For instance, funding sources for DESI came largely from the United States Department of Energy. In contrast, an instrument like the James Webb Telescope required multiple national space agencies, private corporations, universities, and research institutes to contribute to its funding and development. Similarly, the ways in which instruments and organizations administered grants also depended on the research question or project proposed by a researcher. Some projects, like the Human Genome Project, required multiple researchers to contribute to different aspects of the project; thus, grants were given out over a span of multiple years to multiple researchers. Other projects, such as those at the NBER, could be aimed at answering a specific research question; their grants thus tended to focus on a single data set or question being analyzed by a single researcher or a team.

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[4] "Visiting Astronomer's Travel Guide". *NOIRLab*. https://noirlab.edu/science/observing-noirlab/observing-ctio/cerro-tololo/visiting-astronomers-travel-guide.

[5] For access models to restricted data sets hosted by government agencies, refer to PE1; Reynolds, Jen Rosiere, Aditi Bawa, and Kamya Yadav. "Researcher Access to Restricted Government Data". *Carnegie Endowment for International Peace* (2 June 2022). https://drive.google.com/file/d/10dK79PbSWG5hrrgCvcsXfWeaiKxY7vZP/view?usp=sharing

Case Studies

A. *National Bureau of Economic Research (NBER)*

The National Bureau of Economic Research (NBER) was founded in 1920 and carries out economic research through its 20 research programs. We found that the NBER received funding from various sources, including government agencies, private foundations, corporations, individual contributions, and its investment portfolio. The National Institute of Health, the National Science Foundation, the Social Security Administration, and the Alfred P. Sloan Foundation currently contribute the largest funds to NBER-based research projects. Historically, foundations (including the Rockefeller Foundation, Ford Foundation, and others) have played a key role in funding NBER and its research programs.[6]

While NBER raised funds itself to conduct economic research and administer grants, it mostly acted as a facilitator for faculty to prepare grant applications and administer research projects. Faculty members who became research affiliates could apply for grants through NBER, which often has lower overhead costs than their home academic institutions, especially when the research requires minimal support staff and equipment.[7] In addition, NBER provided infrastructural support to its research affiliates. The NBER maintained an Institutional Review Board for projects involving human subjects,[8] provided data management infrastructure and computational support for grant-related research projects, and encouraged the dissemination of project-related research findings through the NBER working paper series.[9] NBER promoted economic research by offering its affiliates research support through grants funded by the government and corporate sponsors, convening research projects, publishing books, and hosting archives of data sets.[10]

For the fiscal year 2019-2020, NBER received $42.7 million in funding, of which $30.6 million came from contributions and grants (71.6 percent); $10 million from investment income (23.4 percent); and

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[6] Rutherford, Malcolm. "'Who's Afraid of Arthur Burns?' The NBER and the Foundations". *Journal of the History of Economic Thought* (11 June 2009). https://www.cambridge.org/core/journals/journal-of-the-history-of-economic-thought/article/abs/whos-afraid-of-arthur-burns-the-nber-and-the-foundations/A42C12E19540627A822CF7896B30986A

[7] Interview with an NBER Research Affiliate.

[8] "Human Subjects Protection and Institutional Review Board". *National Bureau of Economic Research (NBER)* (21 January 2019). https://www.nber.org/programs-projects/projects-and-centers/human-subjects-protection-and-institutional-review-board-irb

[9] "Projects & Centers". *National Bureau of Economic Research (NBER)* (2022). https://www.nber.org/programs-projects/projects-and-centers?page=1&perPage=50

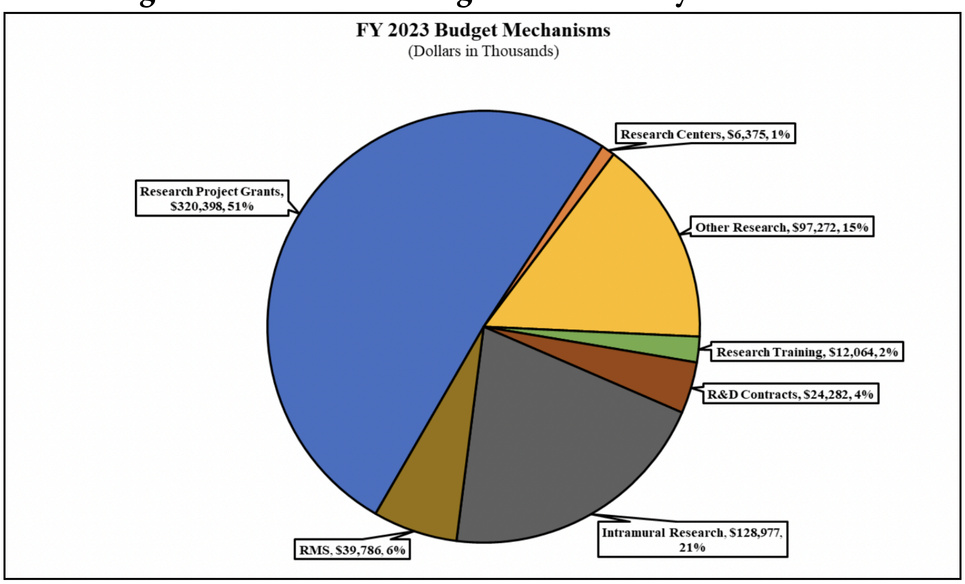
[10] Research affiliates are chosen after a call for nominations and a competitive process each year. Tenured faculty are appointed as Research Associates and untenured faculty are appointed as Faculty Research Fellows.

the rest from program service revenue, which includes subscriptions and publications (4.9 percent).[11] Of the $30.6 million in contributions and grants, $24.3 million were government grants. For the same year, NBER's total expenses amounted to $36.53 million. $2.16 million was spent on grants for research (5.9 percent); $17.19 million was spent on personnel expenses, such as wages, pensions, employee benefits, etc. (47 percent); the remaining $17.18 million was spent on expenses such as travel, occupancy, conferences, subcontracts, etc. (47 percent).[12]

B. National Human Genome Research Institute (NHGRI)

The National Human Genome Research Institute (NHGRI) is one of the many institutes associated with the National Institutes of Health (NIH). It was established in 1989 as NIH's contribution to the International Human Genome Project (HGP). NHGRI is entirely funded by the United States Government. Each year, NIH's president presents its budget to various House and Senate committees and subcommittees, including those on Health and Human Services, Labor, and Education.[13] Subsequently, representatives of the NHGRI and other NIH institutes testify in front of the subcommittees, and the House, Senate, and president have to approve its budget. Initially, NHGRI determined how to spend its funds based on five-year plans. These five-year plans were replaced by mission and vision statements, which are released periodically; the last one was released in 2018.

Figure 2: NHGRI Funding Distribution by Mechanism



Source: National Human Genome Research Institute

[11] "Form 990 for period ending June 2020". *ProPublica* (24 February 2021). https://projects.propublica.org/nonprofits/display_990/131641075/04_2021_prefixes_06-13%2F131641075_202006_990_2021041317937351

[12] Ibid.

[13] "Budget and Financial Information". *Department of Health and Human Services National Human Genome Research Institute (NIH)* (29 March 2022). https://www.genome.gov/about-nhgri/Budget-Financial-Information

For the fiscal year 2023, the NHGRI requested $629 million.[14] Figure 2 shows how the requested funds will be distributed within the organization. More than half of the funds will be spent on research project grants. Grants will be offered to programs and projects that conducted research in one of the six domains supported by NHGRI–bioinformatics and computational biology; biology of disease; structure and biology of genomes; science and effectiveness of medicine; ethical, legal, and social implications; and the NIH common fund. Through a number of programs and projects falling under each of these domains, NHGRI gave out funding to researchers. The Human Genome Project was one such project. Proposed in 1990 and completed in 2003, the entire project cost $2.7 billion. In fiscal year 2023, NHGRI will support 414 research project grants, amounting to $320.4 million.[15]

NHGRI's budget also offered to fund the construction of research centers ($6.4 million) and institutional and individual funding for research training at the undergraduate, post-baccalaureate, graduate, postdoctoral, and faculty levels ($12 million). Personnel costs were included within the categories shown in figure 2. NHGRI spends $126.4 million on personnel costs and benefits (20 percent of its total budget).[16]

C. Sloan Digital Sky Survey-IV and V (SDSS-IV and V)

The Sloan Digital Sky Survey (SDSS) creates three-dimensional maps of the universe. It started regular survey operations in 2000, after a decade of construction and planning. It has evolved through four phases and is currently in its fifth phase, SDSS-V. Funding for SDSS has come from three sources–the United States Department of Energy Office of Science, the Alfred P. Sloan Foundation, and member institutions. A member of SDSS told us that since its inception, the Sloan Foundation has provided 25 percent of SDSS' funding, the Department of Energy has provided between 5 and 25 percent, and member institutions have provided the rest. Since SDSS' main purpose is to run its surveys, the funding received covers all the costs related to each survey phase –including construction and management of the instrument, personnel costs associated with the same, etc.

The funding paid for project infrastructure and operations, including the construction of astronomical instruments, writing software, planning and conducting observations, cleaning the data collected, and releasing the data to the public. These operations included personnel costs. SDSS subcontracted well-defined deliverables to member institutions; these deliverables had to conform to the overall project plan. SDSS did not offer grants to researchers to write papers or pursue research

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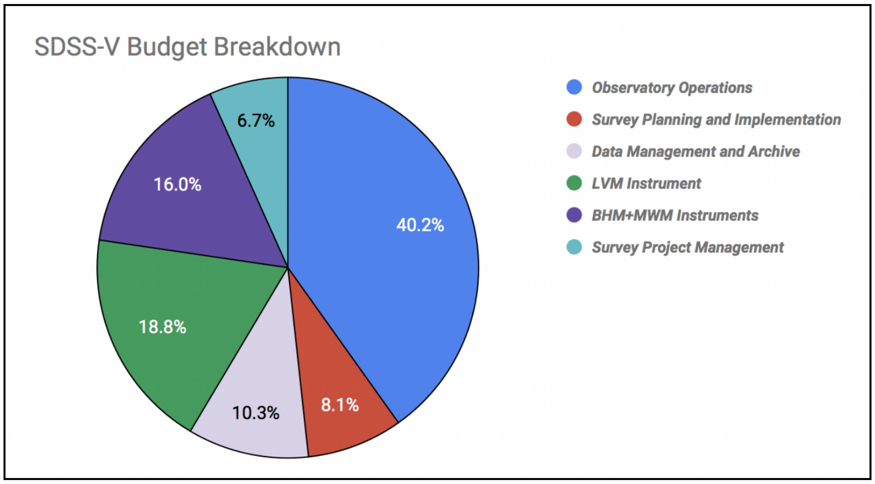
[14] "NHGRI Congressional Justification FY 2023". *Department of Health and Human Services National Human Genome Research Institute (NIH)* (2022).
https://www.genome.gov/sites/default/files/media/files/2022-03/NHGRIFY2023-Congressional-Justification.pdf

[15] Ibid.

[16] Ibid.

projects based on SDSS data. SDSS-V is meant to cost $60 million, of which $16 million is provided by the Sloan Foundation.[17] Figure 3 breaks down the budget for SDSS-V.[18]

Figure 3: SDSS-V Budget



Source: Sloan Digital Sky Survey

SDSS presented an interesting funding model. The combination of government and foundation grants and institutional buy-in made for a steady funding stream. Institutional buy-in meant that academic institutions and individual researchers paid a certain amount of money over a fixed number of years to become members of SDSS. This allowed members to gain early access to the data collected by the survey and contribute to the planning of the survey, construction and maintenance of the instruments, and the data collection effort.[19] Membership was tiered, with each tier carrying different costs and providing differential benefits:[20]

1. **Full membership** included proprietary data rights for an unlimited number of participants from the institution. These participants may sponsor an unlimited number of postdocs or other short-term staff from the institution, as well as an unlimited number of graduate and undergraduate students enrolled at the institution. This required a total contribution of $1.15 million per institution.

[17] Dorminey, Bruce. "Next Generation Of The Sloan Digital Sky Survey To See First Light In 2020". *Forbes* (21 November 2017).
https://www.forbes.com/sites/brucedorminey/2017/11/21/next-generation-of-the-sloan-digital-sky-survey-to-see-first-light-in-2020/?sh=7a0f480b7477

[18] "SDSS and the Astro2020 Decadal Survey". *Sloan Digital Sky Survey (SDSS)* (2020).
https://www.sdss.org/future/astro2020/

[19] This data is eventually made available to the public for use.

[20] "Procedures for obtaining membership in SDSS-V". *Sloan Digital Sky Survey-V (SDSS-V)* (15 May 2017).
https://www.sdss.org/wp-content/uploads/2017/11/sdss5-joining-2017-05-15-a.pdf; Specific details on membership can be found in detail in this document.

2. **Associate Institutional Membership** included proprietary data rights for a specified number of slots. The cost-per-slot model was one-fifth of a full membership cost–i.e., $230K. Typically a slot would cover one Participant and one postdoctoral researcher, but this could be negotiated in specific cases.
3. Associate Institutional Members could associate themselves together into **Participation Groups** (PGs) with the approval of the Director and the Steering Committee (or Advisory Committee (AC) when it was formed). Memoranda of Understanding would be signed independently with each institution. The designation of a PG with three or more slots total would allow the PG as a whole to have a single vote on the AC.

Because of the collaborative nature of SDSS, the instrument also has innovative authorship policies. SDSS' publication policy states that the architects of the survey were to be credited alongside researchers and scientists analyzing the survey data.[21] For collaborative instruments, crediting architects of the engineering structure along with those analyzing the data offered more inclusive authorship.

D. American National Election Studies (ANES)

The American National Election Studies (ANES) was set up in 1977 through grants by the National Science Foundation (NSF). For twenty-five years prior to this, the University of Michigan had carried out a series of election studies, covering every midterm and presidential election between 1952 and 1977. However, limited funding prevented the improvement of survey designs and instruments and the involvement of the broader research community. Funding by the NSF helped overcome these limitations. NSF grants had a twofold purpose–to generate and collect data and improve the core concepts and instrumentation used in the surveys. Since 1977, NSF has supported ANES' data collection around presidential and midterm elections through competitive grants offered every four years. Between 1977 and 2005, NSF made grants to the University of Michigan to carry out the surveys. Since 2005, ANES has operated under coordinated grants made to the University of Michigan and Stanford University. The most recent grant solicitation by NSF offered two awards up to $14 million for developing the 2024 ANES survey.[22] Administratively, their leadership team were full-time university employees; the survey was organized more like a research project or program within a university than an independent center or institution.

While ANES did not offer grants to researchers or other institutions, it competitively solicited contracts for data collection from vendors that were capable and experienced in similar designs and selected a partner for each data collection effort within the survey, taking into consideration quality and cost.[23]

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[21] "Publication Policy". *Sloan Digital Sky Survey-V (SDSS-V)* (2022). https://www.sdss5.org/collaboration/publication-policy/

[22] Plimpton, Suzanne H. "2024 American National Election Studies Competition". *National Science Foundation (NSF)* (14 July 2021). https://www.nsf.gov/pubs/2021/nsf21601/nsf21601.htm

[23] Interview with ANES member.

Recommendations

Based on our review of financial models at these large-scale scientific instruments across various fields of study, we highlight the following takeaways from the report:

1. **Government funding**: Every instrument and organization in our data set was funded by a government or multiple governments, either in part or whole. Therefore, we recommend that IRIE investigates funding from government grants, including the National Science Foundation, which funds other social science research organizations and instruments (such as ANES and NBER).
2. **Proprietary data**: The organizations and instruments in our data set are valuable because of the data they offer. Proprietary data and early access, such as at SDSS or DESI, make an institutional buy-in model attractive to universities and researchers. We recommend that IRIE explores proprietary data and tooling access models–and marketed as such–when soliciting funding for the organization.
3. **Investments**: An investment portfolio or endowment would provide a revenue stream that does not need fundraising but would be subject to market movement and require internal or outsourced management. We recommend additional research on tax implications and other potential limitations of investments.
4. **Early Institutional Buy-In:** The institutional buy-in model could be useful in the early stages of setting up IRIE's infrastructure. This could be especially helpful when combined with an inclusive authorship policy, like at SDSS. This option highlights a knowledge gap on development pathways and their according funding needs that should be explored in future work. A source we interviewed at DESI explained that in their first phase, most of the funds were used to develop the instrument, while in the second, most of the funds were spent on personnel costs (those who maintain and run the instrument and telescopes). We currently do not have other models against which to compare this growth path to sustainability.

Appendix

A.1 Overview of Instruments and Organizations

Table A1: Overview of Instruments and Organizations

Instrument/Organization	Host Country	Field of Study
CERN: European Organization for Nuclear Research	Switzerland	Astrophysics, nuclear physics
National Aeronautics and Space Administration	United States	Astrophysics
National Aeronautics and Space Administration: James Webb Telescope	United States	Astrophysics
Instituto de Astrofisica de Canarias	Spain	Astrophysics
Center for Machine Learning and Intelligent Systems at UC Irvine	United States	Data science
Indian Space Research Organization	India	Astrophysics
Indian Space Research Organization: Mangalyaan Mission	India	Astrophysics
National Bureau of Economic Research	United States	Social science
Atacama Large Millimeter/submillimeter Array Observatory (ALMA)	Chile	Astrophysics
Secure Access Data Center (CASD)	France	Data science
European Space Agency	France	Astrophysics

European Space Agency: Gaia	France	Astrophysics
European Southern Observatory	Germany	Astrophysics
National Human Genome Research Institute	United States	Life sciences
NOIRLab	United States, Chile	Astrophysics
Sloan Digital Sky Survey IV and V (SDSS-IV, SDSS-V)	United States	Astrophysics
The Carnegie Observatories	United States, Chile	Astrophysics
Dark Energy Spectroscopic Instrument (DESI)	United States	Astrophysics
Laboratory for Analytic Sciences, NC State	United States	Data science
Event Horizon Telescope	France, Spain, Greeland, Chile, United States, Mexico	Astrophysics
National Weather Service	United States	Climate science
American National Election Studies	United States	Social science
National Longitudinal Study of Adolescent to Adult Health	United States	Social science
National Opinion Research Center	United States	Social science

A.2 Codebook

Variable	Description
id	row identification number
institution	name of the institution
instruments	list of the prominent large-scale instruments at the institution
location	location of the institution
funding	list all the sources of funding: government, charity (includes foundations), university, or other
primary_source_of_funding	what is the primary source of funding?
sources_of_funding	names or categories of publicly available funders for the institution
distribution_of_funds	how are funds distributed within the institution?
instrument_costs	what the costs associated with the instruments listed in column three?
funding_purpose	list the purposes for which the organization provides funding: institution-wide (for setting up institutes, research centers, etc.); project-based; unrestricted (funding is offered as a gift)
self_funded	do those who wish to use the instruments at the institution have to raise funds themselves?
notes	additional notes on the institution or instruments or their funding models
source	link to the source of information

A.3 Data

[RA2: Financial Models of Large-Scale Scientific Instruments]