



ECONOMIC ANALYSES OF FEDERAL SCIENTIFIC COLLECTIONS

*METHODS FOR DOCUMENTING
COSTS AND BENEFITS*

DAVID E. SCHINDEL
and the Economic Study Group
of the Interagency Working Group
on Scientific Collections



An Advisory Report to the U.S. Federal Interagency Working Group on Scientific Collections

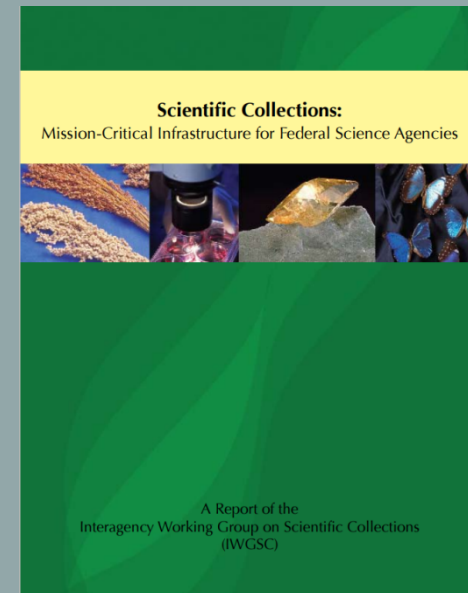
Economic Study Group Report

- An advisory report to the U.S. Federal government's Interagency Working Group on Scientific Collections (IWGSC)
- Reflects input from scientists, economists, collections professionals, program policy specialists
- Considers many scientific disciplines and types of object-based scientific collections
- Describes methods for projecting costs and documenting benefits of long-term “institutional collections”
- Discusses cost recovery through user fees
- Addresses implications for evidence-based management and policies

Analyzing the Costs of Collections

Responds to recommendations in IWGSC 2009 report:

- 1. The IWGSC recommends that agencies with scientific collections work as necessary to support their missions to develop realistic cost projections for collection maintenance and operation, and work to incorporate the needed support as stable budget elements.*



Fulfills requirement of America COMPETES Reauthorization Act of 2010:

- (d) Cost Projections - The Office of Science and Technology Policy, in consultation with relevant Federal agencies, shall develop a common set of methodologies to be used by Federal agencies for the assessment and projection of costs associated with the management and preservation of their scientific collections.*

Assumptions and Definitions

The Report assumes:

- Costs of collections means benefits minus operating and opportunity costs
- Agency missions include programmatic goals as well as legislative and regulatory mandates

Project collections are created for a specific project or goal, and are managed and used by that project

Institutional collections are preserved long-term and managed by collections professionals for future use

Non-renewable collections have unique objects that cannot be replaced; destructive sampling is a management issue

Renewable collections have objects that can be sampled destructively because replacements can be grown or manufactured

Operating Costs

- Institutional collections can offer some or all of six general services.
- Per unit costs of operating collections vary by:
 - the number and amount of services provided,
 - the size and type of collection/preservation,
 - geographic location, and
 - agency budgeting method.
- Operating costs vary among collections based on how many they provide and to what extent.
- The list of standard services provides a framework for (re)constructing operating budgets.

Six Services Provided

1. ***Accessioning*** material into collection
2. ***Preserving*** and maintaining contents
3. ***Documenting*** holdings and disseminating information
4. ***Providing access*** to qualified users
5. ***Data curation*** (error correction, adding metadata, linkage to publications and online data)
6. ***Education and outreach*** to increase public understanding

Five Methods for Estimating Benefits

- 1. Technology/Knowledge transfer (“Value chains”)**
 - USDA National Plant Germplasm, ARS Culture Collection, CDC National Health and Nutrition Survey
- 2. Success Stories (“Winning lottery tickets”)**
 - Yellowstone National Park microbes and biotechnology
- 3. Option Value (“Insurance policies”)**
 - FDA Foodborne Bacteria Collections
- 4. Value added by users (“Co-investment”)**
 - USGS Core Research Center
- 5. Counter-factual Scenarios (“It’s a Wonderful Life”)**
 - Reference collections for USDA/APHIS border inspections and NIST Standard Reference Materials

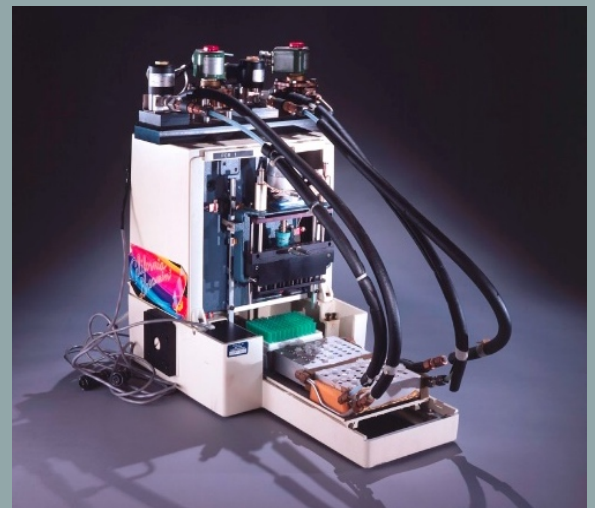
Approach 1. Tech/Knowledge Transfer

- **“Value chain”**: Something from a collection provides a starting point in wealth generation
 - Drug development
 - Bio-inspired design
- Collections are only one part of R&D value chain; how to partition benefits among parts?
- Hard to document process due to delays, multiple components in value chain
- **USDA Tech Transfer Reports**:
 - National Plant Germplasm System, used for plant breeding
 - Culture Collection: Microbes with industrial users
- **NHANES national health survey samples and data**
 - Serum, plasma and urine samples collected with health exams
 - Analyzed to establish statistical distributions of diseases
 - NHANES data used to calibrate “normal range” for new diagnostics



Approach 2. Success Stories

- **“Winning lottery ticket”**: Rare events in which collections play a pivotal role, often in unanticipated ways
- Enormous (but hard to calculate) socioeconomic impact
 - Biomedical and wildlife collections that help predict epidemics
 - Collections of agricultural pests that help prevent crop failure
- Impossible to predict occurrence or anticipated economic benefits
- Often doesn't reflect the normal, everyday activity of collections
- Impact of collections may be indirect, delayed, hard to trace causality



Approach 3. Option Value

- **“Insurance Policies”**: Anticipating and preparing for future emergencies
- Forward-looking counterpart to Success Stories. Data on the costs of past emergencies provide range of potential emergencies
- Requires that collections can demonstrate potential to avoid or mitigate the emergencies
- **USDA National Plant Germplasm System**
 - Collects, preserves, characterizes crop varieties and their relatives
 - Evaluates and develops and accessions for developing new food crops
 - Maintains seedbanks to re-establish farming after famine events
- **HHS/FDA Foodborne Pathogen collection**
 - Used for developing methods for detection of naturally occurring pathogens in seafood
 - State health agencies responsible for response to disease outbreaks use FDA’s samples to identify sources of outbreaks



Approach 4. Value Added by Users

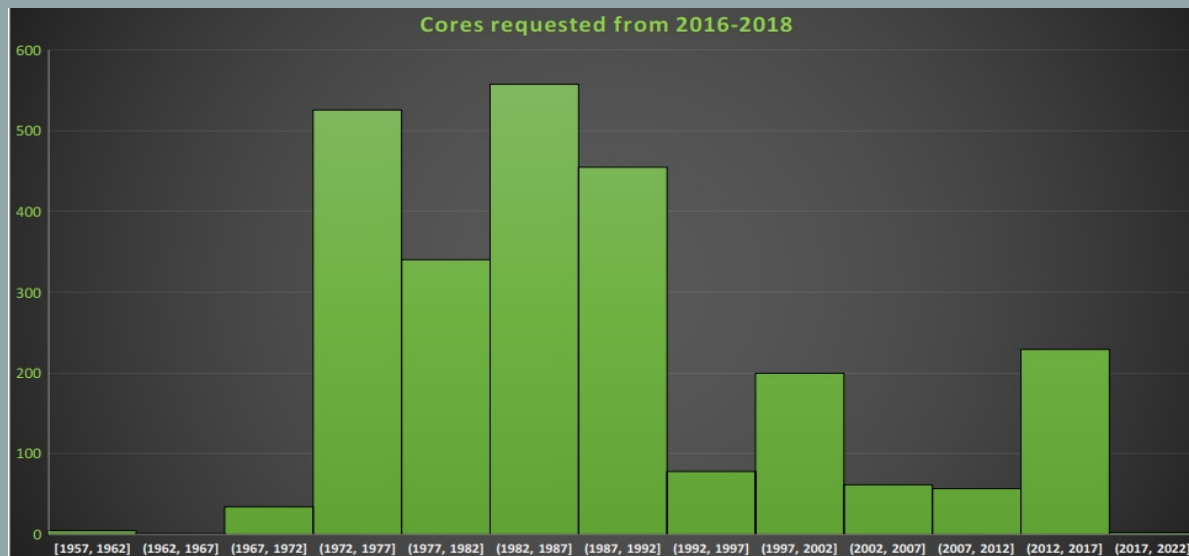
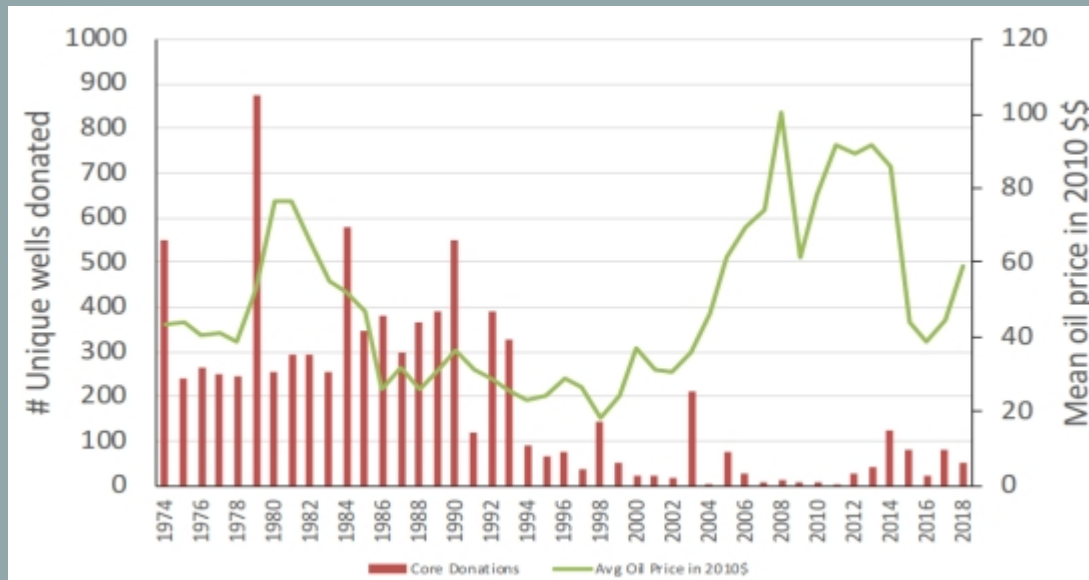
- **“Co-Investment”** by users makes the collection more valuable
- Results in greater: reliability; discoverability; diversity and volume of uses; cost of replacement through:
 - Data curation by users is an unpaid service
 - Analytical data and research publications linked to collection record
 - Preparations returned to collection (e.g., rock thin sections, DNA extracts)
- **USGS Core Research Center**
 - Rock cores from intramural research and donated by companies
 - No user fees, but users must provide analytical data, thin sections produced, publications within time limit
- **CDC NHANES** curates analytical results from users



Does User Interest Decline Over Time?

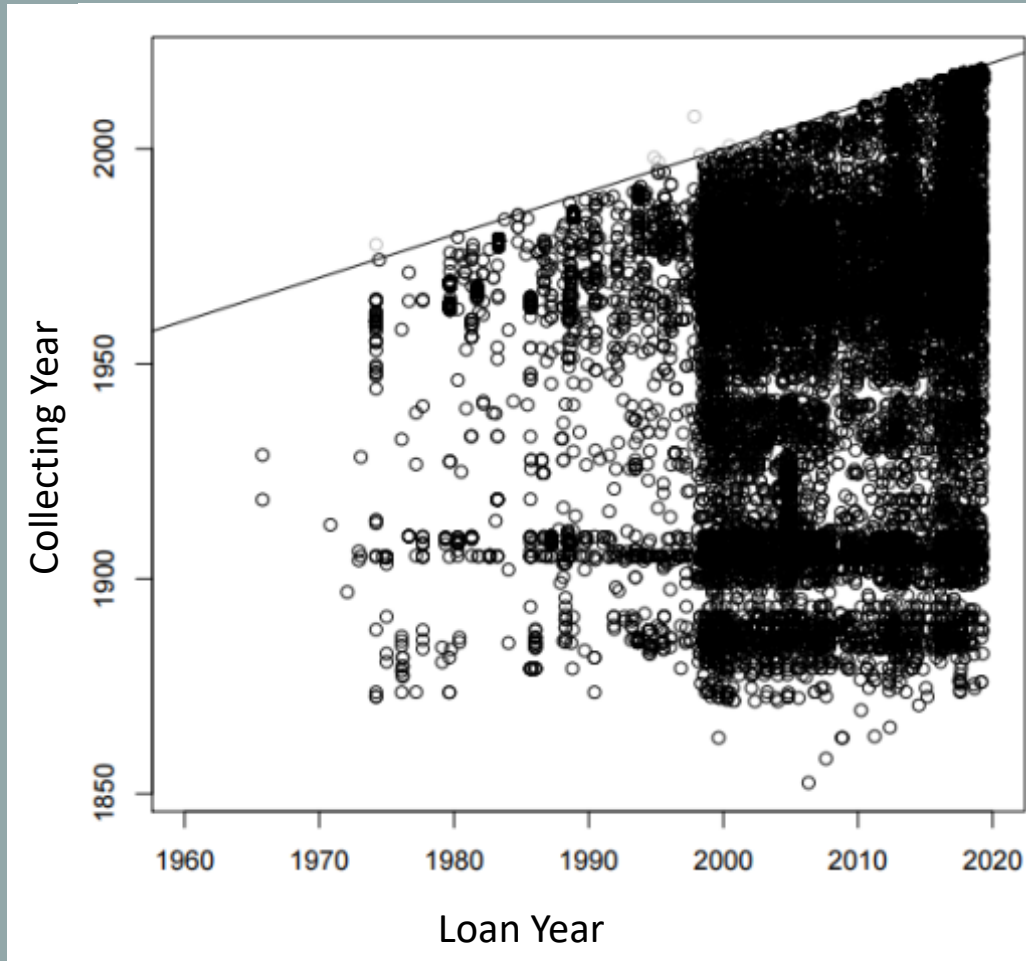
- Compared distributions of accession dates and user access requests
- Datasets from:
 - USGS Core Research Center
 - Smithsonian National Museum of Natural History
- **Patterns indicate that objects retain user interest over time**

User Requests versus Accession Dates



Source:
Lindsay Powers,
US Geological
Survey

Users Requests versus Collection Dates



Data from National Museum of Natural History
Invertebrate Zoology Department

Approach 5. Counter-factual Scenarios

■ “It’s a Wonderful Life”

- What would users do if a collection didn’t exist?
- What would users be willing to pay to have it?



■ NIST Standard Reference Materials

- Enables companies to meet regulatory standards
- Survey of users’ estimates of cost and delay to create or find an alternative
- Paperwork Reduction Act limits sample size, reliability of results

■ USDA Plant Protection and Quarantine

- Reference collections used for border inspection of plant imports for pests, invasive species
- Of imports with insects, fungi, etc., which are safe or can be treated?
- Calculate value of all imports in which benign or treatable insects, fungi, etc. were found



Methods Summary

Method	Principal Advantages	Principal Disadvantages
Technology/ Knowledge Transfer	<ul style="list-style-type: none"> Based on tangible outcomes, often monetary Usually connected to normal collections-based work Can be expressed in quantitative terms (e.g., benefit-cost ratios) 	<ul style="list-style-type: none"> Difficult to connect use of collection to ultimate outcome (delays, other contributors to process) Sometimes serendipitous
Success Stories	<ul style="list-style-type: none"> Can be dramatic, high value Easily understood 	<ul style="list-style-type: none"> Based on rare events that can't be predicted Can be serendipitous and unrelated to normal collections-based work
Option Value	<ul style="list-style-type: none"> Can be dramatic, high value Connects to historical events, easily understood 	<ul style="list-style-type: none"> Based on probability of future use, not past performance
Value Added by Users	<ul style="list-style-type: none"> Based on normal collection activities Highlights patterns of collection use Can be expressed in quantitative terms (e.g., rates of return) 	<ul style="list-style-type: none"> Requires cooperation of users Requires data curation Uses narrow definition of "value" (i.e., value to users, not others)
Counter- factual Scenarios	<ul style="list-style-type: none"> Highlights unique role of collections Based on customer feedback and/or performance data Can be expressed in quantitative terms (e.g., rates of return) 	<ul style="list-style-type: none"> Customer surveys can be expensive, labor-intensive Limitations on federal surveys (Paperwork Reduction Act) Distrust of survey results

Findings and Recommendations (1 of 2)

- The services offered by a collection determine the benefits generated, such as:
 - Preserving and maintaining objects extends their useful life
 - Providing user access and data curation expand the pool of potential users
 - Education and Outreach increases awareness, appreciation, and public support
- Accessioning and preserving compete with other services for resources

Findings and Recommendations (2 of 2)

- Agencies have a choice of several methods for estimating and documenting benefits generated by their collections
 - Approaches to documenting benefits should reflect agency/collection mission
 - Choice of methods should also consider cost and effort, delays, assumptions and preferences of the primary audience of stakeholders
 - How do stakeholders view: Surveys vs. program data? Qualitative vs. quantitative evidence? Retrospective vs. prospective impact?
 - Counterfactual Scenarios can rely on user surveys but their use by Federal collections may be limited by Paperwork Reduction Act
- The framework of interlocking services, costs, and benefits can facilitate evidence-based decisions about:
 - Providing services that will help to generate the kinds of benefits sought by the collection
 - Balancing investments in different services to maximize anticipated benefits

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Additional information available at

<https://iwgsc.nal.usda.gov>

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