Evaluation, Assessment, and Accountability of Public Data Open Sharing: Values, Objective Selection, and Security Considerations

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Abstract

This paper discusses the evaluation and assessment mechanisms for public data open sharing, accountability systems, and the value orientation and objective selection in public data open utilization. Public data open utilization necessitates comprehensive consideration of rights and interests across different relational hierarchies and the requirements of data management policies, enhanced technological research and development and application, and assurance of the security and reliability of public data, thereby promoting the common advancement of scientific research and social development. The value orientation and objective selection in public data open utilization require comprehensive consideration of various factors, including data collection, storage, processing, sharing, utilization, and management. Through the formulation of rational policies and standards, public data open sharing and utilization can be further strengthened, fostering the common advancement of scientific research and social development. The value orientation and objective selection of public data open utilization constitute an important instrument for promoting scientific research and social development. Through enhanced policy formulation and technological research and development, the security and reliability of public data can be improved, propelling the progress of scientific research and social development. Data security also represents a critical issue requiring focused attention in the process of public data open utilization. Data discovery, reuse, and identification likewise constitute important objectives of public data open utilization. Through the formulation of rational policies and standards that promote data sharing and utilization, data visibility and accessibility can be enhanced, driving the progress of scientific research and social development.

Full Text

Evaluation, Assessment, and Accountability for Open Sharing of Public Data: Value, Goal Selection, and Security Considerations

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Abstract

This article discusses the evaluation and assessment mechanisms, accountability systems, and the value and goal selection processes for public data open sharing. The open utilization of public data requires comprehensive consideration of rights and interests across different stakeholder levels and the requirements of data management policies. It necessitates strengthening technological research and application to ensure the security and reliability of public data while promoting mutual progress in scientific research and social development. The value and goal selection for public data utilization must integrate multiple factors, including data collection, storage, processing, sharing, utilization, and management. Through the formulation of reasonable policies and standards, public data open sharing and utilization can be enhanced, thereby advancing scientific research and social development. Data security represents a critical concern throughout this process, as do data discovery, reuse, and identification. By establishing appropriate policies and norms that promote data sharing and utilization, data visibility and accessibility can be improved, further driving scientific progress and social development.

Keywords: public data; open sharing; evaluation and assessment; accountability; value and goal selection

1. Evaluation and Assessment Mechanisms for Public Data Open Sharing

The value and goal selection for public data open utilization must account for rights and interests across different stakeholder levels, including research funding agencies, educational institutions, researchers, and subject librarians. Each stakeholder group imposes relevant policy restrictions or requirements on research data management to ensure data accuracy and reliability while promoting mutual advancement in scientific research and social development.

At the international scientific data center level, auditing data sources serves as a crucial means of ensuring data quality. Simultaneously, evaluation and assessment systems for scientific data management and open sharing within institutions and research ecosystems require improvement to enhance data cred-

ibility. Research funding agencies, as primary sponsors of scientific projects, are increasingly willing to promote open sharing of research data to strengthen their credibility within the scientific community. Consequently, many funding agencies have established research data management requirements for funded projects to ensure standardization and normalization, such as the U.S. National Science Foundation (NSF) [01] and UK Research Councils (RCUK) [02].

Research and educational institutions possess research data as institutional assets and maintain policy requirements for data deposit and management. These requirements aim to ensure data security and reliability, promote data sharing and utilization, and improve research efficiency and quality. Researchers, particularly Principal Investigators (PIs), are direct contributors of research data responsible for developing Data Management Plans and managing all research data generated by their projects, including collection, management, preservation, and access [03-04]. Therefore, researchers must enhance their understanding of and compliance with data management policies to ensure data accuracy and reliability.

Data librarians must provide professional management and services for research data in their respective subject domains, including evaluating disciplinary data, assisting in developing data management plans, determining appropriate metadata schemas, and establishing policies for research data preservation and publication. These services enhance data utilization efficiency and sharing, thereby promoting scientific research. The value and goal selection for public data open utilization requires comprehensive consideration of rights and interests across stakeholder levels and data management policy requirements, strengthened technological research and application, and ensured security and reliability to advance scientific research and social development.

2. Accountability Systems for Public Data Open Sharing

The value and goal selection for public data open utilization must address not only data collection, storage, and processing but also establish effective accountability systems to ensure data accuracy and reliability. For behaviors such as data fabrication, intellectual property infringement, and failure to submit data according to regulations, data centers worldwide have implemented measures including revocation, warnings, and public announcements. Additionally, providing concise principles for Scientific Data Management Plans as references for research institutions, research groups, and individual researchers represents an important means of ensuring data quality.

To ensure public data security and reliability, funding applications (for research, equipment, conferences, etc.) should require information about data management plans, and final project reports should include relevant details. These measures strengthen supervision and control of data management, preventing data leakage and misuse. Furthermore, emphasizing the principle that intellectual property protection and open scientific data are not mutually exclusive

is crucial. While protecting intellectual property, active promotion of public data open utilization is necessary to advance scientific research and social development. This requires establishing a balanced mechanism that both protects intellectual property and enables public data open sharing and utilization.

The value and goal selection for public data open utilization must integrate multiple factors, including data collection, storage, processing, accountability systems, and intellectual property protection. Through strengthened technological research and application and the establishment of effective management systems and policies, public data security and reliability can be further enhanced to promote scientific research and social development.

The U.S. National Science Foundation (NSF) emphasizes the value and goal selection for public data open utilization in Section 3.1 of *Today's Data, Tomorrow's Discoveries* (2015). Storing copyrighted materials and providing free public access constitutes an important initiative, including final peer-reviewed manuscripts and conference-reviewed papers, subject to five conditions: (1) storage in NSF-designated institutional repositories to ensure data reliability and permanence; (2) full-text availability for download, reading, and analysis, with free sharing no later than 12 months after initial publication to improve data accessibility and utilization; (3) provision of machine-readable metadata to facilitate standardization; (4) ensuring long-term preservation versions to guarantee sustained availability; and (5) providing permanent identifiers linking to full publications and metadata elements in annual and final reports to enable traceability and citation.

These requirements are documented in NSF's *Proposal and Award Policies and Procedures Guide* (2016), specifically in Section D, Paragraph 2, Clause c of Chapter 4, highlighting the importance and value of public data open utilization. Strengthening public data open sharing and utilization promotes mutual progress in scientific research and social development while improving data utilization efficiency and innovation capacity. Through reasonable policies and requirements, public data security and reliability can be further enhanced to advance scientific research and societal progress.

The value and goal selection for public data open utilization represents an important means of promoting scientific research and social development. Through strengthened policy formulation and technological research, public data utilization efficiency and innovation capacity can be improved, driving scientific progress and social development. NSF's *Today's Data, Tomorrow's Discoveries* (2015) emphasizes these values and goals, following OSTP (2013) policies to enhance open access to publicly funded research results [06], including long-term support for data sharing and research dissemination to improve utilization efficiency and innovation.

The value and goal selection for public data open utilization must comprehensively consider multiple factors, including data collection, storage, processing, sharing, utilization, and management. Through reasonable policies and stan-

dards, public data open sharing and utilization can be strengthened to promote mutual progress in scientific research and social development. The *Proposal and Award Policies and Procedures Guide* (2016) [07] mentions data management standards in multiple sections, demonstrating NSF's emphasis on ensuring data accuracy, reliability, sharing, and utilization to improve research efficiency and quality.

Additionally, technological research and application must be strengthened to ensure public data security and reliability. This requires establishing a comprehensive cybersecurity protection system with effective technical and management measures to prevent data leakage and misuse. NSF's *Today's Data, Tomorrow's Discoveries* (2015) outlines three key policy points: (1) Data Management Plans (DMPs) as required project application materials; (2) Data citation and description (dataset citations equivalent to paper citations); and (3) Mandatory deposit of final peer-reviewed manuscripts and conference-reviewed papers (note: "papers" here are considered a form of open data). These requirements are documented in NSF's *Proposal and Award Policies and Procedures Guide* (2016), which primarily regulates four key areas: 1. Data Management Plans (Sections C and D of Chapter II, Part I); 2. Data Storage (Section D of Chapter II, Part I); 3. Data Rights (Section D of Chapter VI, Part II); and 4. Data Collection (Section H of Chapter VI, Part II).

In research data management and sharing plans, information must be included in the "Professional Information and Attachments" section of proposals. Principal Investigators (PIs) and Co-PIs must provide information from the past five years, including DMPs describing data, publications, samples, software, and other supporting materials. This information helps evaluate applicants' data management and sharing capabilities, improving project quality and standards. Basic information about project personnel, including education and academic experience, must also be provided. Research outputs should include information about "accessible and citable" data publications and releases to facilitate sharing and utilization.

Regarding "collaborative activities" of project members, the focus should be on professional and academic influence, including innovative teaching, learning science sharing, problem-solving algorithms, and dataset development supporting research education to promote scientific progress. In project budgets, expenses related to public data open utilization can be included, such as journal publication fees, images, documents, software, and "data storage and indexing and database development fees." These expenses constitute important guarantees for smooth implementation of public data open utilization.

Therefore, the value and goal selection for public data open utilization must comprehensively consider multiple factors, including policy formulation, standard management, and technical support. Research data management and sharing plans represent important means of promoting public data open utilization. In the two-page DMP, the following must be included: types of data, samples, objects, software, and teaching materials for classification and management;

standards adopted for data and metadata formats and content to improve standardization; sharing and access policies, including privacy protection, confidentiality, intellectual property, and other rights preparations to ensure security and reliability; and plans for preserving data, samples, and research outputs along with sharing methods to promote long-term preservation and utilization.

The UK Research Councils' *Review of the Implementation of the RCUK Policy on Open Access* (2015) Policy Recommendation No. 4 requires ORCID usage to track whether funded researchers' journal papers are open access. This requirement improves traceability and citation rates of public data, promoting sharing and utilization [08]. Additionally, publishing research reports, developing operational and inspectable storage requirement details, referencing the RCUK review for ORCID tracking and inspection, and incorporating these into project evaluation guidelines help strengthen public data management and sharing, improving utilization efficiency and innovation capacity.

NSF requirements for collaborative project applications emphasize the value and goal selection for public data open utilization. Host institutions must be reviewed, with primary institutions required to have DMPs to ensure standardized management and sharing. Equipment and conference applications also require DMPs to demonstrate the importance and value of public data [09]. NSF has established clear requirements for high-performance computing, massive data storage, and visualization to ensure public data usability and sustainability, improving data quality and reliability to promote sharing and utilization.

Within 120 days of project completion, a publicly accessible "Project Outcomes Report" must be submitted, including publications, data, and software to improve public data accessibility and transparency, promoting scientific progress. Raw data, samples, entities, and other auxiliary materials generated during NSF-funded work must be shared with other researchers and experts within reasonable time and at no more than incremental cost, embodying the spirit of open sharing and improving utilization efficiency and innovation. NSF allows funded researchers to enjoy intellectual property rights to incentivize innovation, but this does not exempt them from the responsibility of communicating research results and data, emphasizing the importance of open sharing for scientific progress.

Through project application review, negotiated conditions, and supportive policies encouraging data cleaning, archiving, dissemination, and storage, NSF further strengthens public data management and sharing. NSF also provides clear policy statements on project data collection to ensure standardization and usability. In summary, the value and goal selection for public data open utilization represents an important means of promoting scientific research and social development. Through strengthened policy formulation and technological research, public data security and reliability can be improved, driving scientific progress and social development.

3. Handling Confidential Information in Data Open Sharing

Assessing public interest and confidentiality risks is crucial in public data open utilization. In some cases, mere appeals for attention cannot achieve complete balance, requiring national administrative agencies and their data centers to develop various governance mechanisms to facilitate data access for research and other purposes while reducing risks. For example, informed consent and secure use of restricted-access data should be enforced, with researchers who violate legitimate confidentiality rights subject to punishment. Although legal, ethical, and practical considerations often make it difficult for researchers to achieve their desired outcomes, an independent oversight body should provide recommendations on accessing specific forms of data. These governance mechanisms may include informed consent, secure use of restricted-access data, and penalties for researchers who violate confidentiality agreements. Additionally, establishing an independent oversight body to provide recommendations on data access pathways represents an important means of improving public data utilization efficiency and innovation capacity.

The UK Biobank and its Ethics Governance Committee provide a model for other institutions authorizing public interest operations [10]. The Biobank defines appropriate data uses and determines whether re-licensing is required to ensure standardized use and sharing. Approved researchers must comply with strict rules, with violations of confidentiality agreements facing up to two years of imprisonment and criminal sanctions. Confidentiality agreements regulate researcher behavior when accessing sensitive datasets, preventing abuse of trust and ensuring public data security and reliability.

The value and goal selection for public data open utilization must comprehensively consider multiple factors, including data management, sharing policies, and technical support. Through reasonable policies and standards, strengthened technological research and application, public data security and reliability can be improved to promote scientific progress and social development. Simultaneously, public interest and confidentiality risks must be assessed, with effective governance mechanisms and oversight measures implemented to ensure standardized use and sharing of public data.

4. Public Promotion Services for Data Open Sharing

The Alliance for Permanent Access provides online courses on data storage covering multiple aspects of public data open utilization, which are significant for improving data utilization value and promoting scientific research. Course content includes mission/scope, licensing agreements, continuity of data acquisition/access, data infrastructure, data integrity and authenticity, data appraisal, and record storage procedures, aiming to improve standardization of public data management [11]. Data management plans and professional data workflows represent critical links in public data open utilization that require adequate atten-

tion. DMPs should clarify data types, formats, storage methods, and sharing policies to ensure standardized management and sharing. Different professional data workflows also require appropriate standards to improve utilization efficiency and innovation capacity. Additionally, data security requires focused attention, necessitating strengthened technological research and application to prevent data abuse or leakage. Finally, data discovery, reuse, and identification represent important goals of public data open utilization. Through reasonable policies and standards that promote sharing and utilization, data visibility and accessibility can be improved, driving scientific progress and social development.

The Digital Curation Centre (DCC) provides modular, web-based PDF materials such as the Digital Curation 101 course, which are important for improving public data open utilization value and promoting scientific research [12]. These materials cover licensing agreements, long-term sustainable access, data confidentiality and ethical guidelines, data expert guidance, data integrity records, data storage management, data lifecycle checklists, and data quality and workflows, aiming to improve standardization of public data management. Licensing agreements and long-term sustainable access constitute prerequisites for public data open utilization that require full attention and guarantee. Licensing agreements should clarify data usage rights and sharing policies to ensure legal use and sharing. Long-term sustainable access requires stable data storage and access mechanisms to ensure continuous utilization and long-term preservation.

Data confidentiality and ethical guidelines represent important principles in public data open utilization. Technological research and application must be strengthened to ensure data security and privacy protection while respecting ethical guidelines and protecting personal privacy and rights. Additionally, data expert guidance and data integrity records can improve professionalism and credibility of public data management, promoting standardized management and sharing. Data storage management and data lifecycle checklists can also help managers better manage and utilize public data, improving utilization efficiency and innovation capacity. DCC's modular, web-based PDF materials can further improve standardization of public data management, promoting scientific progress and social development.

Data Archiving and Networked Services provides online courses, discussion forums, and certification services, offering comprehensive educational resources and training opportunities for public data open utilization that help improve management levels and utilization efficiency, promoting scientific progress and social development [13]. These promotion courses cover licensing agreement knowledge, confidentiality principles and academic ethics, data infrastructure introduction, expert guidance, data integrity and authenticity, data quality assessment, data management plans, data quality control, and data discovery and identification methods. Through these courses, researchers and data managers can improve their understanding of public data open utilization value and better manage and utilize public data. These courses also emphasize the importance of confidentiality principles and academic ethics, reminding researchers to comply

with relevant regulations and ethical norms during data use. Data Archiving and Networked Services can provide face-to-face guidance and assessment, offering deeper learning and exchange opportunities. This interactive teaching approach better helps participants understand and master relevant knowledge, improving their practical capabilities.

The International Oceanographic Data and Information Exchange provides PPTs, documents, PDFs, web-based information links, and face-to-face training, offering rich resources and training opportunities for marine domain public data open utilization [14]. OceanTeacher, a comprehensive e-learning platform developed by IODE combined with classroom training, provides free access to course materials focusing on marine research, observation, and service-related data storage and services. These resources and training opportunities help marine researchers and data managers improve their understanding of public data open utilization value and better manage and utilize marine data, embodying the spirit of open sharing and promoting marine scientific progress and social development.

The Facilitate Open Science Training for European Research Project aims to improve European researchers' awareness and skills in public data open utilization [15]. The project primarily collects PPTs and links to various events and courses in several European languages, providing rich learning resources. While resource and course lists may no longer be updated, news content remains current to keep researchers informed about the latest open science developments. The project also promotes exchange and cooperation across different fields, driving interdisciplinary research and development. Through open science training, researchers can learn about other fields' research methods and data utilization techniques, providing new ideas and insights for their own research. These training resources help researchers improve their understanding of public data open utilization value and learn basic principles and methods of open science. By mastering these knowledge and skills, researchers can better utilize public data for scientific research, improving research quality and impact.

The International Association for Social Science Information Services & Technology provides data management tools and resource links offering comprehensive support for public data open utilization [16]. These tools and resources cover data center and repository policies, access licensing agreements, data sustainability, data confidentiality, data integrity and authenticity, data quality control, data management plans, data archiving, technical infrastructure, and security. Through these links, researchers can access the latest data management tools and resources to better manage and utilize public data. These tools help researchers improve data quality and control capabilities, ensuring accuracy and reliability to provide stronger support for social science research. The association maintains constantly updated links to ensure researchers can access the latest data and resources to meet evolving research needs, improving public data open utilization levels and efficiency to promote social science research progress and development.

The UK Data Service is committed to providing data management guidelines on best practices for creating, preparing, and storing shareable datasets for researchers, data creators, data contributors, and data managers [17]. These guidelines cover all aspects of public data open utilization, including data acquisition, processing, analysis, sharing, and protection. Through these guidelines, researchers can better manage and utilize public data, improving utilization efficiency and innovation capacity. Most UK Data Service resources are free, including online information, videos, case demonstrations, links to external resources and tools, PDF versions of course materials, and guidebooks, providing valuable learning and training opportunities.

Knowledge Exchange provides valuable research reports on public data open utilization by comparing research data management training methods among partner member countries [18]. While not directly providing training, it offers numerous links to training resources covering Finland, France, Germany, the Netherlands, and the UK. These resources address data confidentiality, data management plans, data discovery and identification, data reuse, and data security, providing learning opportunities to help researchers better understand and master skills and methods for public data open utilization. Through these resources, researchers can better manage and utilize public data, improving utilization efficiency and innovation capacity to promote scientific progress and social development.

The NASA Earth Science Data and Information System Project provides rich learning resources including videos and external links, along with targeted materials for different data users and managers [19]. These materials cover data development strategies, data integrity and authenticity, data storage planning, data quality, data reuse, data security, and technical infrastructure. These data management and utilization knowledge and skills help improve capabilities in public data open utilization value and goal selection. By learning and mastering these knowledge and skills, data users can better utilize public data for scientific research and social applications, driving progress in Earth science. Data providers and managers can also better manage and protect public data, ensuring accuracy and reliability to provide stronger support for scientific research and social applications.

The Oak Ridge National Laboratory Distributed Active Archive Center provides detailed data management materials for data providers, reflecting the importance of value and goal selection in public data open utilization [20]. These materials are regularly reviewed and updated, providing various resource links including web information, videos, PDF documents, and online tools to help data providers better manage and utilize public data. Through these materials, data providers can understand basic principles and methods of public data open utilization, master data management skills and techniques, and improve data quality and control capabilities. These materials also help promote exchange and cooperation among data providers, driving interdisciplinary research and development.

The Socioeconomic Data and Applications Center provides seven online learning objects on data management topics, offering comprehensive learning and training resources for public data open utilization [21-22]. Created as short course modules, these learning objects include recorded professional videos, audio, and PPT presentations to help learners better understand and master data management knowledge and skills. These learning objects cover all aspects of data management, including data acquisition, processing, analysis, sharing, and security, providing comprehensive learning opportunities. By studying these materials, learners can better manage and utilize public data, improving utilization efficiency and innovation capacity to promote scientific progress and social development. These learning objects also demonstrate the importance of value and goal selection in public data open utilization. Through opening and utilizing public data, sharing and reuse can be promoted, improving utilization efficiency and innovation capacity to drive socioeconomic development and progress.

The advancement methods for scientific data center open sharing are crucial for achieving value goals in public data open utilization. Establishing evaluation and assessment mechanisms can incentivize different stakeholders to actively participate in data sharing, improving utilization efficiency and effectiveness. Simultaneously, establishing and implementing accountability systems can ensure standardization and security in the data sharing process. Regarding confidential information handling, balancing public interest and confidentiality risks is necessary to promote data access and utilization while reducing risks. This requires comprehensive data evaluation and review to ensure security and reliability. Additionally, providing public promotion services represents an important means of advancing public data open utilization. Through online courses, discussion forums, and certification services, researchers can be helped to better manage and share data, improving data quality and availability. Data management tools and resource links provided by organizations such as the International Association for Social Science Information Services & Technology, UK Data Service, Knowledge Exchange research reports, NASA Earth Science Data and Information System Project, and Socioeconomic Data and Applications Center also provide strong support for research data management training. The advancement methods for public data open utilization must adapt to value goals, establishing 完善的制度和机制，促进数据的共享和流通，提高数据的利用效率和效益，推动社会的进步。

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Note: Figure translations are in progress. See original paper for figures.