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putting the pieces together: theory and practice

Staking out the Stakeholders: Using NIST's Research Data Framework Within a Public University System

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Abstract

Purpose: This article first introduces and contextualizes the National Institute of Standards and Technology (NIST) Research Data Framework (RDaF) and then explores its application in a local context.

Setting/Participants: The State University of New York (SUNY) System, both at a system-wide level and at two individual SUNY campuses, developed an approach to applying RDaF to improve research data management (RDM) practices.

Brief Description: As institutions work to establish sound, coordinated services and infrastructure that meet local needs, they look to strategic guidance and established best practices for doing so responsibly and successfully. Modeled after their Cybersecurity and Privacy Frameworks, NIST began developing RDaF in 2019 to address pressing research data community needs. The RDaF provides a comprehensive, structured approach to be used by diverse stakeholders to better understand the benefits, risks, and costs of research data management (RDM).

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Abstract Continued

Results/Outcome: NIST continues to work with other organizations on RDaF's utility in different contexts, and SUNY's application offers both a use case and lessons learned that may offer other institutions a practical, grounded approach for leveraging the power of RDaF to improve their RDM strategy.

Conclusions: RDaF's comprehensive guidance offers a robust, flexible framework for building thorough RDM strategy, whatever an organization's institutional readiness.

Introduction

In recent years, universities have been increasingly focusing on research data management (RDM) policies, procedures, and resources (Bryan et al. 2020; Radecki and Springer 2020). This has been brought about by several factors, including an expansion in the requirements by federal funding agencies for researchers to provide data management and sharing plans (starting with the National Science Foundation in 2010; NSF 2010) in order to enhance the potential benefits of research. There has also been an increasing need to promote transparency and reproducibility in research (Sayre and Riegelman 2018; Korbmacher et al. 2023), to validate findings. Erway (2013) discusses the importance of engaging stakeholders in these processes and points out that library directors are in the best position to initiate these conversations. However, implementation can be a difficult process due to the many facets of RDM and the number of individuals involved. A tool such as the National Institute of Standards and Technology (NIST) Research Data Framework (RDaF) is designed to help streamline this process and may be utilized to ensure that all the necessary players and factors are being represented in the development of these policies and procedures.

RDM planning and strategy is critically important. It requires resources and executive support, includes social and technical infrastructure, and is a vital part of a modern university system. The push for federal funders to require data management and sharing plans as a part of grant applications (Holdren 2013; Nelson 2022) provided a new impetus for previously siloed groups in libraries, sponsored programs, research administration offices, and campus administration to work together to provide guidance for researchers applying for federal grants, review system infrastructure to support data management and sharing, increase data management support services, and consider legal requirements for using and sharing data in the current research ecosystem. Within this landscape, the State University of New York (SUNY) partnered with NIST to test implementation of RDM using the robust NIST RDaF.

Figure 1: RDaF lifecycle figure (Hanisch et al. 2024, 7).

Introduction to RDaF

The NIST RDaF is a near-comprehensive look at the research data landscape across disciplines and organizational types. What follows below is an exploration of the RDaF itself (Hanisch et al. 2024), which is designed to help stakeholders understand a) who the players are, b) what the landscape looks like, and c) how research data is governed, created, and used all within the context of their own institution. Version 2.0 of the Framework describes itself as "a map of the research data space that uses a lifecycle approach with six stages to organize key information concerning RDM and research data dissemination" (Figure 1; Hanisch et al. 2024, i). Through a community-driven and in-depth process, NIST identified and defined specific, high-priority topics and subtopics for each lifecycle stage. The topics and subtopics are programmatic and operational activities, concepts, and other key factors relevant to RDM that form the foundation of the framework. This foundation enables organizations and individual researchers to use the RDaF for self-assessment of the status of their RDM programs. Each subtopic has several informative references—resources such as guidelines, standards, and policies—to help a user understand or implement that subtopic. As such, the RDaF may be considered a "best practices" document.

At the heart of the framework are the six lifecycle stages: Envision, Plan, Generate/Acquire, Process/Analyze, Share/Use/Reuse, and Preserve/Discard. These stages capture the essential steps within the research process. Each lifecycle stage has topics and subtopics which elucidate the programmatic and/or operational activities, considerations, and other factors that make up a picture of the stage. For each topic/subtopic there are definitions and informative references. These references make up a bibliography of nearly 2,000 sources

related to all parts of the RDaF. Beyond these, a set of overarching themes was identified; collectively, these themes touch all the lifecycle stages and each of the 14 themes touch at least five stages, though most cover all six stages (Figure 2).

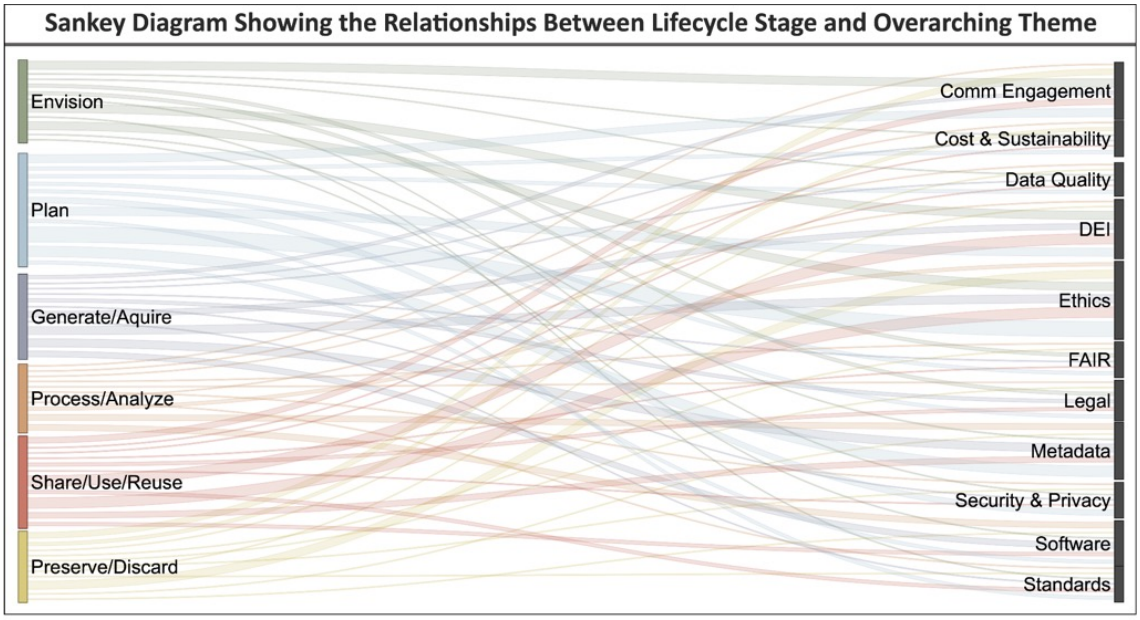

Figure 2: Sankey diagram of the relationships between lifecycle stages (left) and overarching themes (right; Hanisch et al. 2024, 36).

The most robust overarching themes are those that are "social" in nature versus the more "technical" ones. For example, in the Envision stage users will find subtopics that call attention to establishing a data culture that values data workers, incentives data sharing and reuse, and recognizes the ethical and moral concerns that are a part of data practices and principles. This highlights the fact that RDM and governance is not at the core a technical problem to solve, but rather a social one; and thus, the RDaF is a tool for the entirety of an institution.

Over four years the RDaF was developed by the community via multiple plenary and stakeholder meetings, collaboration with a steering committee, and finally, feedback through a notice in the Federal Register. In February 2024, version 2.0 was released; currently, the project is in an implementation phase where the team is working with organizations who would like to use RDaF to better understand their management and governance of research data. Collaboration with SUNY began in the summer of 2023 and was the first time the RDaF team worked with another organization to implement the framework. Other organizations such as

the Digital Research Alliance of Canada (Digital Research Alliance of Canada 2022) and the Research Data Alliance Global Open Research Commons International Model (GORC IM) Working Group (Woodford et al. 2023) have used RDaF versions to benchmark their strategy documentation and model, respectively.

The work with SUNY has been instrumental in understanding not only how a large academic institution might use the RDaF, but also the hurdles any organization can face when starting an implementation of this framework. First, the document is large and the number of connections between nodes (i.e., the topics, subtopics, overarching themes, and references) means that it is difficult to see them all when laid out in PDF tables. Within months after the SUNY and RDaF teams began work together, the NIST RDaF Web App debuted, which allows users to enter the framework at any point and move around in any direction from a given node (Lee et al. 2023). The references are linked to their version of record via DOI. Soon each node will have a persistent identifier (PID), allowing direct referencing of a specific node. In addition, the NIST RDaF team is working on developing network visualizations to gain further insight into the connections throughout the RDaF.

Second, the topics and subtopics are written as statements that are not actionable. For example, one cannot say that the "Organizational support for making data more FAIR" subtopic under the FAIR topic in Plan is actionable. It is also not a yes or no question. These statements can be difficult to translate into actions, considerations, or a rubric of maturity stages. SUNY has taken great strides by interpreting the RDaF topics and subtopics (especially in the Envision and Plan stages) for their own goals and sharing them with the RDaF team.

Intro to SUNY

SUNY is the largest comprehensive university system in the United States. SUNY comprises 64 institutions, including research universities, academic medical centers, liberal arts colleges, community colleges, colleges of technology, and an online learning network. Over 367,500 students annually participate in 7,500 degree, certificate, and continuing education programs throughout New York State (State University of New York 2024).

In 2023, the SUNY Research Foundation Sponsored Program Administration supported over $1.1 billion in total research expenditures conducted by over 3,200 Principal Investigators (State University of New York Research Foundation 2023). Research data created from SUNY-produced research, data about SUNY-produced research, and data reused in SUNY research are fundamental to our efforts to achieve the New York State Governor's and SUNY Chancellor's goal of doubling research expenditures by 2030 (New York State Governor's Press Office 2022). Strategic efforts to manage and administer data created in those research efforts is a high-priority activity across the system.

SUNY System perspective and development of the SUNY RDaF Explorer tool

The use of RDaF at SUNY was precipitated by a need to have a common language and framework to discuss, evaluate, and plan for RDM activities across SUNY. The landscape of data lifecycle tools and models is vast, as demonstrated by the Research Data Alliance and Oracle for Research project Mapping the Landscape of Digital Research Tools Harmonised (MaLDReth). The project reviewed 26 research data lifecycle models and selected the top 5 that met their needs, one of which is RDaF (Research Data Alliance and Oracle for Research n.d). SUNY System reviewed the literature providing institutional strategy for building institutional readiness. Noteworthy is the downstream effect of the Government of Canada's approach. As a result of the implementation of the Tri-Agency Research Data Management Policy, requiring any institution that administers Tri-Agency funding to develop and publish an institutional research data management strategy by 2023 (Government of Canada 2021), Canadian universities began to envision institutional-level data services and provide relatively similar services (MacDougall and Ruediger 2024). Without similar mandates for institutional research data planning in the United States, capacity for and support of data services varies across institutions. Existing practitioner-based guidance documents often centered on building research data services at libraries (ARL/CARL 2021). The guidance also often provided desirable outcomes indicating a mature, robust organizational infrastructure supporting RDM, with little context for how an organization might achieve those outcomes. RDaF provided the most comprehensive data framework that included the Envision stage, which mapped to the interests of investigating institutional readiness to address challenges and strategy for working with research data at SUNY.

A collaborative group of SUNY stakeholders from sponsored programs, research offices, libraries, human resources, and information technology units at the System and individual campuses joined together in an RDM Task Group in spring 2023. From this group, an RDaF Working Group formed to investigate RDaF, collaborate with NIST on potential implementation of the framework, and develop workshop or training materials to assess institutional readiness for RDM.

After reviewing RDaF and selecting the framework as a pilot model for assessing institutional readiness, the working group started with a review of different RDaF profiles using the RDaF sample profiles (Hanisch et al. 2023), including AI Expert, Budget or Cost Expert, Curator, Data/IT Leader. These templates align organizational units and/or individual roles and job functions with the RDaF topics and subtopics that are deemed relevant for that role. Ideally, the working group hoped the profiles could map to specific roles within SUNY to validate that the subtopics were appropriate for SUNY System and campus needs. In the process, the group realized that the subtopics were of varying degrees of granularity and needed a way to explore the different subtopics interactively (at the time NIST RDaF's interactive web application was not yet published).

Working with the subtopics in more depth, and thinking about how to help campuses use the RDaF in RDM activities, it became apparent from the SUNY System perspective that the subtopics fit into three distinct

types: "Outcomes," "Activities" that produce those Outcomes, and "Considerations" that need to be taken into account in the process. From there, exploration began of methods used to conduct the activities, who the participants would be (both titles and roles), what milestone outputs of the activities might look like, and what resources would be helpful to achieve the desired outcomes. Individual RDaF subtopics might spawn multiple outcomes, and multiple activities might be associated with a single outcome. Individual methods, participants, roles, and resources were associated with many different activities. Framed this way, RDaF took shape in the SUNY perspective with stages, topics, and subtopics as nodes in a graph, extended with a SUNY-specific interpretation of them in this actionable model. In order to interact with the graph,[1] to help see these connections, and to provide a vehicle for discussing the framework with campuses, SUNY System built a prototype data model (Figure 3) expressed as a JSON-LD graph, and a javascript-based tool to explore the graph as a decision tree, with a simple scorecard functionality incorporated.

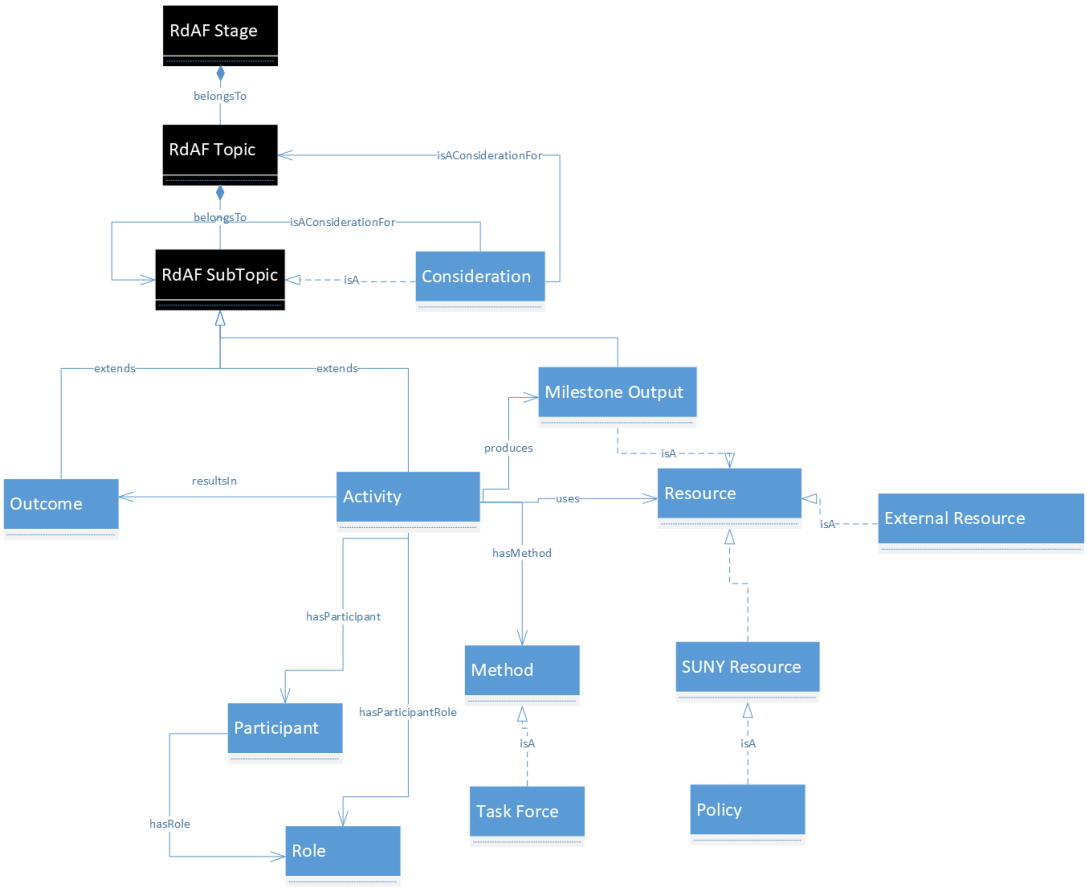

Figure 3: RDaF Data Model.

1 See https://github.com/SUNYORIED/rdaf/wiki/Prototype-Data-Model for details of the prototype data model.

The decision tree enables interactive visualization of the SUNY data model including elements from the RDaF and SUNY interpretations of Topics (Figure 4); Definitions, Outcomes, and Considerations (Figure 5); and Activities (Figure 6). Radio buttons embedded in the RDaF Explorer tool allow the user to select their perceived progress towards Outcomes (interpretations of RDaF subtopics) and can be used to produce a scorecard that can measure and inform local activities. The SUNY RDaF Explorer tool is published as an open-source resource for others to use and extend in a GitHub repository.[2]

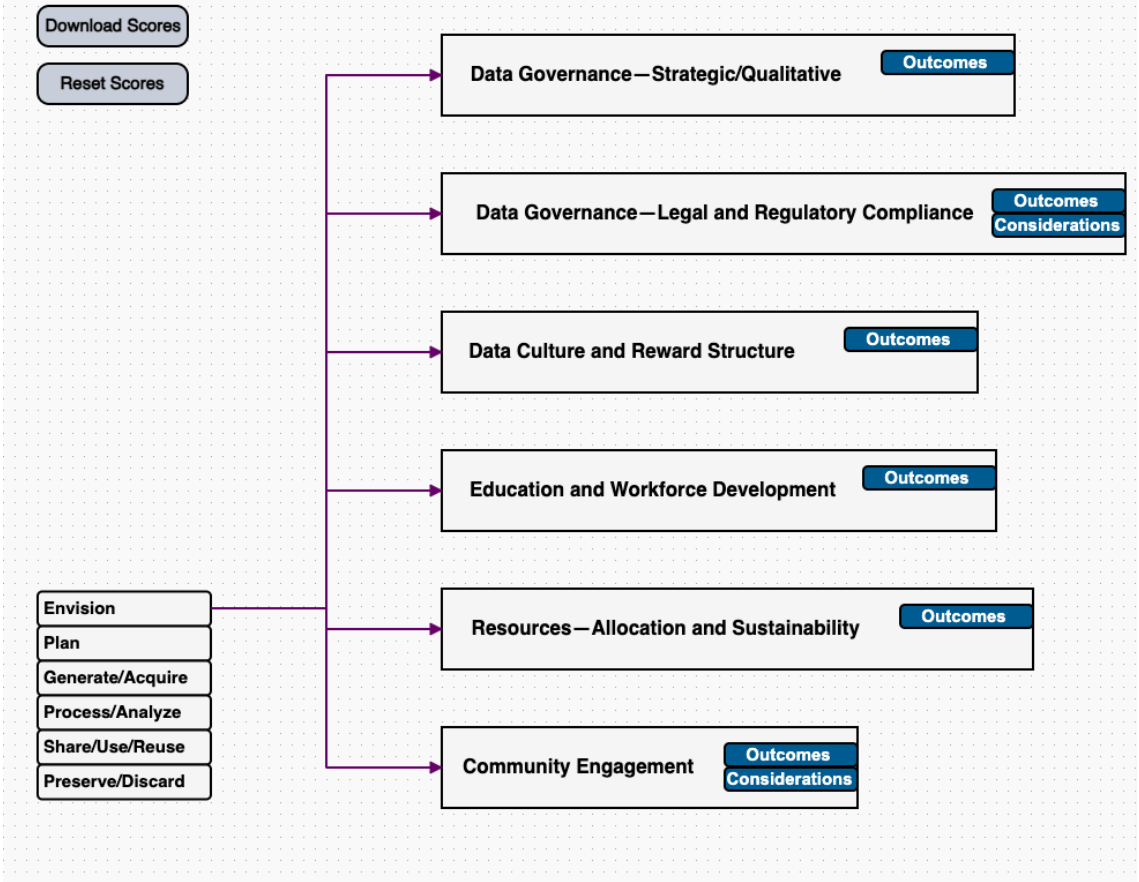

Figure 4: RDaF Explore Prototype, expansion of the RDaF Topics in the "Envision" stage.

2 See https://github.com/SUNYORIED/rdaf.

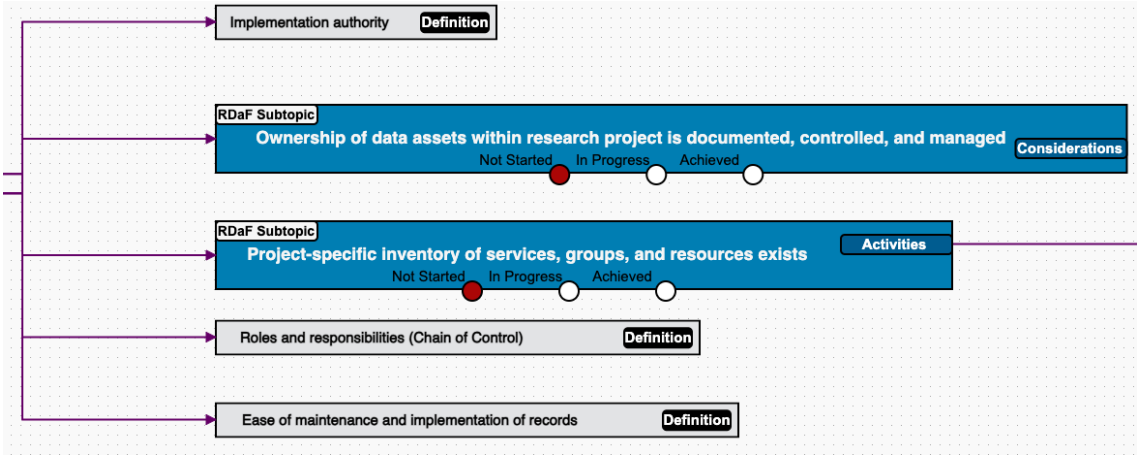

Figure 5: RDaF Explore Prototype, expansion of the "Chain of Control (Custody of Data)" RDaF Topic (from the Plan stage) into its subtopics as mapped to Outcomes (in blue) and Considerations (in gray). The blue color indicates that this Outcome is an interpretation of an RDaF subtopic. The gray color indicates that the Consideration is a verbatim use of an RDaF subtopic. The radio buttons are an interactive element to allow the user to produce a scorecard.

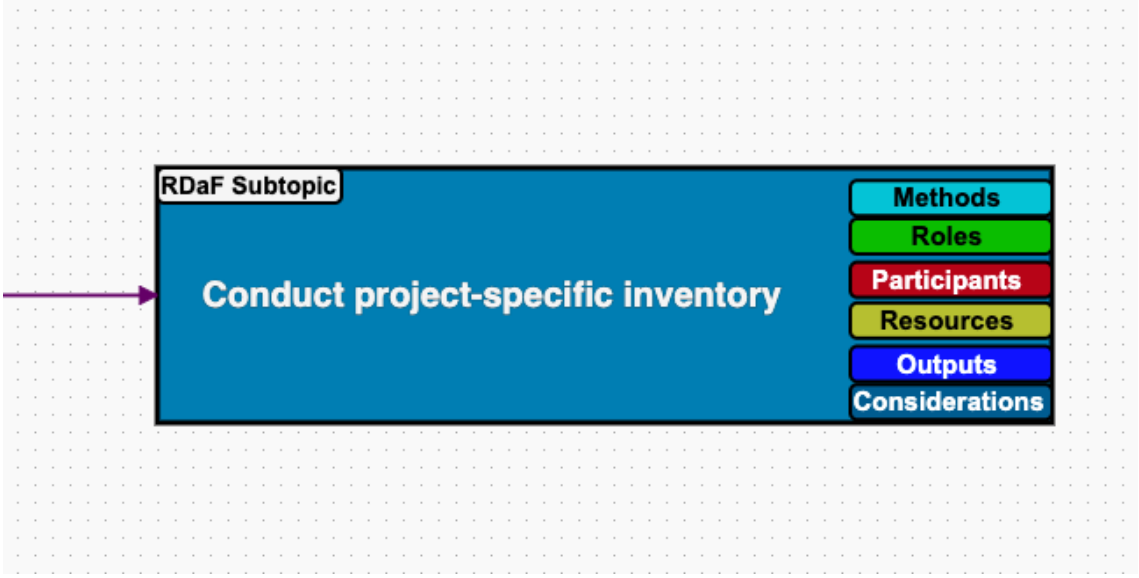

Figure 6: RDaF Explore Prototype, expansion showing an Activity (as an interpretation of an RDaF subtopic) that results in the Outcome of the "Project Specific Inventory of services, groups and resources exists" from Figure 4.

Visualizing and interacting with the RDaF in this way has informed understanding of the full scope of the RDaF as well as served as a foundation for developing pilot workshops for initiating campus discussions on working with research data.

Using the tool as a boundary object to solicit direct feedback on RDM activities, SUNY System hosted pilot feedback sessions with participants from a few campuses that actively participate in sponsored research. Direct feedback on the tool resulted in the following takeaways:

- The SUNY RDaF Explorer tool is complex and useful for a deep dive into multiple aspects of the RDM lifecycle.
- The tool should offer a variety of entry points depending on the audience. Researchers may choose to enter at the Plan or Generate/Acquire stage. Students learning about RDM might enter at any stage. Campus working group staff members might focus on the Envision stage to see subtopics listed as high-level requirements for good RDM.
- Scorecards produced by the SUNY RDaF Explorer tool are best for communicating recommendations about research data strategy to executive stakeholders. The tool as currently designed demonstrates the depth and breadth of RDM. Its complexity allows a user to discover and inform the relationships, tasks, milestones, progress towards outcomes, and related activities; however, communicating recommended actions is best achieved using a scorecard. (Figure 7)
- Definitions were very important for use with the tool and for using RDaF. One of the strengths of the RDaF is its use as a language guide to promote shared discussion of research data concepts.

In addition to capturing suggestions to improve the SUNY RDaF Explorer tool and workshop, the pilot workshops solicited feedback on how to support building organizational infrastructure on campus and across the SUNY System. Specific deliverables requested include:

- workshops for high-level campus administrative leaders on RDM,
- demonstration with RDaF or other frameworks of the comprehensive social, organizational, budgetary, legal, and technical infrastructure required for supporting management of research data,
- a one-page brief on the critical nature of RDM designed for administration audiences,
- training on RDM for librarians, graduate students, staff,
- a pared-down list of research data repositories by discipline as a compliment to the comprehensive re3data.org[3] registry, and
- a "bottom up" integration of RDM into existing, required, and time-saving processes aligned with existing professional and promotional incentive structures wherever possible.

3 https://www.re3data.org

RDaF Scorecard v.1 for use with SUNY RDaF implementation sunyoried.github.io/rdaf/				0=Not Started	1=In Progr	2=Achieved
TOPIC	**Outcomes**	**Example**	**Date 1**	**Date 2**		
E.1. Data Governance—Strategic/Qualitative	Institutional Data Governance goals identified and defined	1				
The policies, procedures, and processes pertaining to authority, control, and shared decision-making (planning, monitoring, and enforcement) over the management of data assets	Institutional Data Governance roles and responsibilities are identified and defined	1				
	Institution has a clearly defined vision for research data management	2				
	Institution has clearly defined high-level policies for research data management	0				
	RDM organization to support data-related activities exists	1				
	Institution has a clearly defined statement of purpose and value for research data	1				
	Data needs assessment completed at the desired level of analysis including: researcher, student, discipline, institution, unit, library	1				
	Organizational intent regarding FAIR data is well defined across the institution and contributes to vision and policy	0				
	Support for end users included in institutional RDM and data governance standards	2				
	Data governance legal policies, framework, and plans exist and are continually updated	2				
E.2 Data Governance—Legal and Regulatory Compliance The policies, procedures, and processes to manage and monitor an organization's regulatory [and] legal responsibilities and risks pertaining to data.		0				
	Dataset inventory exists and includes relevant dataset metadata including: repository, identifiers, data usage metrics, creators, funders, supporting grants	1				
	Data services inventory: includes relevant data services provided across institution or unit	1				
	Risk is assessed and includes risks associated with unmanaged data, research subject privacy, data preservation, funder compliance	0				
	Risks determined in risk assessment are mitigated, managed, and controlled	0				
	Policies for sharing and licensing data exist	0				

Figure 7: Stylized scorecard used in SUNY RDaF Explorer workshops. The tool also exports a scorecard that can be used to track progress achieving outcomes by RDaF topic.

As the need for supporting research through managed data grows at SUNY, so do the efforts to build technical data infrastructure. RDaF can be a helpful tool to expand the narrow focus of building data repositories to include strategic planning and strategy to build institutional capacity, services, and support for research data.

Stony Brook University and University at Albany: RDM Challenges and RDaF as a Solution

Stony Brook University

Stony Brook University (SBU) is an R1 research institution located on Long Island, New York, which consists of multiple campuses as well as medical facilities, including both teaching hospitals and outpatient care operations. It is considered to be a flagship university of the SUNY System. As of 2023, there were 25,865 students total, including 17,549 undergraduates and 8,316 graduate students (Stony Brook University 2024). There are over 900 research faculty, and 2,045 sponsored awards across the institution (Stony Brook University 2024). As of 2024, the university has a total of 1,262 federal awards, amounting to a grand total of over $989 million in active federal research funding (Stony Brook University Office of the Vice President for Research 2024).

SBU's RDM services are found across multiple departments throughout the university; however, the University Libraries currently serve as a central hub for accessing these resources. There are multiple research guides available on the library website, which address various aspects of RDM and serve as a guide to all RDM-related services across the university. There is also a central email address that is monitored regularly by librarians where researchers can ask any questions they may have, and/or request a review of their data management and sharing plans. The University Libraries also provide workshops on a regular basis on topics such as the new NIH Data Management and Sharing Plan requirements, the DMPTool, and more.

There is also a university-wide RDM task force that was initiated by the Office of the Vice President for Research (OVPR) in 2018. This group consists of representatives from University Libraries, the Office of Sponsored Programs, Research Computing, Informatics & Innovation, the Office of Research Compliance, the Office of Proposal Development, the Office of the Vice President for Research, and the Renaissance School of Medicine. The charge of this group has changed over time, starting with the development of archival RDM policies, and, more recently, developing a plan to address the relatively new National Institutes of Health Data Management and Sharing Plan requirements. This group connects RDM stakeholders across the university, and several subgroups have arisen from it in order to address more specific initiatives.

In the case of SBU, the RDaF and the SUNY RDaF Explorer tool have the potential to be very useful in terms of organizing a more comprehensive, proactive approach to RDM. They can not only be used to assess the current state of RDM at SBU, but to also facilitate a more thorough approach proactively to ensuring that all facets of RDM are being addressed effectively and completely. Their use may also ensure that all stakeholders across campus are involved in the creation of RDM policies and procedures, which in turn may ultimately lead to more efficient workflows and increase compliance with funder mandates.

In order to implement the use of RDaF at SBU, it will need to be accepted and promoted by administrators at the top of key departments across campus. One way that this would be able to be accomplished is through the top-down approach of adoption through SUNY first, and then across all relevant SUNY campuses. However, it will be necessary for there to be several "champions" across these campuses to help explain the utility of RDaF to various stakeholders to ensure that it is being used consistently. Due to the role of the University Libraries on the university-side RDM task force, these members would be a natural fit for promotion of the tool.

University at Albany

The University at Albany, State University of New York (UAlbany), is one of four SUNY university centers. A diverse R1 (DataUSA 2024), UAlbany "signature strengths" include climate science, cybersecurity and artificial intelligence, health science, and emergency preparedness (University at Albany, State University of New York 2022). In the 2022/23 academic year, there were 12,654 undergraduate and 4,421 graduate students enrolled, with over 1200 faculty (University at Albany, Undergraduate Admissions 2024). UAlbany's

research funding profile includes 397 sponsored awards totaling over $142 million (University at Albany, Division for Research and Economic Development 2024).

To meet campus needs and respond to evolving RDM needs, there are three tiers to UAlbany's data support on campus. The first is the Data Services Team (DST), led by the Libraries, which includes representation from Information Technology Services, the Data Management and Analytics Center, and Office of Research and Regulatory Compliance. This team provides "on the ground" services, including workshops and resources (e.g., a website, LibGuides, and FAQs), consultations, and tools to meet student and researcher needs. RDM education and outreach about services are a priority for this group, which offers a monthly data newsletter, a regular workshop lineup, consultations on data sharing, and data management plan reviews.

Representatives from this team sit on the Research Data Security Working Group (RDSWG), which serves to establish coordinated stewardship of the University's research data, and includes representation from all of the above-mentioned groups, as well as Sponsored Programs, Enterprise Risk Management, Counsel, Procurement, and a representative group of faculty. The RDSWG is responsible for building data management, sharing, privacy, storage, safety, and security standards. This work includes establishing tools, processes, and workflows, recommending policy, and communicating with and advocating for researchers. A recent RDSWG effort includes establishing a functional, collaborative Data Use Agreement process that included developing an intake form, streamlining cross-departmental review, and routinizing follow-on audits.

At the top of this structure sits the University's Research Data Governance Council (RDGC), developed by the RDSWG, which recognized the need for administrative-level buy-in to RDM efforts. The RDGC's charge is to advise the Vice President for Research on policies and procedures that govern the University's data for the full research data lifecycle, regardless of the unit responsible for the data or any applicable funder requirements. With RDSWG leadership turnover, the RDGC has been slower to become an active, established group. However, it is poised to be an essential advocacy body to University leadership for funding essential resources, establishing sound policy, and legitimizing culture change.

When SUNY convened the RDM Working Group, UAlbany RDST members were pleased to participate. There is strength in collective action, and aligning with the priorities of the SUNY System not only afforded UAlbany's team a chance to learn where there might be opportunities to fold into larger efforts at the System level, but also to inform and advocate for local needs and concerns. The RDM Task Group also fostered information sharing among SUNY colleagues, which has been similarly invaluable. These efforts, along with the RDaF workshop SUNY System colleagues hosted in February 2024, provided key takeaways that the RDST is still looking to fold into the conversation as UAlbany continues to build and refine its data strategy.

Much like SBU, UAlbany is looking to RDaF, and SUNY's RDaF Explorer tool, to provide guidance and authority to the entire swath of RDM considerations to support and inform a rigorous data strategy. The

broader research landscape keeps evolving at a rapid pace, and as much as shifting from a reactive posture would be optimal, the RDaF offers a stable touchstone and reminder to return to stakeholders and actions in the local context. Both the RDaF and RDaF Explorer tool are best suited for use by the RDST and RDSWG, to guide and inform next steps. Additionally, and following from the SUNY-led workshop to RDSWG leadership, one participant noted the RDaF Explorer tool could assist UAlbany in identifying resources that are 1) required and available and 2) required but not available to help with advocating to the RDGC for resource allocation from University leadership. When RDGC is in the position to request for financial assistance from administration to support more robust RDM activities, rooting the ask in RDaF may lend additional credence to the need. Additional local follow-on work at UAlbany will include providing use cases that speak to the different pieces of the RDaF, which will be important for illustrating local successes and gaps. Not only will this demonstrate RDM effort that has already been made, but it will shed light on areas of need with real-time implications.

NIST's frameworks are a recognized, trusted "brand," and RDSWG leadership saw the value of the RDaF Explorer Tool. Much like at SBU, however, the biggest challenge for RDaF implementation at UAlbany is its adoption and use by leadership. The challenge lies with moving from seeing its value to using it to identify priorities and drive campus initiatives. The DST will continue to advocate for the RDaF as a framework to guide UAlbany's efforts, meeting with RDSWG leadership to identify areas where the DST can pull threads together or tease out potential next steps. At the same time, SUNY's leadership in convening System-wide conversation about and continued engagement with building on-ramps to the RDaF will remain critically important. As stated above, so much of the RDaF is a socially focused tool. Changing practice and culture can be slow work, and having the RDaF to return to as a standard, coupled with the relationships established by SUNY, will be invaluable as UAlbany continues to address data needs and challenges locally.

Future Questions and Next Steps

The comprehensive nature of RDaF, incorporating social components as well as technical ones in building infrastructure for data management, makes the framework ideal for expressing a wide scope of issues to senior administrators. The hope in facilitating discussions on research data needs at SUNY using the SUNY RDaF Explorer is to 1) enable campuses to self-assess their own readiness for research, 2) ground conversations in standard terminology, 3) demonstrate the breadth of considerations for managing data beyond hardware and software applications, and 4) create forums for communicating specific activities, methods, goals, and outcomes for this work. A recent project to build a research data repository and related curation services as part of a larger SUNY Digital Transformation Project provides an opportunity for System experimentation with the SUNY RDaF Explorer tool.

With support from SUNY executive leaders, additional workshops to facilitate conversations about research data are needed. Potential workshops could include campus workshops involving individuals working in the same institutions, as well as peer learning workshops composed of individuals working in the same

roles or who perform similar functions on different campuses. Additionally, there is potential for the SUNY RDaF Explorer tool to serve an educational role for students pursuing graduate degrees in data-intensive fields. Early efforts to inform the next generation of researchers on managing their research data may lead to greater outcomes in data sharing for the future.

The SUNY RDaF Explorer tool is one of many possible implementation examples for NIST's framework. Other projects emerging with vast potential include harnessing the power of data used to create RDaF with AI to facilitate a question-and-answer tool for RDM planning. NIST is actively interested in partnering with other organizations or users who might envision additional implementation projects. NIST is continuing work on RDaF web applications, including the addition of PIDs enabling incorporation with other data models. Visualizations of RDaF currently being planned at NIST will also further understanding and use of the framework.

Conclusion

Implementation of RDaF at SUNY demonstrated how to use a comprehensive, community-driven framework to assess and address organizational needs for RDM at a large, federated university system. The robust nature of RDaF perfectly aligned with SUNY's requirement for a solid framework to guide critical work in data management. The collaborative efforts yielded mutual benefits: NIST shared the framework, SUNY System Administration contributed a practical tool for grounded application, and the UAlbany and SBU campuses provided first-hand insights from their work with campus researchers. Potential applications of RDaF and the SUNY RDaF Explorer tool are wide and promising.

Competing Interests

The authors declare that they have no competing interests.

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