

Subcommittee on NSF's Information Technology and Enterprise Architecture Strategy
Recommendations Report—January 21, 2022

Introduction

The Subcommittee has been charged with reviewing NSF's IT Strategy and related Architecture and providing a bulleted list of informed recommendations for changes in process, direction, and/or potential investment in new and emerging technologies for possible implementation in the next budget year. The committee has completed the review.

The recommendations below do not refer to any specific NSF IT strategy document area. However, a high-level view of the IT strategy process is given below to understand the Subcommittee's recommendations better. NSF's IT mission and vision align with NSF's Strategic Goal 3 to Enhance NSF's performance of its mission. Goal 3 is broken down into two Strategic Objectives, (3.1) Human Capital—Attracting, retaining, and empowering a talented and diverse workforce, and (3.2) Processes and Operations—Continually improve agency operations. NSF's IT vision is to provide cutting-edge IT solutions to enable the Foundation to remain agile and thrive in an ever-evolving landscape. NSF's IT mission is to provide the highest quality technology-based services and solutions most cost-effectively to facilitate the Foundation's mission.

The CIO oversees policy and governance to use IT resources to accomplish the Foundation's mission efficiently. The Division of Information Systems (DIS) provides the hardware, software, support systems, and services staff needed to work on behalf of the Foundation, including managing the agency's grant-making process and advanced financial systems. NSF has created an agile and democratized continuous improvement process for IT investments, a Target Technical Architecture (TTA), and a plan for technology investments for FY21 - FY23 to fulfill its IT mission as described above.

In general, NSF is heading in the right direction with emerging technologies with the use of Shared Services, leveraging Data as a Strategic Asset, Multi-Cloud, Empowering Workforce with Digital Technologies, investing in multiple new technologies including AI/ML, Low Code/No Code, DLT, RPA, and Zero Trust. The following recommendations augment NSF's current IT and emerging technology plans to accelerate innovation and achieve the desired "Speed and Scale." The Subcommittee recommends **aligning technical activities** and **organizational capability** with **strategic goals** (recommendations 1 and 2), **accelerating innovation** (recommendation 3), and forming **effective partnerships** (recommendation 4).

Recommendations

1. Establish linkage of technology actions and business objectives and demonstrate that the FY21-FY23 technical investments will incrementally and continuously improve the quality, performance, and scalability of IT solutions cost-effectively while meeting strategic objectives.

1.1 Explain the cohesiveness among the eight “IT portfolios” and make NSF's IT Strategy more understandable, especially by non-IT experts, e.g., mission and budget people.

1.2 Break down Technology Investments with specific operational pain points and expected improvements. For each project, specify target performance metric(s), expected improvement from technology and resource investment. Use state-of-the-art project management and risk assessment tools to measure operational effectiveness and maximize responsiveness to customer needs.

1.3 Develop a strategy that includes using natural language processing technologies to continuously assess internal and external customer and developer experience with IT tools, solutions, and services. Gain actionable strategic insight on IT investments. Include deputy assistant directors, office heads, information systems division (including all IT staff and developers, personnel responsible for the grant-making process, and advanced financial systems).

2. Given the direction stated in the strategic plan, review the current IT operational structures for leadership, governance, delivery, operations and oversight to identify opportunities for streamlining of processes or realignment of responsibilities in order to improve overall visibility, effectiveness and close linkage of organizational capability with business objectives.

2.1 Confirm that the accountability for delivery, oversight and budget decisions are balanced and aligned for informed, efficient decision making.

2.2 Define specific actions to ensure alignment between goals established by senior leadership and democratized idea submission process. Include any needed communication actions.

2.3 Since the individual responsible for strategic IT direction, NSF’s CIO and the individuals responsible for the implementation of technical capabilities and day to day operations are in different parts of the organization, ensure that processes defined support maintaining alignment between strategic goals and project and operational activities.

2.4 Identify approaches (e.g., partnerships) that may be leveraged to expand NSF resource and operational capacity in support of agility for resiliency or significant additional demand.

3. Develop and implement a data centric process that oversees quantifiable results-oriented projects with accountable IT innovations and operations resources to achieve “Speed and Scale”.

3.1 Form a “Technology Innovation” team with the responsibility of evaluating the applicability and viability of emerging technology for the goals of NSF. Given the spectrum of emerging technology NSF plans to undertake, their varying levels of maturity, and the uniqueness of NSF organization, it is imperative that a dedicated team under the leadership of the CIO is charged with technology evaluation and is responsible for customizing and approving their operational IT implementation.

3.2 Additional recommended responsibilities for “Technology Innovation” team:

3.2.1 Bring “data fabric” to the forefront in all central IT implementations to ensure the IT staff in Investment Owners and Working Groups are able to utilize a wide variety of raw data sources, enriched using common patterns for ease of use in low-code/no-code platforms. Specific goals of data fabric are: identify and fill data gaps, automate contextualization, preparation and enrichment of data at the point of ingestion to expedite AI/ML deliveries. This contributes directly to “Speed and Scale”.

3.2.2 Evangelize technology initiatives across NSF’s vast network of universities and partner institutions with efforts such as providing guidance, reference architectures, blueprint solutions, mentorship etc. This is critical considering the success of “Speed and Scale” at NSF is intertwined with that of its vast network of universities and partner institutions. Please refer to recommendation #4.3 for additional responsibility of “Technology Innovation” team.

4. Provide leadership in the creation, growth, and support of external partnerships, and communities of those partners, that increases the impact from the partners’ joint strategic outcomes, especially by streamlining deployment of technology from these partnerships.

4.1 Share and support best practices and establish technology deployment networks to accelerate the transition of NSF-funded research results to the U.S. commercial markets. For certain types of research, it may be possible to include an assessment of deployment value within the review process.

4.2 Expand the creation and use of scientific data, especially through new models for curating derivative datasets from fundamental research activities, to make publicly funded data broadly available. Data is a new “currency” in US competitiveness. NSF has an opportunity to establish leadership of derivative dataset use through demonstrating their value and encouraging university research partners to explore their deployment.

4.3 Collaborate with partners to develop secure, cross-institute IT platforms to meet the requirements of growing and increasingly diverse partnerships and communities. Such a two-way collaboration can result in modern technology at both NSF and its partner institutions. This effort can be particularly valuable in meeting the needs for secure data and information access. For example, moving from authentication by a “home” environment to a focus on the user’s individual identity using next-generation secure access, trust, and user validation systems and

protocols will be critical. In this effort, NSF may provide guidance, reference architectures, and/or blueprint solutions as part of such a mentorship initiative.