

**National Science Foundation
Advisory Committee for Business and Operations
January 2022 Meeting Minutes
January 21, 2022**

Attendance:

Tilak Agerwala	Vice President, IBM (retired)
Benjamin Brown	Director, Facilities Division, Advanced Scientific Computing Research, U.S. Department of Energy, Office of Science
Shawn Brown	Director, Pittsburgh Supercomputing Center, Carnegie Mellon University; Vice Chancellor for Research Computing, University of Pittsburgh
Robert Dixon	Consultant, Higher Education Management
Sabrina Ellis	Vice President and Chief Human Resources Officer, New York University
Larry Koskinen	Chief Risk Officer, U.S. Department of Housing and Urban Development (retired)
Rachel Levinson	Executive Director, National Research Initiatives, Arizona State University
David Mayo	Director, Office of Sponsored Research, California Institute of Technology
Kim Moreland	Associate Vice Chancellor and Director, Research and Sponsored Programs, University of Wisconsin – Madison
Robert Nobles	Vice President for Research Administration, Emory University
Theresa Pardo	Associate Vice President for Research, Special Assistant to the President, University at Albany
Karin O'Leary	Associate Partner, IBM Consulting Fellow, IBM Center for The Business of Government
Gregory Parham	Senior Advisor, U.S. Department of Agriculture
William Valdez	President, Global Innovation Associates LLC
Pamela Webb (co-chair)	Associate Vice President for Research, University of Minnesota
Maureen Wylie (co-chair)	Federal Chief Financial Officer (retired)

Co-Chairs Pamela Webb and Maureen Wylie (this is Maureen's first BOAC meeting serving as co-chair) asked the five new members to introduce themselves: Shawn Brown, Sabrina Ellis, Robert Nobles, Karin O'Leary and Gregory Parham.

This BOAC is a special one hour off-cycle meeting where the group will first hear an introduction on the purpose and background of the subcommittee and then the subcommittee members will present their recommendations. At the end of the meeting, members will vote to accept, reject, or send recommendations back to the subcommittee for revisions.

Subcommittee on NSF's Information Technology and Enterprise Architecture Strategy

Presenter and Discussant: Tilak Agerwala, BOAC, Subcommittee Chair, Vice President, IBM (retired)

Formation of Subcommittee

Prompted by the Office of Management and Budget (OMB) Memorandum M-17-22, titled "Comprehensive Plan for Reforming the Federal Government and Reducing the Federal Civilian Workforce," NSF conducted an agency-wide brainstorming process in spring 2017 that resulted in an approach called "Renewing NSF," which consisted of four broad areas focused on re-imagining the agency's future. The first tenet, "Making IT Work Even Better for All," addressed IT within NSF and deals with continuing funding for cutting-edge science, engineering, and education research, to exploit leading-edge information technology solutions that can adapt easily and quickly to NSF's needs.

One of the Bold Steps under the tenet "Making IT Work Even Better for All" notes that NSF should "Routinely seek advice from industry leaders on NSF IT Strategy." This Bold Step is the impetus for the creation of the subcommittee.

During the March 10th, 2021, BOAC meeting, NSF asked the BOAC to support formation of a subcommittee of external industry experts to give input on NSF's IT Strategy and related Architecture. The BOAC agreed.

Background

The subcommittee was formed on October 29, 2021 and was charged to prepare a bulleted list of recommendations regarding the direction of IT at NSF, and/or suggestions for leading-edge technologies on the horizon for potential implementation in the next budget year. Upon endorsement by BOAC, these recommendations will inform NSF's Capital Planning and Investment Control (CPIC) Board as they identify those ideas to pursue in the upcoming FY 2024 budget year.

The subcommittee has reviewed the NSF IT Strategy and related Architecture to provide informed recommendations for changes in process, direction, and/or potential investment in new and emerging technologies.

Subcommittee Members

- Tilak Agerwala; Vice President, IBM (retired), Subcommittee Chair, BOAC Liaison
- Suzette Kent; CEO, Kent Advisory Services; Former Federal CIO for the US
- Viji Krishnamurthy; Senior Director, Product Management, Oracle Cloud Infrastructure AI services
- Lee Cheatham; i2i Advisers, Director of Technology Deployment and Outreach, Pacific Northwest National Laboratory (retired)

Recommendation Report

Introduction: Tilak Agerwala; Vice President, IBM (retired), Subcommittee Chair, BOAC Liaison

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 NSF 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 Artificial Intelligence/Machine Learning (AI/ML), Low Code/No Code, Distributed Ledger Technology (DLT), Robotic Process Automation (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).

***Introduction Notes:** Tilak described recommendations to be discussed and briefly introduced each subcommittee member. He emphasized recommendations are not prescriptive, but they would emphasize areas that could advance NSF's need for speed and scale. The subcommittee found NSF's strategy is clear and comprehensive. In addition to IT strategy, he mentioned other Renewing NSF efforts in a positive light and indicated NSF was doing a good job overall with strategic goals.*

Recommendation 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.

Presenter: Tilak Agerwala; Vice President, IBM (retired), Subcommittee Chair, BOAC Liaison

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).

Recommendation 1 Notes: *Tilak explained Recommendations 1 and 2 are related. They focus on incremental improvements, use of the right technologies, and linking tech activities, capabilities, and strategic objectives. He added Recommendation 1.1 is comprehensive, and we need to think about how multi-year plans address progress across the eight IT portfolios to make progress on the strategic goals. Tilak also explained the need to continually gather internal and external customer experience data, so we can understand the effectiveness of the tools and our IT investments.*

Recommendation 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.

Presenter: Suzette Kent; CEO, Kent Advisory Services; Former Federal CIO for the US

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.

Recommendation 2 Notes: *Make sure bold IT steps can support operational capacity and pace. Emphasized the importance of adjusting and making tradeoffs throughout the process. NSF has a great process for submitting ideas, but we need to make sure there is transparency about what is selected and why. Need to make sure our IT governance structure is prepared to handle bigger and more frequent changes.*

Recommendation 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”.

Presenter: Viji Krishnamurthy; Senior Director, Product Management, Oracle Cloud Infrastructure AI services

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.

***Recommendation 3 Notes:** In order to achieve speed and scale in the midst of emerging technologies, implementation of a data centric process is key. Data sources should be available to members of IT projects across NSF. The technology innovation team should be accountable to the CIO – NSF is taking on a lot of emerging technologies so NSF can achieve speed and scale.*

Recommendation 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.

Presenter: Lee Cheatham; i2i Advisers, Director of Technology Deployment and Outreach, Pacific Northwest National Laboratory (Retired)

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.

Recommendation 4 Notes: *Lee emphasized partnerships are critical to NSF's success. The exchange of information with our partners allows us to learn and provide information that helps with change. Cross-institution of IT platforms is needed to facilitate collaboration.*

Discussion/Q&A

Pamela Webb thanked the subcommittee members and kicked off the discussion part of the meeting. Reiterated the BOAC will approve, reject, or send recommendations back to the subcommittee for revision.

Data Fabric: Viji Krishnamurthy helped the group understand the concept of “data fabric” by explaining this is an architecture in IT deployment that enriches data by merging it together. The process helps transform data into business insights and includes a common data framework where various data (e.g., proposal data and proposal evaluation) are made available to the majority of IT staff. This enhances the usability of data already collected so that IT professionals can both access the data already collected and work already done and further it. This in turn contributes to speed and scale.

Scope of IT Strategy: A member asked about the scope of NSF’s IT strategy. Is this NSF’s operational IT or does it include NSF research spectrum as well? Chezian Sivagnanam (subcommittee Designated Federal Official), Lee Cheatham and Tilak Agerwala contributed to the group by indicating that the focus of NSF’s IT infrastructure is to support NSF’s operations – an obligation which OMB expects all agencies to do. Examples include mapping objectives to strategic goals, through authority of the CIO, and tying to the roadmap for NSF’s IT infrastructure. The details about how this is operationalized into various roles within NSF will be handled separately within the Foundation after these recommendations are considered. It is not the intent of these recommendations to be prescriptive in that way. The focus of these recommendation is not intended to include research data generated by PIs (e.g., in the research mission). BOAC members were also informed that it is typical for the IT operations team to be different than the technology innovation team. The innovation team investigates emerging technologies before the operations team – it is more forward looking. Emerging technologies that fit into NSF goals can then go forward to the operations team to see if they can or should be deployed.

Several members indicated that they would encourage NSF to undertake additional thinking about aligning the efforts of the IT innovation team and the IT operations team, possibly with formal

accountability or with a liaison assigned, and also to continue to work to ensure alignment/cohesiveness across the recommendations (e.g. recommendations 2.2 and 2.3). It was noted that it is important to make sure roles and responsibilities are clear and documented between these two teams, that handoffs are clearly prescribed and accountability for action is clear, that there is a raised bar in terms of mutual understanding between those teams, and that decisions to implement/scale are chosen to focus on selecting those technologies offering the greatest impact.

Vote

VOTE OF BOAC ON SUBCOMMITTEE RECOMMENDATION: APPROVAL

Pamela Webb asked committee members to vote on recommendations. One member (Tilak Agerwala) recused himself from the vote. All other members were in favor. Pamela reported that BOAC accepts the recommendations, and thanked Tilak and the Subcommittee for their work.

Tilak Agerwala and Pamela Webb made closing remarks and thanked the subcommittee for their hard work, and all members of BOAC for their time in carefully considering the recommendations.