

POLICY BRIEF:

The Congressional Futures Office

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“...for every force there is a counterforce. For every giant step we take for mankind, we seem inexorably to slip backward a little. For every button we push on the gigantic game board of science, another seems to pop up elsewhere on the board.”

Russell W. Peterson, 1979
Director, Office of Technology Assessment

“The Congressional Futures Office: A modern model for science and technology expertise in Congress” interrogates the widening gap between responsive lawmaking in Congress and the deepening complexity of advancements in science and technology (S&T).

It finds that certain weakened capabilities have atrophied the legislature’s *absorptive capacity*, or the ways by which it recognizes the value of, assimilates, and makes use of knowledge outside of itself. We propose the design of a new internal body – the Congressional Futures Office – as an optimal response among a set of considered options.

In this companion policy brief to the full-length report,¹ we describe the observed problem; we present our most relevant findings regarding the factors handicapping Congress and the limits of currently proposed solutions; and we briefly outline a new recommended approach.

Observed Problem

Federal lawmaking is failing to adequately address issues of public interest associated with S&T advancements.

A 2019 report by the Congressional Research Service (CRS) anticipates ten categories of major S&T issues likely to confront the 116th Congress (Appendix 1).¹ Each category includes a basket of pressing policy topics ranging from the proliferation of advanced gene editing tools to emerging crises in water quality and scarcity. This sample of fast-moving and technically complex issues is one with profound social, economic and security implications for the U.S. We observe that lawmakers have increasingly struggled with their complexity.

As a result, devised policies (or an absence of policies) are generating unintended consequences, permitting large-scale waste of federal dollars, and stalling regulatory overhauls necessary for U.S. competitiveness. Legislative responsiveness to the challenges associated with S&T issues has deteriorated as the complexity of S&T issues has considerably deepened, with far-reaching implications. See Appendix 2 for three brief illustrations.

¹ See Belfer Center for Science & International Affairs at <https://www.belfercenter.org/publication/congressional-futures-office>

Key Findings

An overview of the report's three most important findings is featured below. See Appendix 3 for details regarding the research methodology.

Finding #1: The critical issue facing Congress is not a lack of technical expertise but a lack of absorptive capacity.

Congressional members and staff are inundated with information from both external and internal sources. Controlling for inflation, lobbying expenditures experienced a six-fold increase between 1983 and 2013.² The technology industry is now a significant driver of this growth: in 2016, the five largest technology companies in the country together outspent all but two lobbying groups.³ The presence of civil society actors has also swelled. There are presently over 1,800 think tanks in the United States,ⁱⁱ a number that has more than doubled since 1980.⁴ Our analysis finds that more than half of these may produce and distribute S&T-related content.⁵

Congress is also awash with information produced 'internally'. In 2017, for example, members and staff accessed CRS reports and other research products more than 658,300 times; 8,600 congressional participants attended CRS seminars and training programs; and CRS produced 11,100 reports and other products requested by Congress.⁶

Internal capabilities have been unable to cope with this surfeit of information.

Borrowing from the management literature, three dimensions of capability constraints (resources, processes, and priorities) offer a lens by which to organize and analyze Congress's organizational capabilities for legislating on complex, technical topics.⁷

Weaknesses across these dimensions suggested an impaired ability to intake and make use of external knowledge.

- **Resources within Congress (both financial and people) have significantly diminished.** Congress has grown its own operating budget by only 9 percent in real terms – versus 200 percent growth in the executive branchⁱⁱⁱ – between 1976 and 2016.⁸ We find that almost all growth (in real terms) in congressional appropriations over the past two decades is attributable to non-legislative activities such as operations and maintenance of the Capital Complex (Appendix 4.1).⁹ Meanwhile, resources for support bodies have been slashed. Between 1985 and 2015, staffing at CRS and GAO have been reduced by 29 percent and 41 percent, respectively. As with support bodies, congressional committee staff have declined by 35 percent over the same period. Committees with S&T jurisdiction have experienced even sharper declines: 42 percent for both the House and Senate science committees (Appendix 4.2).¹⁰
- **Processes for transforming expertise into legislation are frequently circumvented.** The systematic use of expertise has traditionally been the realm of committees. As polarization has increased, committees have geared information-gathering towards 'partisan warfare' and away from devising policy solutions, diminishing the demand for expertise: a "fundamental change in how committees are processing information."¹¹ Hearings, an interactive and deliberative mechanism of the policymaking process, have also substantially decreased: the House held an average of 6,000 hearings per year in the 1970s but only 2,000 in 2014.¹² Finally, decision making has shifted away from committees as party leadership has centralized legislative authority; the

ⁱⁱ The closest countries in terms of number of think tanks are China (435), the United Kingdom (288), and India (280).

ⁱⁱⁱ Includes 14 of 15 executive departments, excluding Department of Defense.

circumvention of traditional committee procedures has in turn further limited the use of expertise.¹³ In the 113th Congress, for example, roughly 40 percent of “big-ticket” legislation bypassed committees altogether.¹⁴

- **Partisan and present-focused priorities do not preclude the use of S&T expertise but constrain its usefulness.** More often than not, technical analysis is used “to justify action rather than provide rational appraisals.”¹⁵ In Congress, external expertise is commonly marshalled in service of partisan priorities, naturally limiting the influence of expertise to inform policy perspectives. In some cases, moreover, evidence suggests that expertise may exacerbate rather than alleviate partisan conflict, particularly with high-saliency and politicized issues.¹⁶ However, partisan priorities do not obviate the usefulness of external expertise. In more bipartisan environments, expertise may have a greater role in assisting policy formulation. Across Congress, the degree of partisanship varies greatly; in fact, many committees with S&T-related jurisdictions appear relatively ripe for bipartisan collaboration (Appendix 4.3).¹⁷ Still, given the tendency of partisan priorities to elevate near-term concerns, even S&T issues ripe for bipartisan attention are left off the congressional agenda if too abstract or long-term.

These weakened organizational capabilities have atrophied Congress’s absorptive capacity: its ability to recognize the value of new, external information, to assimilate it, and to apply it to desired ends.¹⁸ Absent adequate resources, strengthened process, and amenable priorities, Congress will continue to make inadequate use of the available expertise.

To make progress, *interventions must be focused on improving the information intake and processing capabilities of Congress, not just creating and delivering analysis.*

Finding #2: Existing internal and external resources are insufficiently equipped to address the issue.

External resources (e.g., industry, civil society, scientific associations) **are frequently not useful, lack credibility, and are difficult to mobilize effectively.**

- **Not useful:** Qualitative research suggests that from the perspectives of members and staff, information and analysis supplied to Congress is often not useful; it does not, as one member summarized, “address what I need addressed, even if it’s objectively good.”¹⁹ This is partly explained by the distance of external actors to Congress, making analytical actors poorly positioned to respond to the nuanced and day-to-day needs and evolving priorities of members and staff.
- **Lack credibility:** Large technology companies have expanded lobbying capacities to preempt or influence regulation, biasing their expansive sources of expertise.²⁰ Research further suggests that, while think tanks have swelled in number, their influence as a group has not grown commensurately.²¹ This is in part due to ideological biases²² – subjective leanings that may be increasing over time.²³ The regular sponsorship of think tank research by private sector actors is illustrative of these credibility challenges.²⁴
- **Difficult to mobilize:** The proliferation of technology centers in the U.S. beyond Silicon Valley,²⁵ the emergence of new centers of technology leadership globally,²⁶ and a declining share of federal funding of R&D²⁷ all suggest that S&T expertise is now very broadly distributed. Tapping into this expertise requires expansive networks that do not

currently exist within Congress. Additionally, the scientific community is relatively small in population,²⁸ dispersed in its organization,²⁹ and diverse in its interests,³⁰ limiting its effectiveness as a political constituency that might otherwise mobilize influential S&T expertise.

Congress’s existing internal support functions are limited in their S&T-relevant capacities to support policymaking given current mandates, methods, and products.

- **Congressional Research Service:** CRS provides a distinct set of services that are not well positioned for complex and forward-looking S&T topics. First, CRS’s approach “tends to be reportorial rather than analytical.”³¹ This is in part because CRS staff rely almost exclusively on written works to source information³² and do not actively engage in dialogue with external experts.³³ This considerably limits its ability to provide analysis in uncertain terrains – a defining feature of most emerging S&T topics. Second, CRS is an “existing repository of knowledge; it is not analyzing the future.”³⁴ However, analysis of frontier S&T issues cannot only rely on existing and widely-documented bodies of knowledge. Third, CRS is limited by a risk-averse culture.³⁵ Meeting the dynamic needs of Congress in relation to an evolving technical landscape will require a significant degree of experimentation that CRS may find intolerable.
- **Government Accountability Office:** GAO’s emphasis on S&T has evolved over many decades.^{iv} Traditionally, its focus has not been “on the implications of scientific discoveries or technological activities but instead on government

program implementation and finances.” In practice, that means the “bulk of GAO’s work is retrospective.”³⁶ In 2018, GAO, which unlike CRS produces much larger-scale products for Congress, completed 14 explicitly S&T-focused reports among a total of 633,³⁷ representing roughly 2 percent of its report work.³⁸ Most recently, in early 2019, GAO inaugurated the Science, Technology Assessment and Analytics (STAA) team. STAA may evolve with time but, at present, is not optimally suited to broadly improve S&T policymaking across the legislature. We offer an expanded analysis on pages 5-6 and argue that this effort represents a marginal approach to deeper institutional problems confronting Congress.

- **National Research Council of the National Academies^v (NRC):** NRC carries out studies principally for executive agencies. Utilization of the NRC by Congress, however, is difficult. A study must be “mandated in legislation and... implemented and paid for through appropriations to a federal agency” that will contract with the NRC.³⁹ Typically, no more than a few dozen studies are commissioned for each Congress.⁴⁰ Additionally, reports from the Academies are developed using consensus-style committees. As a result, they tend to be focused on answerable and narrower technical questions upon which consensus can in fact be reached^{41 42} – representing a limited spectrum of S&T issues facing Congress. Finally, the length of these reports and the time required to produce them replicate some of the weaknesses of GAO’s technology assessments (pages 5-6).

^{iv} GAO once housed a science policy staff that was eventually disbanded as a separate entity. Since then, scientific expertise has largely resided within the Applied Research and Methods Group. In 2002, however, GAO was directed by Congress to pilot a TA function inside the organization, later made into a permanent, albeit small, unit in 2008.

^v The National Academies comprises four entities: the National Academy of Sciences (NAS), the National Academy of engineering (NAE), the Institute of Medicine (IOM), and the National Research Council (NRC).

Finding #3: Currently contemplated solutions are unlikely to address these institutional challenges.

Congress previously had a body – the Office of Technology Assessment (OTA) – exclusively dedicated to providing S&T analytical support. OTA was embedded inside Congress, formally producing ‘technology assessments’ and informally engaging with members and staff on complex S&T issues.⁴³ Through rigorous analysis and frequent interactions with members and staff, OTA equipped Congress with objective and authoritative knowledge. OTA was defunded in 1995 after 23 years in operation.

Simply reinstating OTA, however, is not an appropriate solution to today’s problems. The limited usefulness of its products, an operating model no longer appropriate to the congressional environment, and its mixed political legacy together would blunt its efficacy if revived.

- **Products:** While OTA generated substantial value, the usefulness of its products faced legitimate criticisms. By the early 1990s, “a typical OTA assessment took 18 months to complete and cost... \$500,000 in direct expenses.”⁴⁴ While OTA gradually developed other complementary services,⁴⁵ lengthy reports remained its flagship product.⁴⁶ The length and time requirements of its products faced critiques by members and staff and would be even less appropriate for today’s fast-moving environment and heterogeneous congressional needs (see Appendix 5).^{vi}
- **Model:** OTA served a relatively narrow constituency within Congress, a consequence of its governance structure. The Technology Assessment Board (TAB), a bicameral and bipartisan body,

authorized OTA reports. “Virtually all requests made by TAB members” were authorized, with these requests typically reflecting their own committees’ priorities.⁴⁷ In fact, “about one-quarter of the agency’s studies were performed for committees chaired by one of its board members.”⁴⁸ In practice, OTA’s chief client was TAB, not members and staff broadly. This model would be unlikely to enhance information in-take and processing capabilities across Congress broadly.

- **Legacy:** OTA’s political legacy may handicap efforts to both reinstate the body and ensure its durability. Periodic efforts to reinstate funding for OTA have all failed to pass in Congress, with votes falling almost exclusively along party lines. Even if OTA were to be reinstated, a dearth of bipartisan support may leave it continually vulnerable. Defunding OTA was decided along party lines, leaving the agency with “political baggage.”⁴⁹ Any future intervention would most likely require broad bipartisan support and input to be viewed as legitimate and to survive.

Efforts to build OTA-like capacities at existing congressional support services exhibit limited potential for impact. As a recent approach, the creation of STAA at GAO addresses a narrow scope of otherwise expansive and heterogeneous congressional needs. Moreover, it does not fundamentally address Congress’s weakened capabilities.

- **Products:** Outputs typically mirror OTA-like products (e.g., large-scale TA reports), themselves of limited use in today’s environment, while planned future products indicate only marginal additions (e.g. briefings) to the existing STAA repertoire.⁵⁰ According to a current Senate staffer interrogating facial

^{vi} In an exhaustive analysis of congressional needs – where S&T expertise might play a direct and productive role – we find that over a dozen distinct needs throughout the

policymaking process are typically unaddressed or addressed insufficiently from the perspectives of members and staff. See Appendix 5.

recognition technology, “we’ve gotten GAO to initiate a study, but it hasn’t started yet. It will take at least 6-8 months to staff up the project... So I’m doing my own research for now.”⁵¹ These products, moreover, are not a strong reflection of congressional priorities, likely due to the narrow constituency served. As one analyst observed, prior reports by GAO have suggested “a narrow agenda relative to the wide-ranging major S&T issues facing Congress.”⁵²

- **Distance:** a lack of embeddedness within Congress is disadvantageous for addressing the nuanced institutional constraints weakening Congress’s capabilities to make use of external knowledge. The processes for interacting with Congress – e.g., GAO protocols for fielding and channeling formal requests⁵³ – do not require that it engage deeply with members and staff.^{vii} GAO’s distance from most day-to-day work of members, and its non-engagement with staff,⁵⁴ limits the body’s ability to strengthen congressional capabilities. STAA would require a significant break with GAO protocol to operate differently in relation to Congress and in turn broadly enhance its capabilities.
- **Mandate:** Investigating select S&T issues for Congress is a component part of a broader auditing-oriented mandate. In addition to providing technology assessments to Congress, STAA will also audit S&T programs at federal agencies, as well as launch an internal audit innovation lab “to explore, pilot, and deploy new advanced analytic capabilities, information assurance auditing, and emerging technologies that are expected to greatly impact auditing practices.”⁵⁵ However, the complex needs of Congress as they relate to S&T advancements are distinct from Congress’s oversight and auditing needs.

^{vii} For instance, unlike the experience of OTA, STAA and Congress do not informally enjoy ‘shared staff’ between the body and congressional committees.

The current debate between reinstating OTA or expanding resources for STAA is the wrong debate to be having. Neither (1) addresses the vast array of congressional needs documented in our work (Appendix 5), nor (2) sufficiently responds to the novel internal and external dynamics affecting Congress. We advocate that additional interventions could coexist with STAA, but that STAA alone is insufficient.

Recommended Solution

Congress should establish a new and deeply embedded internal support body better suited to Congress’s needs and its contemporary context. Strengthening Congress’s capabilities requires a reinvented model for integrating external expertise into the policymaking process. The rationale for such an approach is threefold:

- **Support bodies deeply embedded within Congress are better positioned to have an impact.** The effectiveness of expertise is affected by severe internal resource constraints, handicapped information-processing functions, and partisan, present-focused priorities. Non-embedded solutions will likely fail to traverse and respond to these institutional constraints. Moreover, the needs of members and staff are nuanced and difficult to ascertain at arms-length from the institution. Internal bodies are best positioned to learn through day-to-day engagement to identify opportunities where expertise may be most useful, and in what form.
- **Establishing a new body enables the design of a solution appropriate to the current problem and context.** Specifically, the design of a new body should reflect a calibrated response to

Congress's central problem of low absorptive capacity. Its mandate, strategy, operating model, and product suite decisions must be formulated accordingly. It should also draw upon the learnings and shortcomings of OTA and other support bodies; we offer a distillation of key learnings in the full-length report.

- **Creating an internal S&T support body is an opportunity to set a new standard for S&T policymaking.** OTA exemplified a standard-setting approach in 1972, inspiring other legislatures around the world to follow suit.⁵⁶ Congress should again engage its imagination for a novel era. Rather than simply reviving old solutions, or marginally expanding existing solutions in the face of dramatic and escalating S&T-related challenges, Congress should once again take bold steps to invest in itself and address its most problematic constraints.

Our report provides a detailed specification for a new support body – the Congressional Futures Office (CFO) – embedded within Congress (see Appendices 6 and 7 for an overview). This specification provides an actionable blueprint for its design and operationalization. Six features reflecting the most significant departures between our proposed design and the approach of STAA or a potentially-revived OTA are summarized.

- **CFO should be established with a 'problem-driven' mandate rather than an 'activity-driven' mandate.** Activity-driven mandates pre-determine what products to produce (e.g., 'technology assessments' mandated for OTA and STAA), whereas problem-driven mandates only articulate the problem to be solved. This approach permits needed experimentation. Specifically, CFO should be charged with "enhancing Congress's abilities to collect, process, and make use of technological and scientific knowledge."
- **CFO should address the proximate needs of members and staff.** We find that members and staff have an array of

S&T-related needs. Proximate needs are those that reflect immediate requirements of members and staff – for example, providing rapid technical analysis of draft legislation (see Exhibit 8 for detail). Given fast-moving congressional priorities, products that fail to address proximate needs are unlikely to create value for their intended audience. The majority of members' many decisions will not typically be enhanced by a two-year analytical report by STAA or OTA. See Appendix 9 for an overview of the proposed products.

- **CFO must serve a broad constituency of members and staff rather than narrow audiences** (e.g., party leadership, select committees). Services that can be provided to many members and staff are more likely to strengthen S&T capabilities within Congress broadly. In contrast, OTA and STAA deliver services based largely on seniority and to narrower congressional constituencies. Of note, OTA was easily defunded in 1995 in large part due to a failure to serve a broad congressional constituency, instead focusing exclusively on serving a handful of powerful committee chairs.
- **CFO should be led by an empowered Director rather than a board of party leaders.** Elected by a newly created bipartisan and bicameral Joint Committee on Science & Technology (JCST), the Director would have broad discretion in defining, managing, and adapting the new organization (see Appendix 10). Our research suggests that OTA's Technology Assessment Board (TAB) would suffer in today's polarized environment, for example, and that it would fail to give CFO needed flexibility to experiment and adapt to evolving congressional needs.
- **CFO should organize its staff by product offerings rather than by domains of topical or technical expertise.** Forming a product-centric organizational structure – for example, distinguishing research analysts from those responsible for the day-to-day

support of members and staff – will allow a new body to match talent to specific problems (see Appendix 11). In contrast, domain-centric structures used by OTA and STAA mirror that of universities, elevating the priorities of experts rather than congressional needs.

- **CFO should cultivate and leverage global networks as its primary source of expertise in lieu of in-house subject matter experts.** This will allow it to meet congressional demands with fewer resources, respond quickly to shifting priorities, and access expertise that is increasingly distributed, fast-paced, and global. In contrast, STAA is developing extensive technical talent in-house. Such an approach is expensive, creates organizational rigidity, and fails to consider the pace and distribution of today's S&T knowledge.

As of this writing, national headlines include: an IPO valuing a large technology company pursuing AVs at \$24.3 billion;⁵⁷ a White House directive to accelerate NASA's timetable for returning humans to the moon "by any means necessary";⁵⁸ a set of internet regulations proposed to U.S. policymakers by Mark Zuckerberg;⁵⁹ the second crash of a commercial Boeing jet after its software failed to receive a detailed review by the FAA;⁶⁰ a projection by DOE that China will have operationalized an exa-scale supercomputer – the world's most powerful – a year before the U.S.;⁶¹ the discovery of hacking risks to AI in healthcare that could generate significant fraud;⁶² and levee systems overwhelmed by flooding across the American Midwest,⁶³ to name a few.

The scale, speed, and complexity of S&T advancements are escalating, whether or not the nation's highest lawmaking body keeps pace. As the gap between the two widens, efforts to address Congress's constraints become more urgent. Efforts that fail to

improve congressional capabilities will also fail to improve legislative outcomes.

Just as S&T issues are big and complex, so too is Congress. Enhancing its abilities to intake, assimilate, and make use of external knowledge requires "knowing its inner workings intimately."⁶⁴ As one former technology advisor in Congress reflected, "big institutional problems require big institutionalized solutions."⁶⁵ The Congressional Futures Office presents one such institutionalized response.

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"Laws and institutions must go hand in hand with the progress of the human mind. As that becomes more developed, more enlightened, as new discoveries are made, new truths disclosed, and manners and opinions change with the change of circumstances, institutions must advance also, and keep pace with the times."

Thomas Jefferson, 1816

Appendices

Appendix 1 | Anticipated S&T issues in the 116th Congress

S&T Issue Category	Associated Policy Topics
Overarching S&T Policy Issues	Federal Science and Technology Policymaking Enterprise Federal Funding for Research and Development Disruptive and Convergent Technology America COMPETES Act Reauthorization Technology Transfer from Federal Laboratories Adequacy of the U.S. Science and Engineering Workforce Science, Technology, Engineering, and Mathematics Education Tax Incentives for Technological Innovation
Agriculture	Agricultural Research National Institute of Food and Agriculture and Economic Research Service Relocation Proposal Agricultural Biotechnology Cell-Cultured Meat
Biomedical Research & Development	National Institutes of Health and the 21st Century Cures Act The Food and Drug Administration: Medical Product Innovation Oversight of Laboratory-Developed Tests (LDTs) Stem Cells and Regenerative Medicine CRISPR: Advanced Genome Editing
Climate Change Science & Water	Climate-Related S&T Expenditures and Activities by the Federal Government Climate Change-Related Science GHG-Related Technology Research, Development, Demonstration, and Deployment Climate Change and Infrastructure Science and Technology for Adaptation and Resilience Carbon Capture and Sequestration Water
Defense	Department of Defense Research and Development
Energy	Reprocessing of Spent Nuclear Fuel Advanced Nuclear Energy Technology Biofuels Offshore Energy Development Technologies International Thermonuclear Experimental Reactor
Homeland Security	R&D in the Department of Homeland Security
Information Technology	Cybersecurity Artificial Intelligence Broadband Deployment Access to Broadband Networks and the Net Neutrality Debate Deployment of the FirstNet Network Emergency Alerting 5G Technologies The Internet of Things Digital Services Tax Evolving Technology and Law Enforcement Investigations The Networking and Information Technology Research and Development Program Quantum Information Science
Physical & Material Sciences	National Science Foundation Nanotechnology and the National Nanotechnology Initiative
Space	NASA Commercial Space Earth-Observing Satellites

Source: Congressional Research Service, "Science and Technology Issues in the 116th Congress", 6 February 2019

Appendix 2 | Consequences of inadequate S&T policymaking: brief illustrations

Unintended consequences: The Compliance with Court Orders Act of 2016 sought to regulate end-to-end encryption on cellular devices – in practice, disabling it – permitting easier access by law enforcement. The Act was met with a wall of resistance from scientists and technologists. A cybersecurity expert at the Stanford Cyber Initiative called the legislation “technologically tone-deaf,” critical that it assumed the existence of a “golden key” to user data available only to law enforcement, when in fact any “built-in means for accessing encrypted data can, and will, be used by the bad guys too.”⁶⁶ A group of fifteen computer scientist and security experts compiled a report to help explain the scale of its unintended consequences, or what the legislation would permit ‘bad actors’ to do.⁶⁷ One technology policy expert charged that it was “easily the most ludicrous, dangerous, technically illiterate proposal I’ve ever seen.”⁶⁸

Large-scale waste: The 2009 HITECH Act,^{viii} an effort to modernize the country’s antiquated patient medical records system,^{ix} allocated \$30 billion in incentives for providers who digitized their records.⁶⁹ By 2014, three-quarters of hospitals had adopted a basic Electronic Health Records (EHR) system – an eightfold increase since 2008.⁷⁰ However, digitizing health records matters only insofar as those records can be shared and deciphered among providers. As evaluations of HITECH have found, the Act failed to “prioritize ‘interoperability’ – the ability to transfer a medical file from one hospital to another.” Six years after the bill’s passage, less than a quarter of hospitals had received EHRs and integrated them into their own systems.⁷¹ U.S. Senators have publicly voiced concern that the promised cost savings have yet to materialize from the \$30 billion federal investment.⁷² A 2014 report by GAO faulted inadequate standards required to transmit EHRs between systems: an issue that more technically adept legislation could have addressed.⁷³

Outdated regulation: Congress’s failure to modernize the National Traffic and Motor Vehicle Safety Act of 1966^x to address the emergence of AVs has left both lives and U.S. competitiveness at-risk. According to researchers, the success of autonomous vehicles (AVs) in accomplishing goals of high public value – such as a substantial reduction in road fatalities – is contingent upon modernized regulation.⁷⁴ One transportation expert observes that there are currently “73 federal vehicle safety regulations that incorporate 257 standards, with half of them dating back before 1980. Nearly all federal auto safety regulations codify technical standards that are years, if not decades, out of date.”⁷⁵ Industry stakeholders are chiefly concerned that an inability to update the regulatory regime will cede U.S. industry’s “innovation edge” to Germany, Singapore, and China, where AV investments are also growing⁷⁶ and where regulatory regimes are being updated to accommodate the new technologies.⁷⁷

^{viii} Health Information Technology for Economic and Clinical Health Act

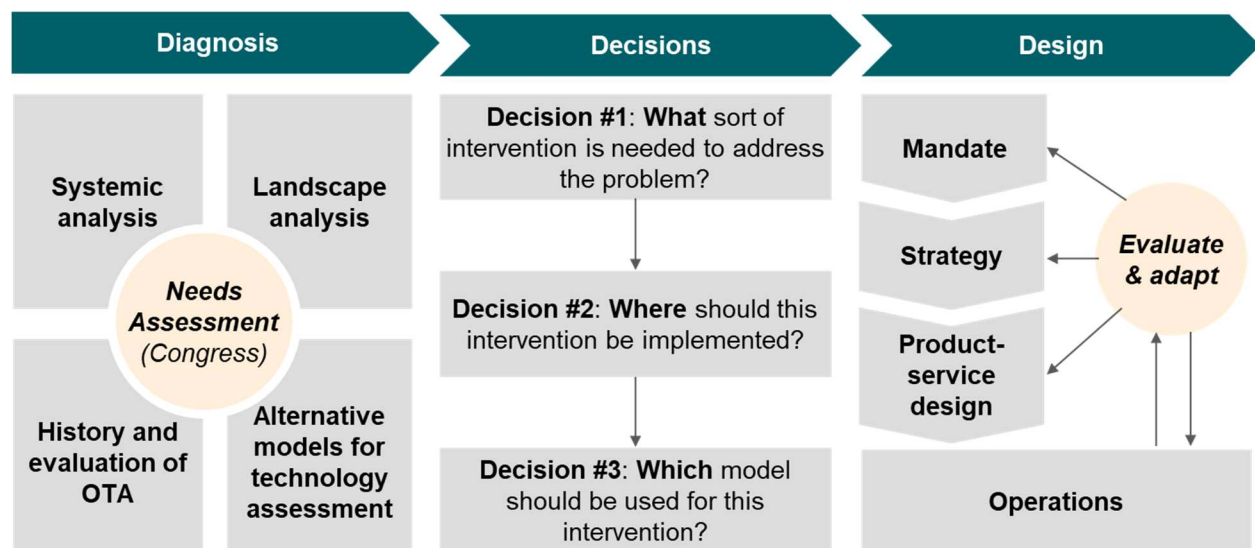
^{ix} The inability of patient records to move securely and seamlessly between healthcare providers has long placed large financial burdens on America’s healthcare system while harming clinical outcomes due to issues like information-related medical errors. See: Menachemi, N., & Collum, T. H. (2011), “Benefits and drawbacks of electronic health record systems,” *Risk management and healthcare policy*, 4, pgs. 47-55

^x In 2018, the American Vision for Safer Transportation Through Advancement of Revolutionary Technologies (AV START) Act stalled in the U.S. Senate, in practice killing the bill at the end of the 115th Congress.

Appendix 3 | Methodology

This report's work is structured as three phases: Diagnosis, Decisions, and Design.

- **Diagnosis:** Examines the intersection of technical expertise and policymaking in Congress. It spans an historical analysis of OTA, an assessment of contemporary forces external to Congress including influences across industry, science, and civil society, an internal assessment of expertise in Congress, and an investigation into the current expertise-related needs of congressional members and their staff.
- **Decisions:** Leveraging the Diagnosis, three sequential decisions are made to determine the approach taken to address the observed problem.
- **Design:** Specifies an internally cohesive mandate, strategy, product-service offering, operational model, and adaptive approach of an intervention linked to the Diagnosis.



A combination of primary and secondary sources was consulted in carrying out this work. S&T today threads itself through an expansive scope of public policy issues; the research required to investigate it proved to be necessarily as expansive.

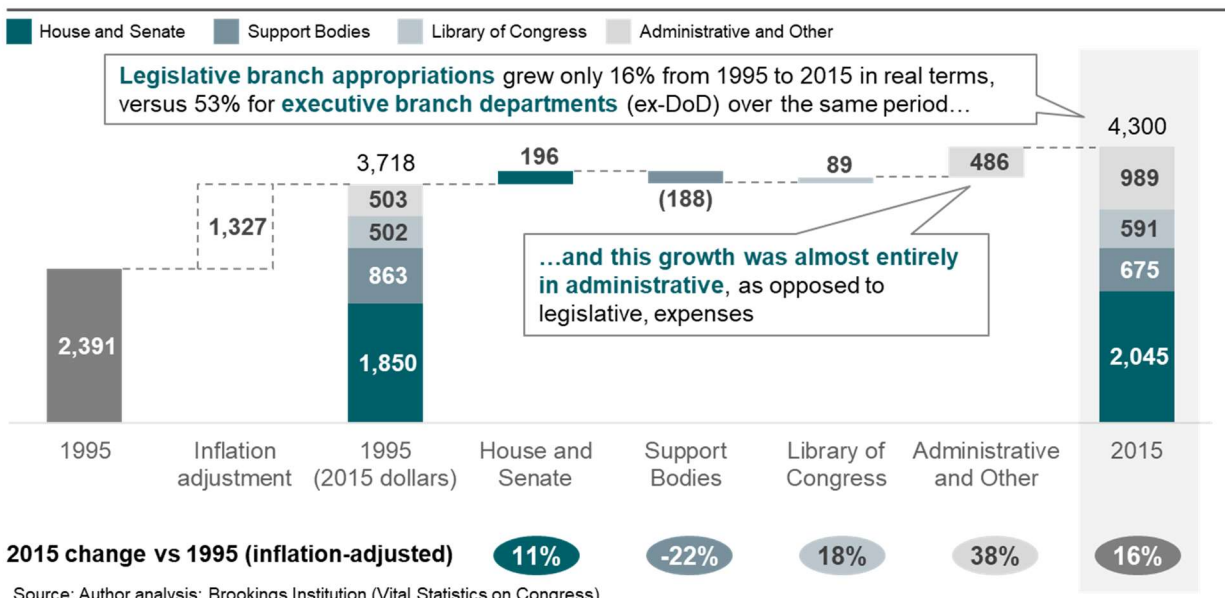
- **Primary research:** We conducted structured interviews with more than 40 individuals, a majority representing those formerly or currently in Congress; academics and civil society leaders (e.g., AAAS and FAS); and those formerly associated with OTA. Others were drawn from bodies that work partly or wholly in service of Congress (e.g., GAO, CRS, and NASEM); executive branch S&T-related bodies (e.g., OSTP and DOE); and technology industry executives. Other activities included analysis of datasets and sourcing of archival material.
- **Secondary research:** We drew on a large body of literature on the experience of OTA specifically and on technology assessment broadly, as well as on Congress and its relationship to technical expertise. Additionally, we reviewed recent research on the changing institutional dynamics within Congress. Finally, we borrowed and adapted select theories and frameworks from management and organizational design literature.

Appendix 4 | Selected analyses of congressional resources and priorities

4.1) Minimal growth in legislative appropriations, 1995-2015

Legislative branch appropriations

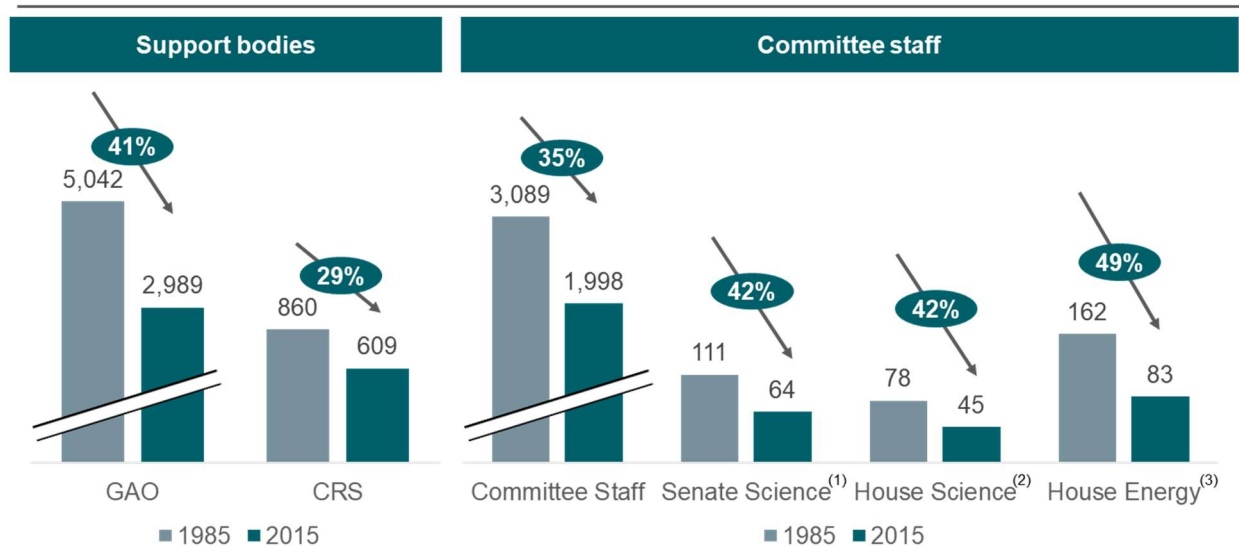
\$ millions



4.2) Decline in congressional S&T resources, 1985-2015

Staffing by type of congressional resource

Number of staff

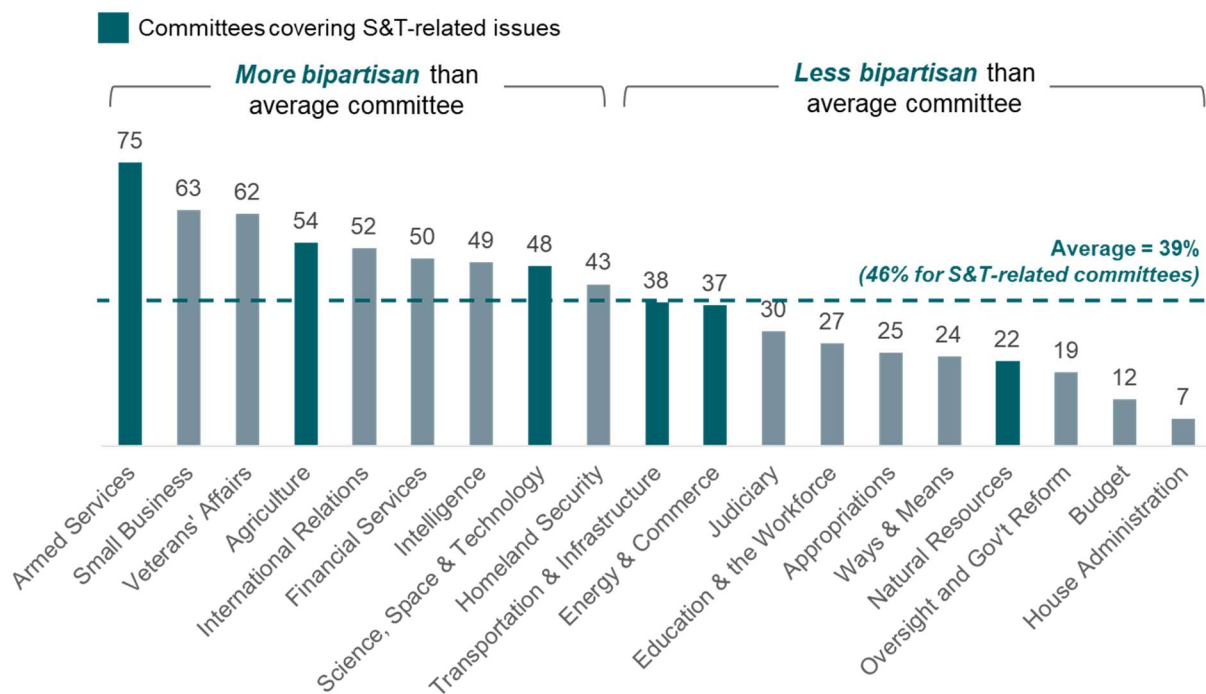


Source: Author analysis; Brookings Institution (Vital Statistics on Congress)

(1) Senate Committee on Commerce, Science, & Transport; (2) House Committee on Science, Space, & Technology; (3) House Committee on Energy & Commerce

4.3) Relative partisanship across committees

Minority party voting to report legislation to full House, 104-114th Congress
Percentage of minority party members



Source: Author analysis; Committee reports; LegBranch

Appendix 5 | Identifying S&T-related congressional needs

Members and staff have an expansive set of needs as they relate to S&T expertise. As an organizing approach, we considered the specific ends that members and their staff hope to accomplish. We refer to these specific ends as “jobs-to-be-done” (or simply “jobs”). Policy analytical products are often developed with the agenda of the author in mind, not the needs of the user. However, analyses and reports are not ends to themselves. Rather, they fulfill specific jobs. Until congressional staff have a job to “hire” it for, it will not be used. Interventions to improve S&T-related policymaking must therefore address one or more specific “jobs”.

Identifying these specific “jobs” makes it possible to pinpoint where S&T expertise may be relevant, the places members and staff currently look to “hire” expertise, and where opportunities for improvement exist. We identified 32 individual jobs extending across 10 steps in policymaking processes. Out of these 32 jobs, 17 involving S&T expertise are not being done well or are only being done well sometimes. Illustrations of such jobs (5.1) and a summary of the assessment (5.2) are included below.

5.1) Illustrations of S&T-related jobs currently not being done well

Cultivating Networks

Offices across Congress specialize in issue-areas, serving as distributed sources of internal expertise. As a former LD commented, “when we needed to know about PEPFAR, or about the PATRIOT Act, we knew which offices to call for information.”⁷⁸ Offices also develop their own networks of expertise outside of Congress. These informal networks are called upon frequently. However, they are typically patchwork, failing to reach deeply into S&T communities of expertise; they are not always responsive to the timelines of congressional needs; and they tend to favor seniority, as more junior members generally have more inchoate networks.

Assessing Credibility

Consistent with much of the literature on credibility evaluation and cognitive heuristics, members and staff describe relying on regular ‘trusted’ sources in lieu of interrogating the credibility of individual pieces of information produced by that source. Members and staff are also highly time-constrained, often exhausted, and typically lack technical expertise themselves. These constraints limit their capacities to assess the credibility of technical information. While some sources are regarded as nonpartisan and highly credible, such as CRS, many others that members and staff acknowledge may have some bias are nonetheless regularly consulted, including for complex S&T-related issues, in the rapid day-to-day of congressional work.

Searching for Problems

An LD, who holds a personal interest in a particular emerging technology, dedicated time last year beyond his regular responsibilities to learn about issues related to its regulation. The technology had not yet been broadly discussed by Congress and was, according to him, not on any other office’s agenda. He hoped to change that, and in the process make his principal a go-to expert on the issue. Learning about the full scope of the technology’s social and economic implications, as well as plausible policy approaches to supporting its innovation while mitigating its downsides, became a stress. As the LD commented, “it took too much from me.”⁷⁹ He also perceived that his effort was unique. “I don’t think others at my level are doing this... People here are managing the day-to-day.” Scanning the horizon for frontier S&T issues is not among most day-to-day activities. For those who choose to take an interest in emerging technologies, their capacities to comprehensively analyze them are limited.

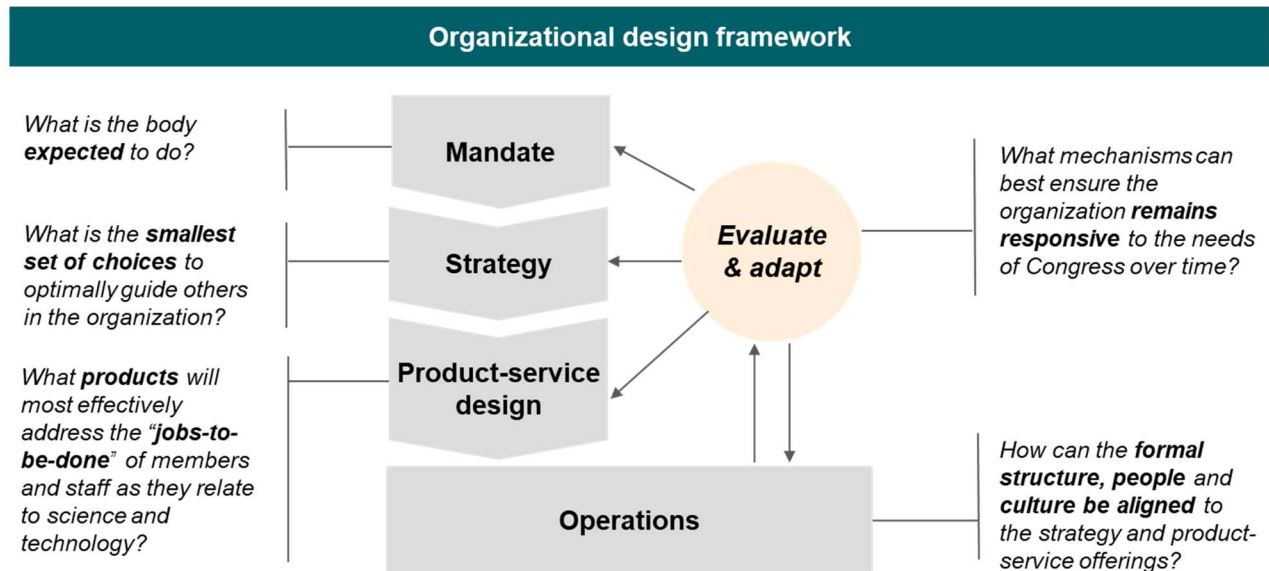
5.2) Evaluation of S&T-related jobs

	Activity	"Jobs-to-be-done" that requiring S&T expertise	Who does this job today?	Is it generally being done well?
Priority setting	1 Understand current demands	Search for problems across relevant constituencies	Lobbyists, staff	No: Information from lobbyists and interest groups may crowd out smaller voices, failing to incorporate broadly distributed S&T knowledge
		Assess credibility of what is learned	Staff	Sometimes: Staff may develop skills over time but are ultimately vulnerable to bias; frequent staff turnover results in loss of expertise
	2 Anticipate future policy problems	Identify future issues potentially warranting policy attention	Think tanks, GAO (recently)	No: Policy priorities driven primarily by short-term interests with less time spent 'looking forward' ("Washington runs on a two-day news cycle")
		Develop questions for further investigation	Lobbyists, staff, personal networks	No: Lack of technical expertise can make it difficult to know the right questions to be asking
	3 Develop legislative priorities	Assess the magnitude of the problems identified	Staff	Sometimes: Proximity to constituents facilitates understanding of potential impacts
Policy development	4 Collect information and expertise	Get up to speed on current status and history of the issue	CRS, staff, personal networks	Yes: CRS develops reports on the legislative history of various issues; staff engages personal and internal networks of staff to acquire baseline knowledge
		Develop baseline technical literacy	CRS, staff, personal networks	Sometimes: Some basic primers on technical topics from CRS exist but limited in breadth; existing resources (e.g., online search) not developed for policy-oriented audiences
		Cultivate and maintain networks of expertise	Staff	No: Networks can be difficult to maintain, time-consuming to develop, and difficult to call upon on quick notice; creates a strong bias in favor of veteran members and staff
		Collect information from sources of expertise	Personal networks	No: Networks can be too narrow to provide full range of potential views; potential for influential staffers to drive party understanding of an issue
	5 Make sense of that information	Assess the credibility of the information provided	Staff	No: Time-constraints and lack of technical expertise leads staffers to rely on heuristics, like the source of information; risk of confirmation bias; CRS rarely engages outside experts
		Synthesize information into policy-relevant material	Staff	Sometimes: A primary responsibility of staff, who are time-constrained and are increasingly being pulled away from policy work and into constituent-facing activities
		Conduct policy analysis of options	Committee staff, think tanks, CRS	No: Many external sources for policy analysis but quality and credibility are highly variable; internal capacities to conduct rigorous analysis are constrained (e.g., technical skill, competing priorities like constituent work)
Governance	7 Mobilize other lawmakers	Build credibility for the desired solution	Members, staff, personal networks	Sometimes: Potentially constrained by lack of collective understanding of what constitutes "credible" evidence; may leverage networks to pull in new evidence
	8 Vote on legislation	Understand key terms in the bill	Committee staff, personal networks, CRS	Yes: Committee may supply overview memos alongside legislation; otherwise, staffers leverage internal networks (e.g., offices of members that are domain experts)
		Assess credibility of the analysis	Staff, networks, think tanks	Sometimes: Existing resources (CRS, GAO) rarely perform such functions; public comments period on legislation may fill this role
	9 Monitor and oversee executive agencies	Identify issues requiring attention	Media, industry, committee staff	Sometimes: Statutory protocols and structures create mechanisms for issues to be surfaced; external groups also surface issues
		Craft information requests from relevant agency officials	Committee staff, personal networks	No: Expertise needed to ask the right questions; potential conflict of interest between agency experts and oversight activities
		Assess the credibility of the information provided	Committee staff	No: Most staff lack the technical training; potential conflicts of interest between agency experts and oversight activities
		Search for and evaluate potential remedies	Committee staff, GAO, CBO	Sometimes: Resources exist but solution-set limited by breadth and depth of networks
	10 Engage with constituents	Evaluate impact of policy on constituents	Staff	Yes: Proximity to constituents facilitates understanding of potential impacts

Source: Author analysis, interviews

Appendix 6 | Design Framework: Congressional Futures Office (CFO)

The CFO model is comprised of five interrelated parts. Each part, visualized below, identifies a necessary component to operationalize the body in response to the challenges identified by the report. Taken together, the components are intended to form a *tightly aligned system*. Key features of the design are briefly summarized in this brief, with a full specification detailed in the full-length report.



Appendix 7 | Recommended design of CFO

Mandate	CFO should be established to enhance Congress's abilities to collect, process , and make use of technological and scientific knowledge	
Strategy	Prioritizing the proximate needs of a broad congressional constituency through open-ended product-service design and expansive networks of expertise under partisan constraints	
Product-Service Design	<p>Products are designed in response to identified needs: the proximate challenges members and staff face ("jobs-to-be-done") relating to S&T expertise across policymaking</p> <p>Product prioritization and design considers each product's potential to build absorptive capacity and likelihood to be valued by a congressional audience</p>	
Operations	Governance	Led by an empowered Director , selected and authorized by a newly-established Joint Committee on Science & Technology (JCST)
	Structure	Organized according to type of products , rather than topical domains, with deliberate interdependencies between product groups
	Priorities	Director meets congressional demand under resource constraints through demand management, supply management , and topic selection
	People	Bias towards hiring problem-focused experts , as opposed to subject-matter experts, on permanent bases while utilizing flexible structures to involve topical expertise as-needed
	Culture	Culture of risk-tolerance and rapid experimentation developed through formal structures, choice of Director, and operational decisions
Evaluation & Adaptation	Rigorous internal assessment mechanism facilitating broad communication of the value generated by CFO, with metrics aligned to the motivating values of different groups	
	Rapid learning and experimentation through intimate access and daily interactions with congressional members and staff	

Appendix 8 | Prioritization of S&T-related jobs

We evaluate ‘jobs’ along two dimensions: the value congressional members and staff would place on that job being done better (‘importance to audience’) and the impact such an improvement would have on policymaking (‘potential to build absorptive capacity’). Both dimensions are critical to consider, as doing work that fails to build capacity will have little impact, while doing work that Congress does not want risks positioning the body as irrelevant to members and staff, making it vulnerable. What emerges is a two-dimensional view of S&T-related jobs (see 8.2 below), each falling into one of three broad categories:

1. **‘Win-wins’** are jobs of high importance to a congressional audience with high potential to build absorptive capacity if addressed. These jobs should be considered the highest priority for product development as they do not require a trade-off between congressional interest and potential impact.
2. **‘Constituency-builders’** are important jobs from the perspectives of members and staff but with less potential for enhancing absorptive capacity. This may be the result of limited relevance to the policymaking process or because the job is already being done well at least sometimes. Developing products to address these jobs will build political support and legitimacy with the constituents for whom those products were developed.
3. **‘Capacity-builders’** are jobs that address some of the most binding constraints to absorptive capacity in Congress but may fail to generate interest from members and staff. This may be due to short-termism, lack of interest, or failure to recognize the problem to begin with. These issues are most closely related to Congress’s ability to identify important problems, collect and process high-quality expertise, and take action based on the findings. Thus, they will be critical to address if policymaking for S&T-related issues is to be improved significantly.

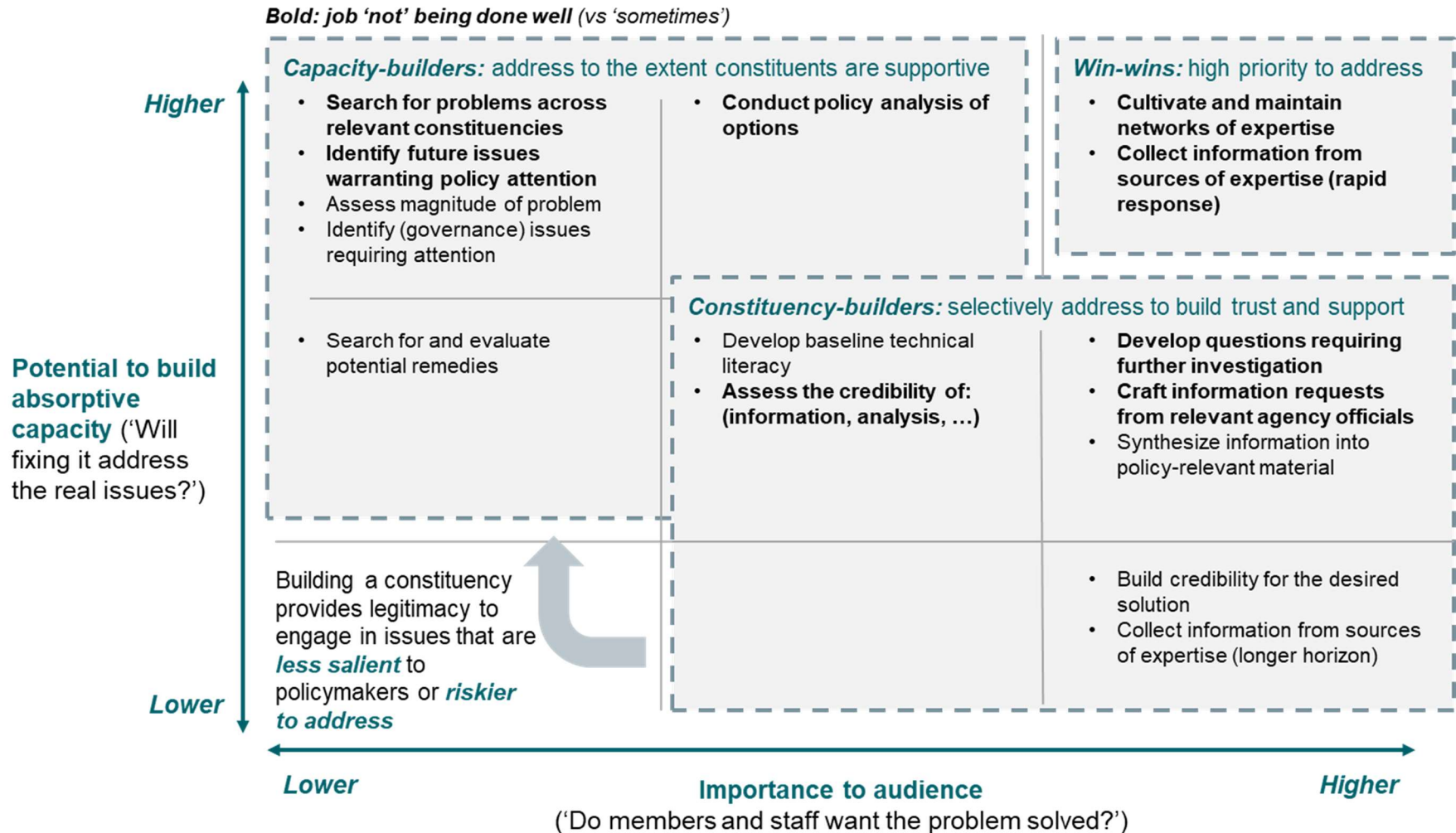
CFO’s effectiveness will be predicated on developing products addressing jobs across all three categories. **‘Win-wins’** involve no trade-off between importance to user and potential impact and should be priority. The other two categories must be pursued *selectively* and *sequentially*: **‘Constituency-builders’** provide the legitimacy and political cover to address **‘Capacity-builders’**, or critical issues that are less salient to lawmakers or politically riskier to address.

8.1) Jobs selected for product-service development

	Jobs prioritized for attention	Proposed product
Win-wins	• Cultivate and maintain networks of expertise	Futures ‘Network’
	• Collect information from sources of expertise (rapid response)	Futures ‘On-call’
Constituency builders	• Develop baseline technical literacy	Futures ‘Briefs’
	• Develop questions requiring further investigation	Futures ‘Support’
	• Craft information requests from relevant agency officials	
Capacity builders	• Collect information from sources of expertise (longer horizon)	Futures ‘Perspectives’
	• Conduct policy analysis of options	
	• Search for problems across relevant constituencies	Futures ‘Scans’
	• Identify future issues warranting policy attention	

8.2) Evaluation of jobs by needs and potential impact

This view provides a framework from which to select specific jobs for product-service development. Only jobs potentially involving S&T expertise that are not currently being done well, or only being done well 'sometimes', were included.



Appendix 9 | Summary of Recommended Product-Service Mix

	Product	Brief description	Rationale	Inspirations
Win-wins	Futures 'Network'	A living global database of science and technology experts, accompanied by a set of tools for convening customized groups for different purposes and guarding against capture by special interests	<ul style="list-style-type: none"> Gives Congress-wide access to a shared pool of global expertise, regardless of party affiliation or seniority Provides the expertise and networking tools needed to power all other 'Futures' products and services 	<ul style="list-style-type: none"> Profiles Research Networking Software (RNS) FDA "Network of Experts"
	Futures 'On-call'	Rapid technical commentary delivered (same-day) to Congress on high-profile issues of national importance as they enter the media spotlight	<ul style="list-style-type: none"> Provides a common base of technical understanding during times when member offices are most constrained 	<ul style="list-style-type: none"> Explainers (e.g., Vox, TheUpshot, WSJ)
Constituency builders	Futures 'Briefs'	Short memos (2-4 pages) providing members and staff only what they need to know to begin engaging on policy issues of technical relevance	<ul style="list-style-type: none"> Ensures basic technical and policy literacy Topical coverage can be scaled rapidly through product standardization and use of the Futures 'Network' 	<ul style="list-style-type: none"> POSTnotes, POSTbriefs (U.K. Parliamentary Office of Science & Tech)
	Futures 'Support'	Flexible and targeted investigative assistance that empowers members and staff in their own work rather than conducting research for them.	<ul style="list-style-type: none"> Builds upon existing policymaking processes rather than recreating them Leverage of Futures 'Network' can provide significant value with limited administrative support from CFO Form of support can be adapted based on user needs and capacity constraints 	<ul style="list-style-type: none"> N/A
Capacity builders	Futures 'Perspectives'	Policy analyses in extended memo format (8-15 pages) defining and framing the impacts of potential policy choices by incorporating the broadest range of technically-legitimate perspectives on an issue but providing no direct policy recommendations	<ul style="list-style-type: none"> Bring clarity and focus to debates involving technical issues, clearly separating issues of values and stakeholder preferences from technical considerations Provides a mechanism for rigorous policy analysis developed over a time horizon relevant for policymakers (1-3 months) 	<ul style="list-style-type: none"> N/A
	Futures 'Scans'	Brief 'red flag' report delivered bi-annually which flags important S&T issues for congressional attention . May take the form of a living dashboard or a 'pressing issues' list.	<ul style="list-style-type: none"> Leverage of Futures 'Network' facilitates broad participation in the process Can be delivered publicly to create pull from constituents to Congress to address the issues 	<ul style="list-style-type: none"> World Economic Forum's annual Global Risks Report Tech (Reilly) Top 10 List

Appendix 10 | Overview of CFO governance

Joint Committee on Science & Technology (JCST)	Structure	<ul style="list-style-type: none"> • Bicameral: equal membership from House and Senate • Bipartisan: equal membership from both major parties • Membership pulled from Senate Committee on Commerce, Science, and Transportation and House Committee on Science, Space, and Technology¹
	Roles	<ul style="list-style-type: none"> • Elect directors by a simple majority • Terminate directors by a simple majority • Authorize assessments (if, for example, CFO is requested to perform a TA function or if STAA responsibilities are subsumed by CFO) • Commission and deliver CFO annual reports to Congress
CFO Director	Roles	<ul style="list-style-type: none"> • CFO staffing • Product-service selection, development, and iteration • Organizational structure • Budget allocation for CFO activities

¹ Membership from multiple committees would undermine the benefit of tying CFO to a committee in each chamber that develops a vested interest in its protection, as with CBO and the Budget committees.

Five principal justifications support this arrangement.

1. Enhanced political legitimacy. Maintaining a bicameral and bipartisan method for selecting CFO's leadership through JCST enhances the political legitimacy of the body – compared, for instance, to a majority vote in one or both chambers, or selection by a party leader. Given contemporary threats to legislative support bodies, as well as the importance of political legitimacy conferred by TAB to OTA, we find this characteristic for CFO essential. Bipartisan and bicameral director selection is one chief mechanism to enhance it, signaling that CFO is equally in service of both chambers and parties.

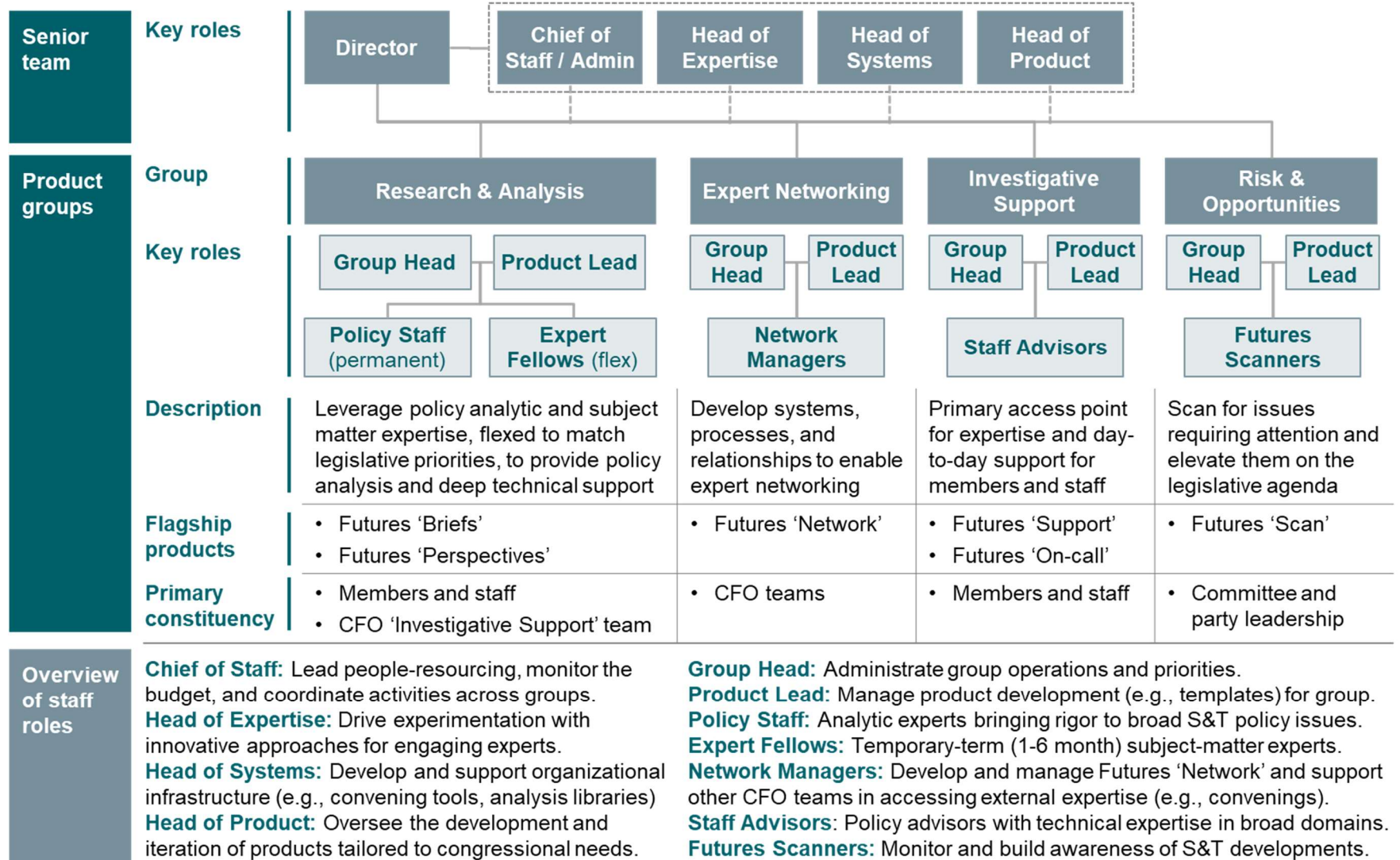
2. Insulation from centralized power. A body that performs basic oversight functions also functions to insulate CFO from the centralized power of party leadership. A layer of authority between party leaders and CFO's operations can help to buffer against polarizing partisan influence. (Additionally, unlike TAB, whose members were selected directly by party leadership, the joint committee's members are drawn from relevant standing committees.)

3. Greater demand across Congress. Greater operational control allocated to CFO prevents limited demand for its services. Because product offerings are not subject to direct authorization by a small group of members constituting the JCST, as was the case with TAB's assessment authorizations, CFO remains free to respond to a broad constituency across Congress. This arrangement decouples the governing body from the primary client. Unlike the OTA-TAB relationship, CFO would not operate primarily in service of JCST.

4. Buffer of internal support. Drawing JCST members from the House and Senate Science committees links the committees to CFO. Evidence from the CBO experience suggests that relationships with relevant committees help to insulate nonpartisan bodies from attempts to politicize or weaken them.⁸⁰ While the House and Senate Budget committees criticize CBO from time to time, they ultimately have a vested interest in protecting a body over which they carry influence.

5. Responsive to polarization. We argue that operationalizing TAB is a less feasible option today given Congress's hyperpolarization. While levels of polarization meaningfully differ throughout the institution, Congress is nonetheless characterized by "a near-permanent state of gridlock."⁸¹ Establishing a bipartisan board with direct control over CFO's regular operations – authorizing regular activities and associated expenditures – risks handicapping its ability to perform basic functions. This arrangement hedges against the risk of mirroring Congress's gridlock within the new body.

Appendix 11 | CFO organizational structure



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