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Regional Innovation: Federal Programs and Issues for Consideration

SUMMARY

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In recent years, Congress has increased support for economic development policies that incorporate a regional innovation systems (RIS) approach. RIS are composed of public and private sector partners, including educational and research institutions, investors, firms, economic development organizations, and entrepreneurs, among others. The RIS approach seeks to develop an ecosystem that fosters linkages between organizations so that a region may increase jobs, attract investment, and otherwise support economic development and related goals.

The rationale for increased federal involvement in developing connected, innovative regional economies is often associated with concerns that the United States is ceding its global technology and economic competitiveness position, in particular relative to China. Proponents of RIS policies also view the approach as a means of addressing regional barriers to innovation and entrepreneurship and strengthening the capacity of regional stakeholders. Some policymakers and analysts consider federal support for RIS as a way to help revitalize and restructure places and regional economies that have been impacted by globalization and international trade. Others emphasize the spread of innovation and bolstering innovation capacity in specific regions as a means of creating well-paying jobs and combating socioeconomic and regional disparities.

While federal involvement in RIS began to expand in the mid-2000s, multiple Administrations and Congress have continued to take action to increase the size and scope of federal investments in the approach. In July 2021, the Economic Development Administration (EDA, in the Department of Commerce) allocated $1 billion of supplemental funding for economic recovery activities to the Build Back Better Regional Challenge, a new grant initiative to support new or existing regional industry clusters. With the enactment of the CHIPS and Science Act (P.L. 117-167) in August 2022, Congress required the establishment of a number of new regional innovation programs, including the Regional Technology and Innovation Hubs program at EDA, the Regional Innovation Engines program at the National Science Foundation (NSF), and the Regional Clean Energy Innovation program at the Department of Energy (DOE). Through recent annual appropriations, Congress has also directed agencies to allocate funding to existing RIS programs such as EDA's Build to Scale, DOE's Energy Program for Innovation Clusters, and the Small Business Administration's Regional Innovation Clusters programs, among others.

In light of this recent legislation, the 118th Congress may consider options to expand the federal role in the development of RIS or make adjustments to the scope and scale of RIS assistance. Congress may also consider enhanced oversight of how new and existing regional innovation programs are implemented and how they are coordinated between federal agencies and across multiple levels of government. Congress may be interested in reviewing options to integrate the assistance and services provided by other federal programs, such as capital access, infrastructure, and existing research institutions, with certain RIS grantees. Coordination issues that may warrant further review include aligning RIS programs with other federal efforts designed to prepare a STEM-capable (science, technology, engineering, and mathematics) workforce, building the capacity of support organizations in under-resourced and disadvantaged communities, and expanding access to capital for entrepreneurs. In addition, Congress may seek ways to better evaluate the outcomes of strategies used to address socioeconomic and regional disparities when considering their possible use in other place-based development policies.

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Introduction

Economists widely recognize technological advancement as one of the most important sources of productivity growth and long-term economic growth.[1] The development of new technologies and the improvement of existing ones can contribute to the economy through the creation of new goods and services, new industries, and new jobs. Technological progress is achieved through innovation—a process that may involve, among other activities, idea origination, research, development, commercialization, adaptation, and diffusion.[2] Some technological changes may also negatively affect workers, businesses, and communities. For example, automation may contribute to regional job losses or businesses may close because their products become obsolete or they fail to keep up with advances in manufacturing techniques.

For decades, federal policies have supported innovation, including by providing financial assistance (e.g., grants and tax credits) for research and development (R&D); supporting science, technology, engineering, and mathematics (STEM) education, training, and workforce development; and facilitating public-private R&D partnerships, among others.[3] However, innovation and economic growth based on technological progress vary across the nation with high-income groups and a few selected cities receiving most of the economic gains.[4]

According to some experts, such demographic and geographic disparities in innovation and economic growth have the potential to seriously disadvantage the long-term competitiveness of the United States.[5] Policymakers and outside groups suggest that integrating place-based economic development policies with innovation policies may address concerns about competitiveness and disparities by strengthening innovation economies at the regional level. For example, the National League of Cities (NLC) states that "a fundamentally missing piece of federal research and economic policy is a focus on the innovation and entrepreneurial capacity of specific places."[6] State, regional, and local economic development practitioners have implemented place-based innovation strategies, like the ones described by the NLC, for decades.[7]

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[1] For an overview of concepts related to economic growth and factors that impact an economy's productive capacity, see "Economic Growth" in CRS In Focus IF10408, *Introduction to U.S. Economy: GDP and Economic Growth*, by Mark P. Keightley and Lida R. Weinstock, and CRS In Focus IF10557, *Introduction to U.S. Economy: Productivity*, by Lida R. Weinstock.

[2] According to a report by the Congressional Budget Office (CBO), "broadly speaking, an innovation is a new or significantly improved product or process." See CBO, *Federal Policies and Innovation*, November 2014, p. 5, https://www.cbo.gov/sites/default/files/113th-congress-2013-2014/reports/49487-Innovation.pdf.

[3] For more information on select science, technology, and innovation issues, federal science agencies, and associated CRS experts, see CRS Report R47373, *Science and Technology Issues for the 118th Congress*, coordinated by Frank Gottron and Jason A. Gallo.

[4] Robert D. Atkinson, Mark Muro, and Jacob Whiton, *The Case for Growth Centers: How to Spread Tech Innovation Across America*, The Brookings Institution and The Information Technology and Innovation Foundation, Washington, DC, December 8, 2019, https://www.brookings.edu/research/growth-centers-how-to-spread-tech-innovation-across-america/.

[5] Ibid.

[6] Scott Andes, *Place-Based Policies for America's Innovation Economy*, National League of Cities, 2019, https://www.nlc.org/wp-content/uploads/2019/11/Place-Based-Paper_1.pdf.

[7] Arizona's Science Foundation Arizona and Ohio's Third Frontier initiatives are examples of state support for the Regional Innovation Systems (RIS) approach and are noted in Mark Muro and Bruce Katz, "The New 'Cluster Moment': How Regional Innovation Clusters Can Foster the Next Economy," The Brookings Institute, Metropolitan Planning Institute, September 2010. Additional state-led RIS initiatives are listed in the following report: Karen G. Mills, Elisabeth B. Reynolds, and Andrew Reamer, *Clusters and Competitiveness: A New Federal Role for Stimulating Regional Economies*, The Brookings Institution, April 2008, p. 4, https://www.brookings.edu/wp-content/uploads/

In recent years, congressional interest in developing regional innovation systems (RIS) has grown steadily. Additionally, congressional support for RIS policies indicates further interest in ensuring that disparate regional economies have resources to enhance their RIS capacity.

This report describes the potential for RIS (and other place-based innovation policies) to facilitate the growth of firms, regional economies, and national economic and competitiveness interests. It also discusses the portfolio of federal programs and activities in support of regional innovation objectives, including a number of new regional innovation programs enacted across multiple federal agencies in P.L. 117-167, often referred to as the CHIPS and Science Act. The report focuses on RIS programs administered by the National Science Foundation, the Department of Commerce, the Department of Energy, and the Small Business Administration. Programs and other initiatives administered by the Departments of Defense and Labor and the National Institutes of Health are not included, but may contribute to regional economic development or support components of RIS (e.g., workforce development). Additionally, programs and other initiatives administered by federal regional commissions and authorities are not included; however, these entities are often involved in the implementation of regional economic development strategies.[8] Selected considerations for Congress with regard to the implementation and oversight of regional innovation programs and activities are presented at the end.

Regional Innovation Systems (RIS)

Over time, economic development policies at multiple levels of government have evolved to support more innovation- and technology-based economic development (TBED) strategies.[9] TBED strategies are based on the premise that—in addition to physical capital, human capital, and natural resources—innovation and technological advancement drive economic growth.[10] In other words, knowledge- and technology-based firms can be generators of new ideas, processes, products, or services, which then contribute to increased productivity and economic growth. Policymakers and economic development practitioners sometimes support TBED strategies, in part, because average wages for STEM workers associated with high-tech firms generally exceed those for workers at non-high-tech firms.[11] While TBED strategies emphasize growth associated

2016/07/Clusters-Brief.pdf.

[8] For more information on federal regional commissions and authorities, see CRS Report R45997, *Federal Regional Commissions and Authorities: Structural Features and Function*, by Julie M. Lawhorn.

[9] Organization for Economic Cooperation and Development, *Reviews of Regional Innovation, Regions and Innovation Policy*, 2011, p. 33. Technology-based economic development (TBED) is one of seven investment priorities of the Economic Development Administration (EDA, an agency in the Commerce Department) and is defined by EDA as "economic development planning or implementation projects that foster regional knowledge ecosystems that support entrepreneurs and startups, including the commercialization of new technologies, that are creating technology-driven businesses and high-skilled, well-paying jobs of the future." See EDA, "Investment Priorities," https://www.eda.gov/funding/investment-priorities.

[10] See "Economic Growth" in CRS In Focus IF10408, *Introduction to U.S. Economy: GDP and Economic Growth*, by Mark P. Keightley and Lida R. Weinstock.

[11] Brian Roberts and Michael Wolf, "High-Tech Industries: An Analysis of Employment, Wages, and Output," *Beyond the Numbers: Employment and Unemployment*, vol. 7, no. 7 (U.S. Bureau of Labor Statistics (BLS), May 2018), https://www.bls.gov/opub/btn/volume-7/high-tech-industries-an-analysis-of-employment-wages-and-output.htm. The report notes that high-tech industries were defined in a 2016 BLS article "as those having high concentrations of workers in STEM (Science, Technology, Engineering, and Mathematics) occupations." The report further notes that, "There are alternative methods of defining high-tech industries, based on R&D expenditures, patents, and other metrics." Additionally, researchers and practitioners also use the term "advanced industries." For a definition and examples of advanced industries, see Mark Muro et al., *America's Advanced Industries: What They Are, Where They Are, and Why They Matter*, The Brookings Institute, February 3, 2015, https://www.brookings.edu/research/

with technology firms, innovation can occur in any sector, including healthcare, education, or manufacturing (e.g., steel, textiles).[12]

The RIS approach is a place-based form of TBED. Experts define RIS as "interacting knowledge generation and exploitation subsystems linked to global, national, and other regional systems,"[13] as well as the "institutional infrastructure supporting innovation within the production structure of a region."[14] As conveyed by these and other definitions, the RIS approach involves private industry and public sector partners coordinating efforts to develop and grow regional economies and employment bases through the development, application, and diffusion of technological and business knowledge. Researchers and government agencies consider certain actors, networks, and institutions—including research institutions, private sector firms, government agencies, investors, and entrepreneurs—as components of innovation "ecosystems" that are integral to the development of RIS.[15] The EDA defines a region as a geographic area based on economic and demographic patterns that may cross municipal and state boundaries.[16] **Figure 1** shows the stakeholders and activities generally involved in the implementation of RIS.

americas-advanced-industries-what-they-are-where-they-are-and-why-they-matter/.

[12] The Economic Development Administration's (EDA's) definition of innovation further notes that it may occur within all aspects of the economic development ecosystem. See EDA, "Key Definitions," https://eda.gov/performance/key-definitions/.

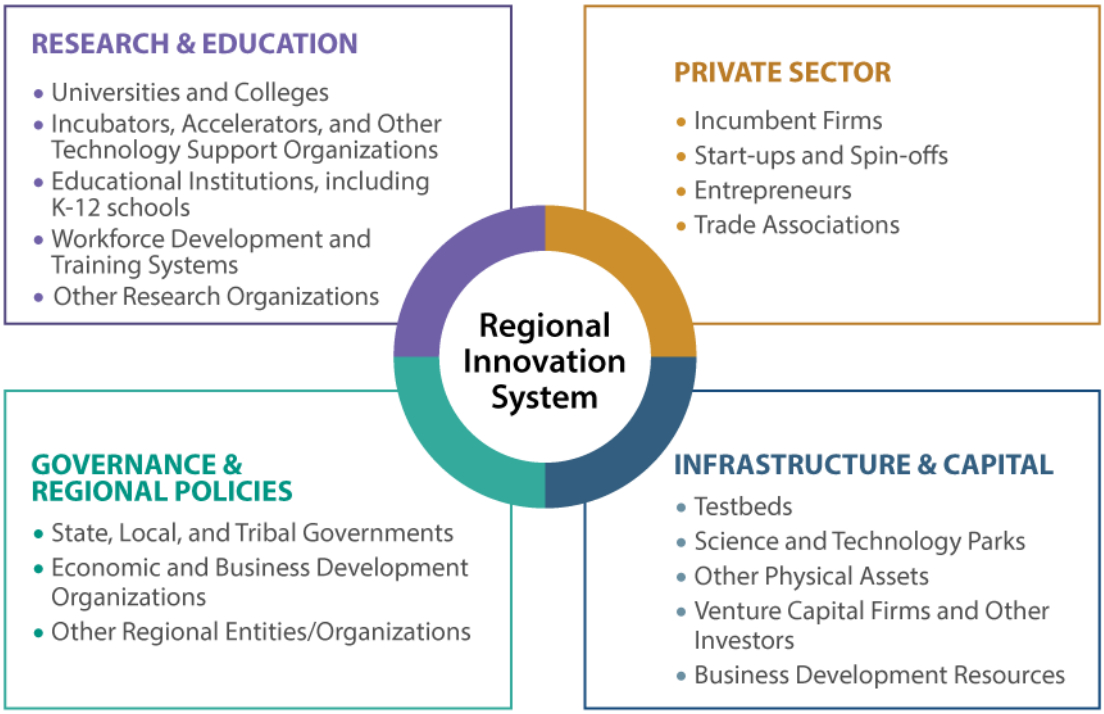
[13] Philip N. Cooke, "Regional Innovation Systems—An Evolutionary Approach," in *Regional Innovation Systems: the Role of Governance in a Globalized World*, 2nd ed., eds., Philip Cooke, Martin Heidenreich, and Hans-Joachim Braczyk. (London: Routledge, 2004), p. 3.

[14] Bjørn T. Asheim and Lars Coenen, "Knowledge Bases and Regional Innovation Systems: Comparing Nordic Clusters," *Research Policy*, vol. 34, no. 8, (October 2005), p. 1177.

[15] Experts generally use a broad perspective to describe RIS as encompassing all regional economic, social, and institutional factors that affect the innovativeness of firms. Such RIS are composed of firms, universities, public and private research organizations, technology mediating organizations, workforce organizations, and educational organizations. For additional definitions and analysis of RIS, see Bjørn T. Asheim, Arne Isaksen, and Michael Trippl, *Advanced Introduction to Regional Innovation Systems* (Northampton, MA: Edward Elgar Publishing, 2019); Björn T. Asheim, Markus Grillitsch, and Michaela Trippl, "Regional Innovation Systems: Past—Present—Future," in *Handbook on the Geographies of Innovation* (Northampton, MA: Edward Elgar, 2016), pp. 48-49; F. Hu, "Study on the Roles and Responsibilities of Government in the Regional Innovation System," in *Frontiers in Enterprise Integration* (CRC Press, 2008), p. 382, https://www.taylorfrancis.com/chapters/edit/10.1201/9781003061090-58/study-roles-responsibilities-government-regional-innovation-system-hu; Lars Coenen and Kevin Morgan, "Evolving Geographies of Innovation: Existing Paradigms, Critiques and Possible Alternatives," *Norsk Geografisk Tidsskrift—Norwegian Journal of Geography*, vol. 74, no. 1, 2020, pp. 13-24, https://www.tandfonline.com/doi/full/10.1080/00291951.2019.1692065; and Franz Tödtling, Michaela Trippl, and Veronika Desch, "New Directions for RIS Studies and Policies in the Face of Grand Societal Challenges," *European Planning Studies*, vol. 30, no. 11, 2022, pp. 2139-2156, https://doi.org/10.1080/09654313.2021.1951177.

[16] EDA, "Key Definitions," https://eda.gov/performance/key-definitions/.

Figure 1. Regional Innovation System Stakeholders



Source: CRS.

Notes: Accelerator programs help existing businesses start new initiatives, expand into new markets, or accelerate growth. Incubator programs provide services to assist with business formation and the development of new products and services. See Minority Business Development Agency, "MBDA Capital Readiness Program," https://www.mbda.gov/mbda-capital-readiness-program. Testbeds provide conditions for analyzing a product or service before it is commercialized and may be in real or simulated environments or laboratories. Physical assets include facilities, buildings, equipment, and infrastructure that may be used in developing RIS and facilitating economic development.

The geographic dimension of where and how knowledge and technology firms interact with each other and with other stakeholders is central to the development of RIS. Geographic concentrations of interconnected companies and institutions can provide an opportunity to leverage talent, infrastructure, supply chains, and other spillover effects that are advantageous to companies and economic growth.[17] RIS are often designed to build on place-based assets, such as research universities, or to address structural or institutional challenges that face an area's entrepreneurs and innovators (e.g., access to capital). In the United States, RIS are generally planned and implemented at the state, local, or regional level; instead of using a federally led approach. Advocates for this approach assert that it is both place-sensitive and community-driven. In some instances in certain countries, RIS policies may be centrally planned, or may feature thematic or sectoral priorities selected by national governments or public-private partnerships.[18]

[17] Philip Cooke, "Strategies for Regional Innovation Systems: Learning, Transfer and Applications," *United Nations Industrial Development Organization*, 2003.

[18] Analysis of RIS policies outside of the United States is beyond the scope of this report. For additional analysis of RIS policies in other settings, see, for example, Bjørn T. Asheim, Arne Isaksen, and Michael Trippl, *Advanced Introduction to Regional Innovation Systems* (Northampton, MA: Edward Elgar Publishing, 2019); OECD, *Reviews of Regional Innovation, Regions and Innovation Policy*, 2011; and Philip Cooke, Martin Heidenreich, and Hans-Joachim Braczyk,

RIS strategies also overlap with another TBED strategy that focuses on developing industry clusters—"companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate."[19] Cluster development efforts are often designed to facilitate the co-location of related firms in a particular area, but not necessarily with a focus on innovation. The RIS approach generally focuses on facilitating *innovation* clusters and reflects the premise that places, and regions in particular, have a role in fostering innovation.[20]

Increased Federal Attention and Assistance for Regional Innovation

State, local, and regional stakeholders have pursued cross-sector, multidisciplinary approaches to economic development and RIS for decades. However, many regard the federal role in place-based RIS as limited in size, scope, and coordination prior to the mid-2000s.[21] For example, federal efforts in the late 1970s and 1980s focused primarily on facilitating the transfer of federally developed technologies to states and the private sector, and on encouraging collaborative research and development activities, broadly (without a regional or place-based emphasis).[22]

Federal involvement in a RIS approach expanded starting in the mid-2000s. In 2009, the Obama Administration published a national innovation strategy that included support for regional innovation clusters.[23] During this time, multiple federal agencies increased support for industry clusters and regional innovation initiatives—several of which leveraged recently authorized programs and funding from the American Recovery and Reinvestment Act of 2009 (P.L. 111-5).[24]

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eds., *Regional Innovation Systems: the Role of Governance in a Globalized World*, 2nd ed. (London: Routledge, 2004).

[19] Michael C. Porter, "Location, Competition, and Economic Development: Local Clusters in a Global Economy," *Economic Development Quarterly*, vol. 14, no. 1, February 2000, pp. 16, 19-20. See also Mark Muro and Bruce Katz, "How Regional Innovation Clusters Can Foster the Next Economy," Brookings Institution, 2010, https://www.brookings.edu/wp-content/uploads/2016/06/0921_clusters_muro_katz.pdf.

[20] Researchers have further distinguished clusters from RIS by noting that, "RIS overlaps with but is different from a cluster. Clusters are central elements of the knowledge application and exploitation subsystem, whilst the RIS is a wider concept in the sense (1) that there are usually several clusters and many industries in a RIS and (2) that institutions play a larger role." See Franz Tödtling and Michaela Trippl, "One Size Fits All? Towards a Differentiated Regional Innovation Policy Approach," *Research Policy*, vol. 34, 2005, pp. 1203-1219.

[21] Some analysts regard the national approach to innovation policy in the United States as decentralized and note that states historically have led the development of innovation strategies at the subnational level. A review of national or federal innovation policy is beyond the scope of this report. For a summary of post-WWII milestones in national innovation policy, see Robert Atkinson, "Understanding the U.S. National Innovation System," Information Technology Innovation Foundation, November 2, 2020, https://itif.org/publications/2020/11/02/understanding-us-national-innovation-system-2020/; and Philip Shapira and Jan Youtie, "The Innovation System and Innovation Policy in the United States," in *Competing for Global Innovation Leadership: Innovation Systems and Policies in the USA, EU and Asia*, ed. Rainer Friestch and Margot Schüller (Stuttgart, Germany: Fraunhofer Verlog, 2010). For a review of the evolution of and the study of regional innovation systems, see Bjørn T Asheim, Arne Isaksen, and Michael Trippl, *Advanced Introduction to Regional Innovation Systems* (Northampton, MA: Edward Elgar Publishing, 2019), pp. 13-22.

[22] See, for example, the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480); the Government Patent Policy Act (P.L. 96-517, commonly referred to as the "Bayh-Dole Act"); the Federal Technology Transfer Act of 1986 (P.L. 99-502); and the creation of the National Science Foundation's Industry–University Cooperative Research Centers (IUCRC) and Engineering Research Centers (ERC) programs.

[23] White House, "A Strategy for American Innovation: Driving Towards Sustainable Growth and Quality Jobs," October 2015, https://obamawhitehouse.archives.gov/sites/default/files/strategy_for_american_innovation_october_2015.pdf.

[24] See, for example, the solicitation for applications under the EDA's American Recovery Act Program at

In subsequent years, support for RIS expanded through congressional authorization and appropriations. For example, in 2011, Congress established the Regional Innovation Program (now called the Build to Scale Program; discussed in more detail below) through the America COMPETES Reauthorization Act of 2010 (P.L. 111-358); appropriations for the program increased from $10 million in FY2014 to $50 million in FY2023.[25] Similarly, the enactment of P.L. 117-167 (the CHIPS and Science Act) in 2022 marked another significant increase in support for RIS policies due to the authorization of several new programs at various federal agencies. Notably, P.L. 117-167 authorized $10 billion to be appropriated over five years for the new Department of Commerce Regional Innovation and Technology Hubs program and additional amounts for programs administered by the National Science Foundation, the Department of Energy, and other agencies (discussed in detail below).[26]

Federal support for RIS may be based on one or more objectives. The rationale for regional innovation programs is often framed as one aspect of a broader strategy for strengthening U.S. global technological and economic competitiveness, particularly in relation to China.[27] Additionally, support for federal involvement in the RIS approach is often based on a view of the U.S. economy as a collection of subnational, regional economies. According to this view, stronger regional economies contribute to a more resilient national economic position; policymakers may focus on innovation and technology in particular due to the expectation of growth associated with these activities and industries.[28] Some policymakers and analysts also view federal support for RIS as a means of addressing challenges related to revitalizing and restructuring places and regional economies that have been impacted by globalization and international trade.[29] Others emphasize the spread of innovation and bolstering innovation capacity in specific regions as a means of creating well-paying jobs and combating socioeconomic and regional disparities.[30]

Federal Regional Innovation Programs

Administration and legislative actions indicate continued federal interest and support for developing RIS. The following sections provide descriptions of select programs focused on

https://www.grants.gov/web/grants/view-opportunity.html?oppId=45786.

[25] For a summary of EDA appropriations by program, see Table B-2. Funding for EDA, by Program, FY2011-FY2022, in CRS Report R46991, *Economic Development Administration: An Overview of Programs and Appropriations (FY2011-FY2022)*, by Julie M. Lawhorn.

[26] Daniel Gross and Bhaven Sampat, "America, Jump-Started: World War II R&D and the Takeoff of the U.S. Innovation System," NBER Working Papers, No. 27375, National Bureau of Economic Research, Inc., 2020.

[27] Sintia Radu, "The U.S. Is (Again) Among the World's Top Innovators," *U.S. News and World Report,* August 8, 2019. See also Robert Hassink, "Advancing Place-Based Regional Innovation Policies" (2019); F. Hu, "Study on the Roles and Responsibilities of Government in the Regional Innovation System," in *Frontiers in Enterprise Integration*, (CRC Press, 2008), pp. 381-384, https://www.taylorfrancis.com/chapters/edit/10.1201/9781003061090-58/study-roles-responsibilities-government-regional-innovation-system-hu; and Karen G. Mills, Elisabeth B. Reynolds, and Andrew Reamer, *Clusters and Competitiveness: A New Federal Role for Stimulating Regional Economies*, The Brookings Institution, April 2008, https://www.brookings.edu/wp-content/uploads/2016/07/Clusters-Brief.pdf.

[28] Amy Liu et al., "Making Local Economies Prosperous and Resilient: The Case for a Modern Economic Development Administration," The Brookings Institution, June 27, 2022, https://www.brookings.edu/research/making-local-economies-prosperous-and-resilient-the-case-for-a-modern-economic-development-administration/.

[29] National League of Cities, "Place-Based Policies for America's Innovation Economy," 2019.

[30] See, for example, U.S. Congress, House Committee on Science, Space, and Technology, *Regional Innovation Act of 2021*, 117th Cong., 2nd sess., February 28, 2022, H.Rept. 117-254 (Washington: GPO, 2022); and Bjørn T. Asheim, Arne Isaksen, and Michael Trippl, *Advanced Introduction to Regional Innovation Systems* (Northampton, MA: Edward Elgar Publishing, 2019), pp. 13-22.

improving regional innovation administered by the National Science Foundation (NSF), the Department of Commerce (DOC), the Department of Energy (DOE), and the Small Business Administration (SBA). The selection of programs described below should be considered illustrative and not comprehensive.

National Science Foundation (NSF)

Regional Innovation Engines Program

The CHIPS and Science Act (P.L. 117-167) authorized the creation of the Regional Innovation Engines (RIE) program at NSF to support a broad range of activities intended to build regional innovation systems. Activities under the program may include conducting use-inspired and translational research; facilitating the adoption, development, and commercialization of research results; developing and managing test beds and instrumentation necessary to advance key technologies; training graduate students and conducting outreach to broaden participation in RIE activities; and reimbursing the cost of commercialization activities.[31]

The entities eligible to receive RIE funding are accredited institutions of higher education with a campus located in the United States and U.S.-based nonprofit and for-profit organizations. Other entities, including federally funded research and development centers (FFRDCs), DOE national laboratories, and state, local, and tribal governments, are eligible to receive funds through sub-awards.[32] To be eligible for funding, applicants must propose a partnership with one or more institutions classified as a minority-serving institution, a historically black college or university, a Tribal College or University, an Established Program to Stimulate Competitive Research (EPSCoR) institution, a community college, or an emerging research institution.[33]

NSF is expected to administer the RIE program through two types of awards designed to fund "regional coalitions of partnering organizations to establish NSF Engines that will catalyze technology and science-based regional innovation ecosystems":[34]

- **Type-1 Awards.** Type-1 Awards offer up to $1 million in total funding for up to two years to enable awardees to lay the groundwork for establishing a new NSF Engine, such as by defining the initial scope and developing strategic plans for an NSF Engine in a given region and topic area.
- **Type-2 Awards.** Type-2 Awards offer up to $160 million in total funding for up to 10 years to enable awardees to develop an NSF Engine across three distinct phases: (1) creating firm partner and stakeholder commitments; (2) growing an innovation system by expanding scientific, technical, education, and workforce development; and (3) growing the innovation system as a national leader by attracting increasing levels of economic activity and business creation. NSF Engines are intended to emerge from the Type-2 Award funding period as a

[31] P.L. 117-167, §10388.

[32] National Science Foundation (NSF), "Regional Innovation Engines: Funding and Regions of Interest," https://beta.nsf.gov/funding/initiatives/regional-innovation-engines/funding-regions-interest.

[33] P.L. 117-167, §10388(e)(2). An "emerging research institution" is defined as "an institution of higher education with an established undergraduate or graduate program that has less than $50,000,000 in Federal research expenditures" (§10002).

[34] NSF, *NSF Regional Innovation Engines Broad Agency Announcement*, NSFBAA-ENGINES-2022-05-1, https://sam.gov/opp/68c9f585eed7457a9c1c1fe5dd6ae9a2/view.

mature innovation system that is well established and financially self-sustaining.[35]

P.L. 117-167 did not authorize specific levels of appropriations for the RIE program; rather it authorized a combined $6.5 billion for FY2023-FY2027 for two programs: the RIE and Translation Accelerator programs.[36] For FY2023, NSF requested $200 million to support up to 10 RIEs as part of the President's annual budget request to Congress.[37] REIs were not allocated a specific funding amount in the Consolidated Appropriations Act, 2023 (P.L. 117-328), which appropriated a total of $9.9 billion for NSF in FY2023,[38] but the accompanying joint explanatory statement expressed general support for the RIE program.[39]

Department of Commerce

Regional Technology and Innovation Hub Program

The CHIPS and Science Act (P.L. 117-167) established a new Regional Technology and Innovation Hub Program at DOC.[40] The law requires the designation of at least 20 geographically distributed technology and innovation hubs in areas that are currently not leading technology centers to support technology development, job creation, and the expansion of U.S. innovation capacity. Congress directed two DOC agencies, the Economic Development Administration (EDA) and the National Institute of Standards and Technology (NIST), to make hub designations and awards using a competitive merit-review process and in a manner that ensures geographic diversity and representation from communities of differing populations, among other considerations. The program will administer two types of awards:

- **Strategy development awards.** Strategy development awards will support planning, assessments, coordination, and other pre-development activities, as well as the formation of workforce development strategies. Approximately 60 eligible consortia will receive strategy development awards.
- **Strategy implementation awards.** Strategy implementation awards are available to regional technology and innovation hubs for workforce development; business and entrepreneur development; technology development and maturation

[35] Ibid.

[36] P.L. 117-167, §10389(c) directs the NSF to establish Translation Accelerators to "further the research, development, and commercialization of innovation in the key technology focus areas." The Translation Accelerators are expected to include two or more of the following entities: an institution of higher education, a for-profit company, a nonprofit organization, a federal agency, or another entity determined by the NSF.

[37] NSF, *FY 2023 Budget Request to Congress*, March 28, 2022, p. Cross-Theme Topics-25, https://www.nsf.gov/about/budget/fy2023/pdf/fy2023budget.pdf.

[38] P.L. 117-328.

[39] Senator Patrick Leahy, "Explanatory Statement Submitted by Mr. Leahy, Chair of the Senate Committee on Appropriations, Regarding H.R. 2617, Consolidated Appropriations Act, 2023," Senate, *Congressional Record*, vol. 168, no. 198 (December 20, 2022), p. S7950, https://www.congress.gov/congressional-record/volume-168/issue-198/senate-section/article/S7819-2.

[40] See P.L. 117-167, Division B, Title VI—Miscellaneous Science and Technology Provisions, Subtitle C, Section 10621 for definitions of terms relevant to the Regional Technology and Innovation Hub program, including "eligible consortium."

> activities; and infrastructure-related activities. Regional technology and innovation hubs do not have to receive a strategy development award to apply for an implementation award.

The law does not list specific industry or technology focus areas for the hubs. However, P.L. 117-167 outlines "considerations for the designation and award of implementation grants." One of the considerations indicates that, among other factors, the Secretary of Commerce shall consider

> the potential of the eligible consortium to advance the research, development, deployment, and domestic manufacturing of technologies in a key technology focus area, as described in section 10387 of the Research and Development, Competition, and Innovation Act or other technology or innovation sector critical to national security and economic competitiveness.

The initial list of 10 key technology focus areas in Section 10387 (Division B, Title III, Subtitle G) includes biotechnology, quantum information sciences, advanced materials science, and advanced energy and industrial efficiency technologies, among others.[41] Program applicants will likely determine their technology focus area and hub activities based on their regional assets and other factors.[42]

P.L. 117-167 authorized $10 billion to be appropriated over five years (FY2023-FY2027) for the program.[43] The Consolidated Appropriations Act, 2023 (P.L. 117-328) appropriated $500 million for the Regional Technology and Innovation Hub Program.[44]

Recompete Pilot Program

The CHIPS and Science Act (P.L. 117-167) also established a new Recompete Pilot program at the EDA to provide grants and cooperative agreements to persistently distressed areas in support of long-term economic development and job creation.[45] As an industry-neutral economic development policy, the Recompete Pilot program does not explicitly require TBED or RIS, but instead provides long-term, place-based assistance in amounts that will be larger than most

[41] The full list of 10 initial key technology areas is artificial intelligence, machine learning, autonomy, and related advances; high performance computing, semiconductors, and advanced computer hardware and software; quantum information science and technology; robotics, automation, and advanced manufacturing; natural and anthropogenic disaster prevention or mitigation; advanced communications technology and immersive technology; biotechnology, medical technology, genomics, and synthetic biology; data storage, data management, distributed ledger technologies, and cybersecurity, including biometrics; advanced energy and industrial efficiency technologies, such as batteries and advanced nuclear technologies; and advanced materials science, including composites 2D materials, other next-generation materials, and related manufacturing technologies.

[42] As of March 2023, the DOC had not released a request for proposals or notice of funding opportunity for the Regional Technology and Innovation Hub Program. However, in February 2023, the EDA requested stakeholder input to inform future funding guidance. See EDA, "Request for Information on Implementation of the Regional Technology and Innovation Hub Program," 88 *Federal Register* 9427, February 14, 2023, https://www.govinfo.gov/content/pkg/FR-2023-02-14/pdf/2023-03022.pdf.

[43] P.L. 117-167 directs the Secretary of Commerce to provide $50 million for strategy development awards for FY2023-FY2027; $2.950 billion for strategy implementation awards for FY2023-FY2024; and $7 billion for FY2025-FY2027.

[44] The Consolidated Appropriations Act, 2023 (P.L. 117-328) appropriated $41 million in regular appropriations in Division B and $459 million in supplemental appropriations in Division N for the Regional Technology and Innovation Hub Program.

[45] Division B, Title VI—Miscellaneous Science and Technology Provisions, Subtitle C, Section 10621.

existing EDA program awards.[46] The minimum grant award amount will be $20 million. The program will administer two types of awards:

- **Strategy development awards.** Strategy development awards will support planning and other pre-development activities, such as the formulation of a Recompete Plan. A Recompete Plan is a comprehensive economic development plan that includes the proposed multiyear activities to be implemented, projected costs, partner roles, and other information.
- **Strategy implementation awards.** Implementation funds may be used for activities that are consistent with an applicant's approved Recompete Plan in order to support workforce development, business and entrepreneur development, infrastructure (or other site development programs), and planning and technical assistance activities. Implementation award recipients are not required to have previously received a strategy development award.

The CHIPS and Science Act (P.L. 117-167, Section 10621) authorized $1 billion over five years (FY2022-FY2026) for the program. The Consolidated Appropriations Act, 2023 (P.L. 117-328) appropriated $200 million for the Recompete Pilot Program.[47]

Build to Scale (formerly "Regional Innovation Strategies")[48]

The EDA administers the Build to Scale program (B2S)—formerly the Regional Innovation Program (RIP) or the Regional Innovation Strategies (RIS) program—which was established in Section 603 of the America COMPETES Reauthorization Act of 2010 (P.L. 111-358).[49] The program is designed to spur community and regional capacity-building by providing commercialization assistance to entrepreneurs and supporting organizations that provide early-stage investments to startups.[50] B2S is composed of the Venture Challenge and the Capital Challenge:

- **Venture Challenge.** The Venture Challenge funds entrepreneurship support programs and other models to accelerate high-growth entrepreneurship activities.

[46] As of March 2023, the DOC had not released a request for proposals or notice of funding opportunity for the Recompete Pilot Program. However, in February 2023, the EDA requested stakeholder input to inform future funding guidance. See EDA, "Request for Information on Implementation of the Distressed Area Recompete Pilot Program," 88 *Federal Register* 11406, February 23, 2023, https://www.govinfo.gov/content/pkg/FR-2023-02-23/pdf/2023-03732.pdf.

[47] The Consolidated Appropriations Act, 2023 (P.L. 117-328) appropriated $41 million in regular appropriations in Division B and $159 million in supplemental appropriations in Division N for the Recompete Pilot program.

[48] Build to Scale was called Regional Innovation Strategies (RIS) or Regional Innovations Program (RIP) in annual appropriations bills from FY2014 to FY2021; EDA began administering RIS/RIP funding using the Build to Scale program name in FY2020. OIE administered the first round of the RIS/RIP competitions in September 2014 (see EDA, U.S. Department of Commerce, "Regional Innovation Program," 82 *Federal Register* 3131-3137, January 11, 2017, https://www.federalregister.gov/documents/2017/01/11/2017-00116/regional-innovation-program). The RIS/RIP included Science Parks Loan Guarantees in FY2014 (P.L. 113-76). In FY2015 (P.L. 113-235), the explanatory statement indicated that the amount for regional innovation would include up to $5 million for planning grants for science park infrastructure. See https://eda.gov/files/oie/ris/EDA-RIS-Full-Program-Evaluation.pdf for an evaluation of the B2S/RIS program.

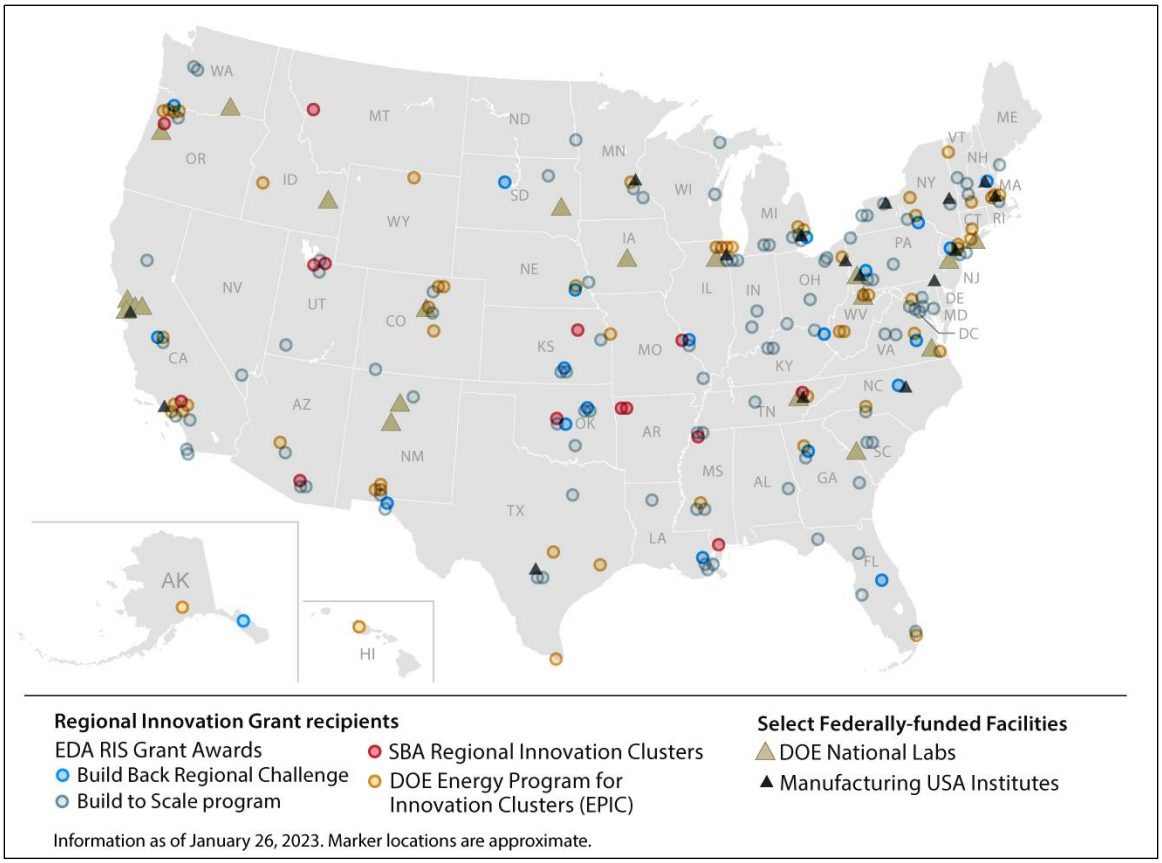
[49] 15 U.S.C. §3722.

[50] EDA, "2019 Regional Innovation Strategies Program, Notice of Funding Opportunity," January 31, 2019, https://www.grants.gov/web/grants/view-opportunity.html?oppId=312519.

- **Capital Challenge.** The Capital Challenge provides operational support to help organizations and regions expand access to risk capital.[51]

Figure 2 shows the locations of B2S grantees in FY2021 and FY2022. In FY2022 and FY2023, Congress directed EDA to allocate $45 and $50 million, respectively, to the B2S program.[52]

Figure 2. Selected RIS Program Awards and Facilities, by Location



Sources: Map by CRS. Locations of EDA grant program awards are from https://www.eda.gov/news/press-release/2022/09/02/president-biden-announce-21-winners-1-billion-american-rescue-plan and https://www.eda.gov/funding/programs/build-to-scale. Locations of SBA RICs are based on information from https://www.sba.gov/local-assistance/regional-innovation-clusters. Locations of DOE EPIC prize and funding opportunity announcement (FOA) awards are from https://www.energy.gov/articles/department-energy-announces-energy-incubator-prize-selections (DOE, October 2020 prize announcement); https://www.energy.gov/articles/doe-awards-95-million-support-clean-energy-innovation-and-commercialization-across-america (DOE, June 2021 FOA announcement); and https://www.energy.gov/technologytransitions/articles/us-department-energy-awards-13-million-incubators-and-accelerators (DOE, December 2022 Phase 2 prize award announcement). Locations of the Manufacturing USA Institutes are from the list of centers at https://www.manufacturingusa.com/institutes. Locations of the DOE national laboratories are based on the list at https://www.energy.gov/doe-national-laboratories. All locations are based on data as of January 26, 2023.

[51] EDA, "NOFO—2020 Build to Scale Program—Concept Proposal," EDA-HDQ-OIE-2020, https://www.grants.gov/web/grants/view-opportunity.html?oppId=324375, and "NOFO—FY2020 STEM Talent Challege," EDA-HDQ-OIE-2020-2006617, https://www.grants.gov/web/grants/view-opportunity.html?oppId=328794.

[52] CRS Report R46991, *Economic Development Administration: An Overview of Programs and Appropriations (FY2011-FY2022)*, by Julie M. Lawhorn, provides a summary of EDA appropriations by program (see "Table B-2. Funding for EDA, by Program, FY2011-FY2022").

Notes: Map reflects location of program awardees for grant, cooperative agreement, and prize award programs and the locations of the DOE national laboratories and Manufacturing USA Institutes. Markers indicate the primary grant recipient location. Some grant awardees may represent multi-location projects or projects that impact a state-wide or broader geographic region.

Economic Recovery Funding for Innovation Initiatives[53]

As a part of the federal disaster response and recovery assistance in FY2020 and FY2021, Congress provided supplemental appropriations to the EDA Economic Adjustment Assistance (EAA) program for COVID-19 pandemic response efforts. The EDA allocated some of the supplemental appropriations to the RIS-related initiatives described below.

- The Coronavirus Aid, Relief, and Economic Security (CARES) Act (P.L. 116-136), enacted March 27, 2020, provided $1.5 billion to the EDA for economic adjustment assistance in response to the COVID-19 pandemic. In October 2020, the EDA allocated $25 million to the Scaling Pandemic Resilience through Innovation and Technology (SPRINT) Challenge grants to help regions address the economic, health, and safety risks caused by the coronavirus pandemic through entrepreneurship and innovation activities.[54]
- The American Rescue Plan (ARP) Act (P.L. 117-2), enacted March 11, 2021, provided $3 billion to the EDA for economic adjustment assistance in response to the COVID-19 pandemic. In July 2021, the EDA allocated $1 billion of this supplemental funding for economic recovery activities to the Build Back Better Regional Challenge (BBBRC), a new grant initiative to support new or existing regional industry clusters.[55] In September 2022, EDA announced 21 BBBRC awards (see **Figure 2**).[56] The EDA also allocated $500 million of ARP Act funding to the Good Jobs Challenge to enhance local efforts to develop and strengthen regional workforce training systems and sector-based partnerships, but did not require grant recipients to focus on innovation or technology sectors.[57]

Manufacturing USA

Through the Revitalize American Manufacturing and Innovation Act, as amended, Congress directed the Secretary of Commerce, operating through NIST, to establish a Manufacturing USA program.[58] Manufacturing USA is a network of institutes focused on facilitating the development and commercialization of emerging manufacturing technologies. The network currently consists of 16 institutes sponsored by DOC, the Department of Defense (DOD), and DOE and co-funded

[53] For more information, see CRS Insight IN11402, *The Economic Development Administration's Economic Recovery Assistance for COVID-19 Impacted Communities*, and CRS Insight IN11712, *The Economic Development Administration's American Rescue Plan (ARP) Act Grant Programs*.

[54] For more information and a list of grant recipients, see EDA, "SPRINT Challenge," https://eda.gov/oie/sprint/.

[55] For more information about the EDA's allocation of supplemental appropriations approved in the American Rescue Plan Act (P.L. 117-2), see CRS Insight IN11712, *The Economic Development Administration's American Rescue Plan (ARP) Act Grant Programs*. For information about EDA's regional innovation programs and activities, see EDA, "About OIE," https://eda.gov/oie/.

[56] EDA, "President Biden to Announce 21 Winners of $1 Billion American Rescue Plan Regional Challenge," September 2, 2022, https://www.eda.gov/news/press-release/2022/09/02/president-biden-announce-21-winners-1-billion-american-rescue-plan.

[57] For a summary of EDA's Build Back Better Regional Challenge and Good Jobs Challenge grant awards, see https://eda.gov/arpa/.

[58] 15 U.S.C. §278s; for more information on Manufacturing USA, see CRS Report R46703, *Manufacturing USA: Advanced Manufacturing Institutes and Network*.

with private sector partners (**Figure 2**). Manufacturing USA institutes (also called Manufacturing Institutes) are intended to

- improve the competitiveness of United States manufacturing and increase the production of goods manufactured predominantly within the United States;
- facilitate the transition of innovative technologies into scalable, cost-effective, and high-performing manufacturing capabilities;
- accelerate the development of an advanced manufacturing workforce; and
- contribute to the development of regional innovation initiatives across the United States.

Congress provided the Manufacturing USA program with $37 million in FY2023. Such funds are for a new NIST-funded Manufacturing USA institute, to support the existing NIST-funded Manufacturing USA institute, and for overseeing and carrying out the Manufacturing USA program through the Manufacturing USA National Program Office. Manufacturing USA institutes sponsored by DOE and DOD are funded through appropriations associated with those agencies.

Department of Energy Programs

Energy Program for Innovation Clusters (EPIC) Program[59]

The DOE Office of Technology Transitions (OTT) administers the Energy Program for Innovation Clusters (EPIC), which funds regional incubators and accelerators that support energy-related technology innovation clusters, entrepreneurs, and start-ups. **Figure 2** includes the locations of the following EPIC awards:

- In October 2020, DOE awarded 20 prizes of $50,000 each to incubators and accelerators focused on developing energy-related regional innovation clusters.[60]
- In June 2021, DOE awarded $9.5 million in cooperative agreements to 10 incubators and accelerators to facilitate energy hardware development.[61]
- In December 2022, DOE awarded $1.3 million in prizes to incubators and accelerators to develop regional partnerships that facilitate energy technology start-ups and related efforts.[62]

[59] For more information on the Energy Program for Innovation Clusters (EPIC), see https://www.energy.gov/technologytransitions/energy-program-innovation-clusters.

[60] Department of Energy (DOE), "Department of Energy Announces Energy Incubator Prize Selections," https://www.energy.gov/articles/department-energy-announces-energy-incubator-prize-selections.

[61] DOE, "DOE Awards $9.5 Million to Support Clean Energy Innovation and Commercialization Across America," June 4, 2021, https://www.energy.gov/articles/doe-awards-95-million-support-clean-energy-innovation-and-commercialization-across-america.

[62] DOE, "U.S. Department of Energy Awards $1.3 Million to Incubators and Accelerators in Support of Place-Based Energy Innovation," December 6, 2022, https://www.energy.gov/technologytransitions/articles/us-department-energy-awards-13-million-incubators-and-accelerators.

Congress directed DOE to allocate $5 million for the EPIC program for each of FY2020 through FY2023.[63]

Regional Clean Energy Innovation Program[64]

The CHIPS and Science Act (P.L. 117-167) established the Regional Clean Energy Innovation program to advance the innovation of clean energy technologies and improve the competitiveness of U.S. firms in this sector. Subject to the availability of appropriations, the program will connect state and local economic development organizations and universities with other stakeholders and support clean energy innovation activities, such as:[65]

- facilitating the commercial application of clean energy products, processes, and services, including through research, development, demonstration, or technology transfer;
- improving stakeholder involvement;
- assessing different incentive mechanisms for clean energy development and commercial applications;
- establishing and updating roadmaps;
- planning; and
- hosting conferences and events.

The Secretary of Energy is directed to consider geographic diversity, including rural, tribal, and low-income communities as part of the selection process. P.L. 117-167 authorized $50 million for each of FY2023 through FY2027 for the program. Congress, however, has yet to appropriate funding for the program.

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[63] See explanatory statements accompanying annual appropriations laws for each of FY2020 through FY2023: Representative Nita Lowey, "Explanatory Statement Submitted by Mrs. Lowey, Chairwoman of the House Committee on Appropriations Regarding H.R. 1865, Further Consolidated Appropriations Act, 2020," *Congressional Record*, vol. 165, No. 204-Book III (December 17, 2019), p. H11248, https://www.congress.gov/116/crec/2019/12/17/CREC-2019-12-17-pt3-PgH11061.pdf; Representative Nita Lowey, "Explanatory Statement Submitted by Mrs. Lowey, Chairwoman of the House Committee on Appropriations Regarding H.R. 133, Consolidated Appropriations Act, 2021," *Congressional Record*, vol. 166, no. 218-Book IV(December 21, 2020), p. H8375, https://www.congress.gov/116/crec/2020/12/21/166/218/CREC-2020-12-21-pt4-PgH8311.pdf; Representative Rosa DeLauro, "Explanatory Statement Submitted by Ms. Delauro, Chair of the House Committee On Appropriations, Regarding the House Amendment to the Senate Amendment to H.R. 2471, Consolidated Appropriations Act, 2022," House, *Congressional Record*, vol. 168, no. 42, (March 9, 2022), p. H2254, https://www.congress.gov/117/crec/2022/03/09/168/42/CREC-2022-03-09-bk3.pdf; and Senator Patrick Leahy, "Explanatory Statement Submitted by Mr. Leahy, Chair of the Senate Committee on Appropriations, Regarding H.R. 2617, Consolidated Appropriations Act, 2023," Senate, *Congressional Record*, vol. 168, no. 198, (December 20, 2022), p. S8364, https://www.congress.gov/congressional-record/volume-168/issue-198/senate-section/article/S7819-2.

[64] Division B, Title VI—Miscellaneous Science and Technology Provisions, Subtitle C, 2.

[65] U.S. Congress, House Committee on Science, Space, and Technology, *Regional Innovation Act of 2021*, 117th Cong., 2nd sess., February 28, 2022, H.Rept. 117-254 (Washington: GPO, 2022).

Additional DOE Hub Programs for Technology Commercialization

The Infrastructure Investment and Jobs Act (IIJA, P.L. 117-58) authorized several new DOE programs designed to advance the commercialization of specific types of energy or climate-related technologies. Specifically, P.L. 117-58 authorized the Regional Clean Direct Air Capture[66] Hubs and the Regional Clean Hydrogen Hubs[67] programs to support direct air capture and hydrogen demonstration projects. The IIJA directed the Secretary to prioritize awards for both hub programs that "are likely to create opportunities for skilled training and long-term employment to the greatest number of residents of the region."[68] The IIJA further directed the Secretary of Energy to locate two Regional Clean Direct Air Capture Hubs in "economically distressed communities" with "high levels of coal, oil, or natural gas resources."[69] The IIJA also further directed the Secretary to select Regional Clean Hydrogen Hubs according to criteria in the IIJA for feedstock diversity, end-use diversity, geographic diversity, hubs in natural gas-producing regions, and additional criteria as needed in the Secretary's judgment.[70] The IIJA appropriated $3.5 billion for the Regional Clean Direct Air Capture Hubs program (for the FY2022 through FY2026 period) and appropriated $8 billion for the Regional Clean Hydrogen Hubs program (for the FY2022 through FY2026 period).[71]

Small Business Administration

Regional Innovation Clusters Program

The Small Business Administration's (SBA's) Office of Entrepreneurial Development has operated the Regional Innovation Cluster (RIC) program since FY2010.[72] According to the SBA, RICs are "on-the-ground collaborations between business, research, education, financing, and government institutions that work to develop and grow a particular industry or related set of industries in a geographic region."[73] RICs serve as networking hubs to help high-growth small businesses connect with other small and large businesses, as well as with specialized suppliers, academic institutions, service providers, and economic organizations in a geographic area. The clusters help match those small businesses with technical assistance providers, development and financing opportunities, and mentoring, among other activities.[74] RICs are typically centered on

[66] See P.L. 117-58, Division D, Title III, Section 40308. For more information, see CRS Report R47034, *Energy and Minerals Provisions in the Infrastructure Investment and Jobs Act (P.L. 117-58)*, coordinated by Brent D. Yacobucci. For more information about DOE's carbon capture and related programs, see CRS In Focus IF11861, *DOE's Carbon Capture and Storage (CCS) and Carbon Removal Programs*, by Ashley J. Lawson.

[67] See P.L. 117-58, Division D, Title III, Section 40314. For more information about DOE's hydrogen hubs, see CRS Report R47289, *Hydrogen Hubs and Demonstrating the Hydrogen Energy Value Chain*, by Martin C. Offutt, and CRS In Focus IF12163, *Department of Energy Funding for Hydrogen and Fuel Cell Technology Programs FY2022*, by Martin C. Offutt.

[68] 42 U.S.C. §16161a(3)(E) and §16298d.

[69] P.L. 117-58, Division D, Title III, Section 40308.

[70] 42 U.S.C. §16161a(3).

[71] P.L. 117-58, Division J, Title III.

[72] Congress has appropriated funding for the Regional Innovation Clusters Initiative since FY2010. For more information on historical funding levels see Table 17 of CRS Report R43846, *Small Business Administration (SBA) Funding: Overview and Recent Trends*, by Robert Jay Dilger, R. Corinne Blackford, and Anthony A. Cilluffo.

[73] U.S. Small Business Administration (SBA), *FY 2023 Congressional Budget Justification FY 2021 Annual Performance Report*, March 28, 2022, p. 87, https://www.sba.gov/sites/default/files/2022-04/FY%202023%20SBA%20Congressional%20Budget%20Justification-508-2022-0413%20updated.pdf.

[74] SBA, *Regional Innovation Cluster Initiative Services—2018 Performance-Based Statement of Work*, 2018,

particular fields; including bioscience and health care, agriculture, and autonomous and unmanned systems.[75] Twenty-three clusters have participated in the program, and as of November 2022, the SBA supported 14 clusters (see **Figure 2**).[76] In FY2020, the most recent year for which data are available, 1,220 small businesses participated in a RIC.[77] Congress directed $10 million to the RIC program in FY2023.[78]

Additional Programs and Support for Regional Innovation Systems

Other federal programs that support innovation and R&D may not have regional economic development as a core program objective even though they may contribute to or support core stakeholders in a regional innovation system. Some such programs or activities may be place-based in that the distribution of funding is contingent upon a location. For example:

- The Established Program to Stimulate Competitive Research (EPSCoR)—originally named the Experimental Program to Stimulate Competitive Research—was established at NSF in 1978 to address congressional concerns about an "undue concentration" of federal R&D funding in certain states. The program is designed to help institutions in eligible states build infrastructure, research capabilities, and training and human resource capacities to enable them to compete more successfully for open federal R&D funding awards. In addition to NSF, agencies with active EPSCoR programs include DOE, the National Aeronautics and Space Administration, DOD, the U.S. Department of Agriculture, and the National Institutes of Health (whose program is called the Institutional Development Award [IDeA] program).[79]
- Federal laboratories and other federal R&D assets are located across the nation. These facilities have the potential to serve as anchors for regional innovation. Some such entities, including DOE's national laboratories, often actively engage in place-based innovation. For example, in 2020, Argonne National Laboratory established a collaboration space in Chicago, IL with the "mission to drive inclusive innovation that will help advance economic and societal impacts for underserved and under-represented communities."[80] In January 2023, DOE announced a request for information for strategies to apply the resources associated with DOE national laboratories, plants, and sites to further support economic growth and place-based innovation activities.[81] **Figure 2** shows the locations of the DOE national laboratories.

https://sam.gov/api/prod/opps/v3/opportunities/resources/files/49614056be72fe01d0c5d49c3e0a2ab3/download?&status=archived&token=.

[75] SBA, "Regional Innovation Clusters," https://www.sba.gov/local-assistance/regional-innovation-clusters.

[76] SBA, "Data Collection Available for Public Comments," 87 *Federal Register* 8906, February 16, 2022; and SBA, "Regional Innovation Clusters," https://www.sba.gov/local-assistance/regional-innovation-clusters.

[77] SBA, *FY 2022 Congressional Justification FY 2020 Annual Performance Report*, June 11, 2021, p. 89, https://www.sba.gov/sites/default/files/2021-06/FY2022_SBA_Congressional_Justification-508_0.pdf.

[78] U.S. Congress, House Committee on Appropriations, Subcommittee on Financial Services and General Government, *Financial Services and General Government Appropriations Bill, 2023*, report to accompany H.R. 8254, 117th Cong., 2nd sess., June 28, 2022, H.Rept. 117-393 (Washington: GPO, 2022), p. 108.

[79] For more information on EPSCoR, see CRS Report R44689, *Established Program to Stimulate Competitive Research (EPSCoR): Background and Selected Issues*, by Laurie A. Harris.

[80] Argonne National Laboratory, "Argonne in Chicago," https://www.anl.gov/chicago.

[81] DOE, "Activation Energy: DOE's National Laboratories as Catalysts of Regional Innovation," 88 *Federal Register*

- The DOC Hollings Manufacturing Extension Partnership (MEP) Program provides place-based, business technical assistance to small and medium-sized manufacturers (SMMs, manufacturing firms with 500 or fewer employees) to improve production processes, upgrade technological capabilities, and facilitate product innovation. The MEP Program is a network of state and regional centers—located in all 50 states and Puerto Rico—established by Congress in 1988 through the Omnibus Trade and Competitiveness Act (P.L. 100-418).[82] Funding for the MEP centers is provided on a cost-shared basis between the federal government and nonfederal sources, including state and local governments, and fees charged to SMMs for center services. Congress appropriated $75 million to the MEP program in FY2023 (P.L. 117-328).

In addition, policies designed to address the science and engineering workforce and STEM education are generally considered core components of—and complementary to—the development of RIS.[83] Technology firms that seek STEM workers may be incentivized to locate in areas with an experienced, existing workforce and K-12 schools with a strong STEM curriculum. Over the years, Congress has authorized various programs to address STEM workforce and training needs. For example, the CHIPS and Science Act (P.L. 117-167) provided $200 million in funding for a Creating Helpful Incentives to Produce Semiconductors (CHIPS) for America Workforce and Education Fund to support microelectronics workforce development activities.

Considerations for Congress

The growth in federal attention to and support for regional innovation, including the establishment of several new RIS programs in the CHIPS and Science Act (P.L. 117-167), raises a number of implementation and execution issues for Congress.

Scale, Scope, and Duration of Federal Investments

Federal regional innovation programs vary in scale and in the scope with regard to activities and sectors supported. For example, some programs, such as DOE's Energy Program for Innovation Clusters program and SBA's Regional Innovation Clusters Initiative, offer relatively small, targeted awards (from $50,000 to $300,000) to incubators, accelerators, and other organizations that seek to foster industry clusters through the provision of mentoring, networking, and other support services to start-ups and entrepreneurs. The newly created Regional Technology and Innovation Hub program at EDA is authorized to provide larger awards, up to $150 million in a single strategy implementation award, that can be used for a broader range of activities, including workforce development, business and entrepreneur development, technology development and maturation, and infrastructure projects. The duration of the period of performance for the federal investments also varies, with some programs providing one-time funding over two to five years and others providing subsequent awards that extend the duration of federal investment closer to a decade. Most programs have a legislatively set limit on the duration of federal investment, but in

5323, January 27, 2023, https://www.federalregister.gov/documents/2023/01/27/2023-01440/activation-energy-does-national-laboratories-as-catalysts-of-regional-innovation.

[82] For more information on the Hollings Manufacturing Extension Partnership (MEP) program, see CRS Report R44308, *The Hollings Manufacturing Extension Partnership Program*, by John F. Sargent Jr.

[83] OECD, *Reviews of Regional Innovation, Regions and Innovation Policy*, 2011, pp. 45-48.

the case of EDA's Regional Technology and Innovation Hub program, Congress provided the Secretary of Commerce with the discretion to determine the duration of any subsequent award.

Given the diversity of RIS investments, Congress may consider the most effective way to provide federal funds in support of regional innovation efforts. Since regional economic development is often a long-term process, Congress may wish to consider whether the funding periods of relevant programs are adequate to achieve stated RIS goals.

Congress may also consider connecting the duration and scale of federal support to the level of maturity of a particular RIS. For example, an emerging RIS might receive more funding over a longer period of time than a mature regional innovation system seeking to reinvigorate or adapt its specialization (i.e., cluster or focus area). Additionally, Congress may consider how best to sustain regional innovation efforts after federal funding ceases.

Coordination of Federal Regional Innovation Investments

Interagency Coordination

Regional innovation programs and related activities are supported by multiple agencies, including EDA, SBA, NIST, DOE, and NSF, among others. **Figure 2** shows the location of select regional innovation awards, in addition to the DOE national laboratories and Manufacturing USA institutes. As shown in **Figure 2**, awards from different agencies are often made in the same region or location. Insufficient interagency coordination could impact the efficiency and effectiveness of federal support for regional innovation efforts. For example, a lack of coordination could result in duplicative efforts, in addition to missed opportunities to leverage or complement supported activities.

Congress required interagency coordination for some of the regional innovation programs created in the CHIPS and Science Act (P.L. 117-167). Specifically, P.L. 117-167 requires the Secretary of Commerce, prior to designating an area as a regional technology and innovation hub or making an award for the implementation of a hub's strategy, to coordinate with other federal agencies whose missions contribute to the goals of the hub. P.L. 117-167 also requires the Secretary of Commerce to consult with NSF "for the purpose of ensuring that the regional technology and innovation hubs are aligned with relevant science, technology, and engineering expertise." Similarly, the law requires the NSF Director to ensure that "the focus areas of the Regional Innovation Engines do not substantially and unnecessarily duplicate the efforts of any other Regional Innovation Engine or any other similar effort at another federal agency." It also authorized each of NSF's Regional Innovation Engines to "collaborate and participate in, as appropriate, the activities of any regional technology hub."

RIS Program Alignment

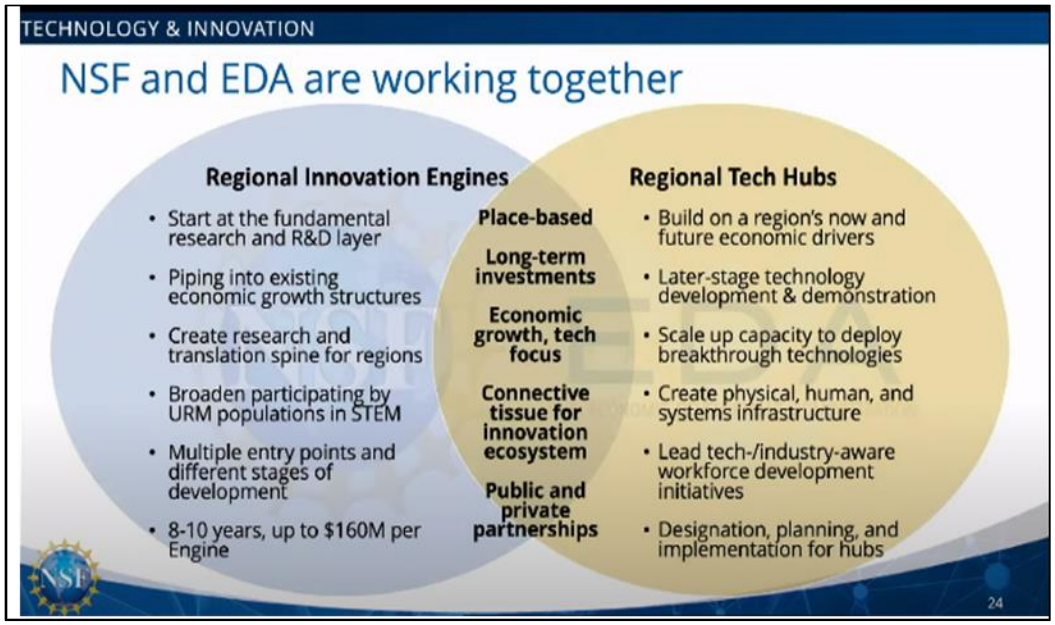
In addition to more general considerations around program coordination, Congress and others have expressed a specific interest in how the NSF Regional Innovation Engines and EDA Regional Technology and Innovation Hub programs align. For example, the joint explanatory statement for the Consolidated Appropriations Act, 2023 (P.L. 117-328) stated "in implementing

the NSF Engines, the Foundation is encouraged to coordinate with the EDA Regional Technology Hubs program."[84]

In a presentation before the President's Council of Advisors on Science and Technology, Dr. Erwin Gianchandani, Assistant Director for Technology, Innovation, and Partnerships at NSF, described how the NSF Regional Innovation Engines and the DOC Regional Technology and Innovation Hub programs fit together (**Figure 3**). He indicated that:

> The Regional Innovation Hubs [Engines] will start with fundamental research and add innovation and translation ecosystems to broaden participation through the intentional engagement of populations underrepresented in STEM. The Regional Technology Hubs will build on a region's current and future economic drivers, and their work on later-stage technology development will scale capacity to deploy breakthrough technologies.... Together, the two programs will serve as the connective tissue for an innovation ecosystem built on public-private partnerships.[85]

Figure 3. Comparison of NSF Regional Innovation Engines and EDA Regional Technology and Innovation Hub Programs



Source: Presentation by Dr. Erwin Gianchandani, Assistant Director for Technology, Innovation, and Partnerships, National Science Foundation, before the President's Council of Advisors on Science and Technology, September 21, 2022, https://www.whitehouse.gov/wp-content/uploads/2022/11/Gianchandani_TIP-and-NSF-Engines-for-PCAST_Sept-2022.pdf.

[84] Senator Patrick Leahy, "Explanatory Statement Submitted by Mr. Leahy, Chair of the Senate Committee on Appropriations, Regarding H.R. 2617, Consolidated Appropriations Act, 2023," Senate, *Congressional Record*, vol. 168, no. 198 (December 20, 2022), p. S7950, https://www.congress.gov/congressional-record/volume-168/issue-198/senate-section/article/S7819-2.

[85] Public Meeting of the President's Council of Advisors on Science and Technology, "Meeting Minutes," September 21, 2022, https://www.whitehouse.gov/wp-content/uploads/2022/11/Meeting-Minutes_PCAST-Public-Meeting_9-21-2022_Final.pdf.

While Congress requires some level of coordination and consultation between the Department of Commerce (i.e., EDA and NIST) and NSF for the Regional Technology and Innovation Hub and Regional Innovation Engines programs, DOC and NSF may also coordinate with other programs that play a role in regional innovation (e.g., the EDA Build to Scale program and the SBA Regional Innovation Clusters Initiative).

Federal Interagency Working Group Considerations

P.L. 117-167 requires the Director of the Office of Science and Technology Policy to establish an interagency working group through the National Science and Technology Council that may facilitate additional coordination of federal regional innovation investments. The interagency working group is directed to "seek to ensure that the activities of different federal agencies enhance and complement, but, as appropriate, do not duplicate, efforts being carried out by another federal agency." A subset of regional innovation programs—NSF's Regional Innovation Engines program, NIST's Manufacturing USA and Manufacturing Extension Partnership programs, and EDA's Regional Technology and Innovation Hub program—are mentioned as part of the activities federal agencies are directed to coordinate; however, the coordination focus is on activities in the key technology areas listed in P.L. 117-167. Key technology area activities may or may not be place-based. In addition, programs created outside of P.L. 117-167, in general, are not required to support efforts that focus on the key technology areas. Furthermore, those that are required to consider if a regional innovation effort is focused on a key technology area may do so to a greater or lesser extent.

As such, the interagency working group required by P.L. 117-167 may be insufficient in providing government-wide coordination of all federal investments in regional innovation. Congress may consider modifying the responsibilities of the interagency working group to ensure broader coordination of federal regional innovation efforts or it could consider tasking another entity with that responsibility. For example, in 2010, EDA's Office of Innovation and Entrepreneurship (OIE) was established to coordinate activities related to innovation, commercialization, and entrepreneurship between the Department of Commerce, other federal agencies, and state and local governments.[86] OIE's roles and responsibilities could be expanded to include broader, more comprehensive coordination of federal regional innovation activities. OIE could also be tasked with facilitating intergovernmental coordination and information sharing to help ensure that federal resources are aligned with, leveraged by, and meet the needs of regional efforts supported by state, local, and tribal governments (see additional discussion below).

EDA Roles and Resources

Congress may seek to review EDA's role in interagency coordination and technical assistance activities that may facilitate the implementation of new RIS programs. The America COMPETES Reauthorization Act of 2010 (P.L. 111-358) identified a leadership role for EDA in certain interagency coordination roles (i.e., through EDA's OIE and National Advisory Council on Innovation and Entrepreneurship (NACIE) activities).[87] Since then, as summarized above,

[86] See EDA, "About OIE," https://eda.gov/oie/. OIE was established by the America COMPETES Reauthorization Act of 2010 (P.L. 111-358). The National Advisory Council on Innovation and Entrepreneurship (NACIE) was established in 2009 by Section 25(c) of the Stevenson-Wydler Technology Innovation Act of 1980, as amended (15 U.S.C. §3720(c)).

[87] Ibid. NACIE was established by the same law, P.L. 111-358, to "provide advice to the Secretary" of Commerce about the implementation of the OIE. See 15 U.S.C. §3720.

Congress has authorized several new RIS programs for administration by EDA as well as new programs to be administered by agencies outside of the Department of Commerce (e.g., DOE, NSF). However, a House hearing report in June 2021 noted that it is unclear how other federal regional innovation programs should be coordinated to facilitate regional innovation economies.[88] Additionally, some analysts have proposed expanding EDA's activities to include additional training and resources for state, regional, and local stakeholders. Specifically, some suggest that EDA may expand its role in disseminating economic development policy insight and analysis.[89]

Congress may be interested in reviewing options to increase EDA's capacity to coordinate RIS development, including its technical expertise and staffing levels. Congress and outside groups have remarked on EDA's expertise in regional development, and that innovation technology expertise is "spread across many different agencies and programs" at the DOC, including NIST and NSF. Among other options, Congress may continue to encourage the agency to consider detailees or intergovernmental exchange programs.[90]

Data for Decisionmaking and Capacity-Building

Regional innovation systems are often based on industry clusters or a geographic concentration of interconnected companies and institutions in a specific field. Some analysts believe that such clusters cannot be created from scratch and must relate "to some historical industry strength in the region."[91] Determining whether a cluster exists in a region or what cluster a region should focus its efforts on can be a complex process. Factors for cluster selection include (1) growth potential and stage of development; (2) specialization; (3) intensity of relationships within the cluster; and (4) the structure and complexity of the cluster, among others.[92] RIS experts observe that incorporating data into decisionmaking processes may improve the identification and prioritization of clusters. Such data analysis may also help determine what strategic interventions, cluster-based or not, a region should implement to increase regional innovation.

In 2016, NACIE recommended that the DOC create "an online, dynamic web resource that catalogues and curates the growing number of indices and tools that seek to measure innovation."[93] According to NACIE,

> Such a resource would not provide evaluative commentary on individual measures or indices; instead, as a curated collection, the resource provides descriptive information, such as authors, major funding sources, primary objectives of measures and indices, and data

[88] U.S. Congress, House Committee on Science, Space, and Technology, Subcommittee on Research and Technology, *Hearing Charter—Regional Innovation Act of 2021*, 117th Cong., 2nd sess., June 9, 2021.

[89] Amy Liu et al., "Making Local Economies Prosperous and Resilient: The Case for a Modern Economic Development Administration," The Brookings Institution, June 27, 2022, https://www.brookings.edu/research/making-local-economies-prosperous-and-resilient-the-case-for-a-modern-economic-development-administration/.

[90] U.S. Congress, House Committee on Science, Space, and Technology, *Regional Innovation Act of 2021*, 117th Cong., 2nd sess., February 28, 2022, H.Rept. 117-254 (Washington: GPO, 2022).

[91] Bjørn T. Asheim, Arne Isaksen, and Michael Trippl, *Advanced Introduction to Regional Innovation Systems* (Northampton, MA: Edward Elgar Publishing, 2019), p. 22; and Ryan Donahue, Joseph Parilla, and Brad McDearman, *Rethinking Cluster Initiatives*, Brookings Institution, Washington, DC, July 2018, https://www.brookings.edu/wp-content/uploads/2018/07/201807_Brookings-Metro_Rethinking-Clusters-Initiatives_Full-report-final.pdf.

[92] Ibid.

[93] NACIE, *Encyclopedia of Innovation Measures Recommendation*, July 12, 2016, p. 1, https://www.eda.gov/sites/default/files/files/oie/nacie/meetings/20160712-Encyclopedia-of-Innovation-Measures-NACIE.pdf.

> sources. The system's architecture, therefore, becomes highly searchable and enables comparisons in multiple ways such as by state, by year, or by type of indicator.[94]

A collection of innovation measures could assist regions in examining their strengths and weakness, in addition to assisting federal agencies in determining the most appropriate type of funding and support to provide. Some research suggests that government effectiveness and institutional quality at the local and regional level are enabling factors in the development and implementation of regional innovation strategies.[95] As such, a pre-condition for innovation may involve the creation of programs and funding focused on building institutional capacity. Capacity-building efforts could focus on research capacity. For example, NSF's Enabling Partnerships to Increase Innovation Capacity (EPIIC) program seeks to support institutions of higher education with limited research capabilities (i.e., minority-serving institutions, predominantly undergraduate institutions, and two-year institutions) so that such institutions can participate in NSF's Regional Innovation Engines program in the future.

Capacity-building efforts could also focus on the quality of local and regional governance. Given the bottom-up nature of regional innovation, improving the ability of regional organizations and local governments to formulate regional strategies, promote and coordinate the participation of stakeholders, and monitor and evaluate implementation will likely be critical to the overall success of federal regional innovation efforts.

RIS Governance Considerations

Congress may consider how federal agencies can best promote good governance at the local and regional level for overall RIS sustainability, communication, and accountability purposes. For example, NSF's Regional Innovation Engines program requires that each Engine "be led by a visionary full-time chief executive, who is the senior official in charge of managing the Engine and is responsible for its overall success."[96] The program also requires each Engine to establish a governance board that "provides, at a minimum, administrative oversight of the Engine's activities and is responsible for the Engine's performance."[97] In another example, EDA's BBBRC program required applicants to designate a "regional economic competitiveness officer" responsible for convening leaders, managing communications, serving as the central coordinator of new and existing resources to the benefit of regional competitiveness, and other roles.[98]

While governance requirements may prove sufficient in ensuring regions have the necessary institutional capacity, other guidance, such as increased technical assistance and the sharing of best practices may be needed for regions that have limited experience in technology-based economic development. In addition, a preliminary examination of EDA's BBBRC program indicated that regional leaders need help in developing data and tracking systems to implement "more holistic, inclusive [innovation] indicator frameworks."[99]

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[94] Ibid., pp. 1-2.

[95] Andrés Rodríguez-Pose, Marco di Cataldo, and Alessandro Rainoldi, *The Role of Government Institutions for Smart Specialisation and Regional Development*, European Commission, Joint Research Center, S3 Policy Brief Series, No. 04/2014, 2014, https://publications.jrc.ec.europa.eu/repository/handle/JRC88935.

[96] NSF, *Regional Innovation Engines Broad Agency Announcement*, NSFBAA-ENGINES-2022-05-1, December 20, 2022.

[97] Ibid.

[98] EDA, *FY 2021 American Rescue Plan Act Build Back*, EDA-HDQ-ARPBBB-2021-2006976, July 22, 2021.

[99] Joseph Parilla, Glencora Haskins, and Mark Muro, *The Future of Place-Based Economic Policy: Early Insights from the Build Back Better Regional Challenge*, Brookings Institution, Washington, DC, November 2022, p. 33,

Equity and Innovation

Some analysts view a shift towards expanded federal, place-based policies, including RIS, as an approach that may advance U.S. competitiveness while also addressing concerns around economic inclusion, regional disparities, and equity.[100] Some scholars, policymakers, and administrators have expressed interest in understanding the demography of America's innovation ecosystem and have expressed concerns that the barriers faced by certain socioeconomic, racial, and gender-based groups hinders participation, which may negatively impact U.S. technological competitiveness.[101] Some studies suggest that the marginalization of certain groups within society, in terms of who can access the "innovation ecosystem" (including advanced training and education, R&D funding, and venture capital), has a dampening effect on innovation.[102] When significant numbers of potential innovators do not participate in the innovation process, their unique perspectives and ideas may be lost.[103] Additionally, some proponents of expanded federal RIS policies consider the potential of additional investment in underserved communities as a means of addressing geographic socioeconomic divergence. These views reflect concerns about "lagging regions" and social division, among other concerns.[104]

In overseeing the implementation of RIS programs, Congress may wish to consider the insights garnered from an analysis of a program with similar RIS-based goals: the EDA's BBBRC. A November 2022 Brookings Institution report analyzed the degree to which BBBRC finalists successfully integrated congressionally mandated equity goals within their regional development plans, among other things, concluding that while "the BBBRC's top priority was equity," grant recipients "had mixed success embedding equity in strategies, governance, and metrics."[105] Analysts from Brookings also noted that the BBBRC's accelerated application timeline, which required participants to condense planning and coalition building into a matter of weeks, may

https://www.brookings.edu/wp-content/uploads/2022/11/EDA-BBBRC_final.pdf.

[100] Amy Liu et al., "Making Local Economies Prosperous and Resilient: The Case for a Modern Economic Development Administration," The Brookings Institution, June 27, 2022, https://www.brookings.edu/research/making-local-economies-prosperous-and-resilient-the-case-for-a-modern-economic-development-administration/.

[101] Shobita Parthasarathy, "Innovation as a Force for Equity," *Issues in Science and Technology*, vol. XXXVIII, no. 2 (Winter 2022); Jonathan Gruber and Simon Johnson, *Jump-Starting America: How Breakthrough Science Can Revive Economic Growth and the American Dream* (New York: Public Affairs, 2019); Alexander Kersten and Gabrielle Athanasia, *Untapped Innovation? The Racial and Gender Divides That Hinder the U.S. Knowledge Economy*, Center for Strategic and International Studies, CSIS Briefs, May 2022, https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/220525_Kersten_Untapped_Innovation.pdf?xSNyYflYj1TUlHfA_TJ7mdbu2TLxijpb; Lisa D. Cook, *Policies to Broaden Participation in the Innovation Process*, The Hamilton Project, Brookings, Policy Proposal 2020-11, August 2020; Holly Fechner and Matthew S. Shapanka, "Closing Diversity Gaps in Innovation: Gender, Race, and Income Disparities in Patenting and Commercialization of Inventions," *Technology and Innovation*, vol. 19 (2018), pp. 727-734.

[102] Lisa D. Cook, *Policies to Broaden Participation in the Innovation Process*, The Hamilton Project, Brookings, Policy Proposal 2020-11, August 2020.

[103] Holly Fechner and Matthew S. Shapanka, "Closing Diversity Gaps in Innovation: Gender, Race, and Income Disparities in Patenting and Commercialization of Inventions," *Technology and Innovation*, vol. 19 (2018), pp. 727-734.

[104] Robert D. Atkinson, Mark Muro, and Jacob Whiton, *The Case for Growth Centers: How to Spread Tech Innovation across America*, The Brookings Institution and The Information Technology and Innovation Foundation, Washington, DC, December 8, 2019, https://www.brookings.edu/research/growth-centers-how-to-spread-tech-innovation-across-america/.

[105] Joseph Parilla, Glencora Haskins, and Mark Muro, *The Future of Place-Based Economic Policy: Early Insights From the Build Back Better Regional Challenge*, Brookings Metro, November 17, 2022, p. 29, https://www.brookings.edu/research/the-future-of-place-based-economic-policy-early-insights-from-the-build-back-better-regional-challenge/.

have hampered the ability of recipients to develop comprehensive equity plans. The report's assessment of the specific ways BBBRC finalists failed to fully deliver on the program's intended equity goals may prove useful in overseeing the implementation of subsequent regional innovation programs:

> Equity strategies were weakest when they relied on boilerplate arguments about inclusion, either by failing to develop initiatives targeted to their region's historically excluded populations or neglecting to articulate how equity-focused community organizations were meaningfully integrated into each project's planning, governance, and execution.[106]

Congress may wish to consider potential metrics to assess program design and efficacy in addressing disparities in innovation. For instance, patenting rates within the United States (specifically utility patenting rates, the largest component of patenting activity) demonstrate that innovative activity is not currently distributed evenly throughout the country. Analyzing the "geography of U.S. patenting," the *2022 Science and Engineering Indicators* report, published by the National Science Board, found that areas of high patenting intensity in the United States (measured by the patent owner's location per 1,000 residents) are primarily concentrated along the coasts, in Texas, and in parts of the Great Lakes and Rocky Mountains (see **Figure 4**).[107] The report also found that, in 2020, 41.6% of U.S. counties had zero patents granted to people residing in that county.[108] Since patents are widely recognized as an important measure of innovation, monitoring the trends in U.S. patenting activity may assist policymakers in assessing current sources of innovation and in identifying potential inequities that may limit future U.S. technological and economic leadership.[109] Congress may also wish to consider evaluating whether investments in regional innovation programs increase patenting rates in targeted regions or for minority- and women-owned businesses.

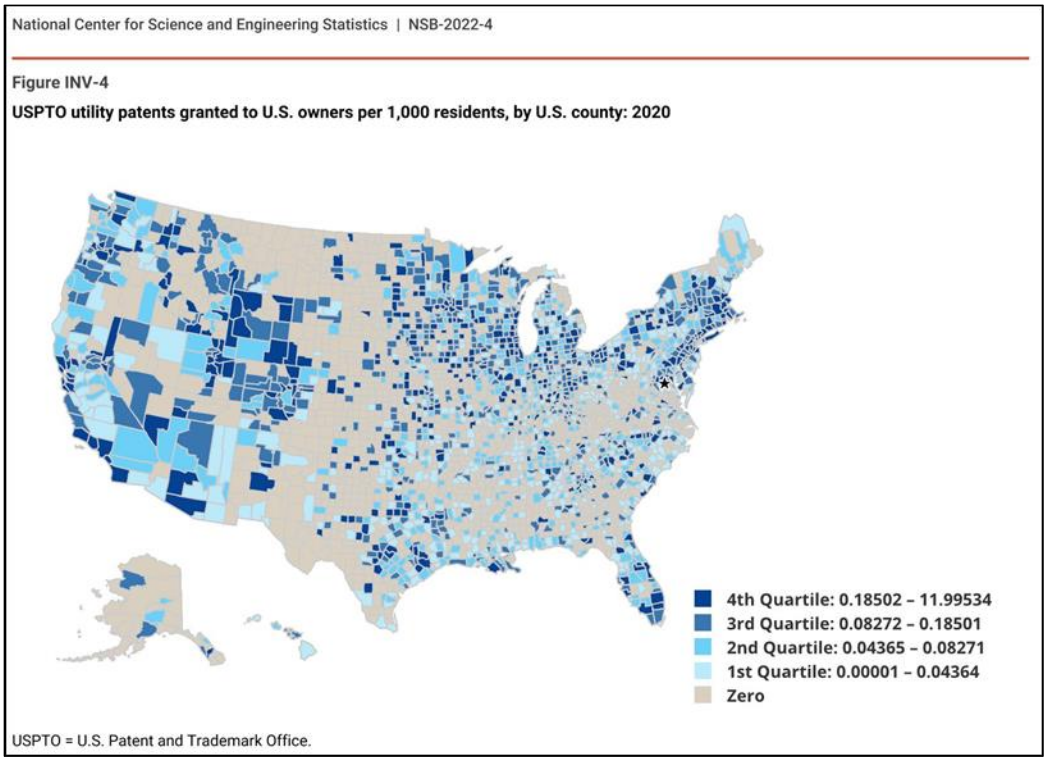
[106] Ibid.

[107] National Science Board, NSF, *Invention, Knowledge Transfer, and Innovation. Science and Engineering Indicators 2022*, NSB-2022-4, Alexandria, VA, p. 19, https://ncses.nsf.gov/pubs/nsb20224/.

[108] Ibid., p. 20.

[109] For more information on patents and innovation policy, see CRS Report R47267, *Patents and Innovation Policy*, by Emily G. Blevins.

Figure 4. U.S. Patent and Trademark Office (USPTO) Utility Patents Granted to U.S. Owners per 1,000 Residents, by U.S. County: 2020



Source: National Science Board, National Science Foundation, *Invention, Knowledge Transfer, and Innovation. Science and Engineering Indicators 2022*, NSB-2022-4, 2022, https://ncses.nsf.gov/pubs/nsb20224/; population data from the U.S. Census Bureau accessed June 2021, https://www.census.gov/newsroom/press-releases/2021/2020-vintage-population-estimates.html, cited in National Science Board, National Science Foundation, *Invention, Knowledge Transfer, and Innovation. Science and Engineering Indicators 2022*, NSB-2022-4, 2022, https://ncses.nsf.gov/pubs/nsb20224/.

Capital Access

The availability of private market capital is associated with increased levels of business starts, income, and employment growth, and is an integral component of RIS. Venture capital is one of several types of private market capital that may facilitate the formation of high-growth business and may support funding needs for specific phases of innovation processes.[110] However, barriers to capital may limit innovation and hamper the eventual growth of firms and regional

[110] Sampsa Samila and Olav Sorenson, "Venture Capital, Entrepreneurship, and Regional Economic Growth," (July 6, 2009), available at SSRN, https://ssrn.com/abstract=1183576; Robert Fairlie, Alicia Robb, and David Robinson, "Black and White: Access to Capital Among Minority-Owned Startups" (Stanford Institute for Economic Policy Research, 99 December 2016), https://doi.org/10.3386/w28154.

According to SBA's "Venture Capital" video and transcript, venture capital (VC) is:

> a type of equity financing that addresses the funding needs of entrepreneurial ventures which, for reasons of size, assets, and stage of development, cannot seek capital from more traditional sources, such as public markets and banks. Venture capital investments are generally made as cash in exchange for shares and play an active role in the company invested in.

For more information, including a summary of advantages and disadvantages of VC, see https://learn.sba.gov/learning-center-launch/learning-center-financing-your-business/venture-capital.

economies.[111] Private capital resources, and venture capital in particular, are not evenly distributed across all regions of the United States and may not be available to all types and sizes of firms. For instance, minority business enterprises face barriers in accessing private market capital, particularly private equity and venture capital.[112] Industry reports also document the regional disparities in venture capital availability, which is generally concentrated in certain metro regions.[113]

Congress has taken several actions to expand capital access programs. For example, Congress continues to support SBA and Minority Business Development Agency (MBDA) programs designed to expand access to credit for specific types of businesses and types of capital. Considering recent congressional examinations of the barriers to certain types of private market capital,[114] and the expansion of RIS programs, Congress may be interested in reviewing how existing or new capital access programs may be used to address regional innovation and capital access disparities. Congress may be interested in reviewing options to create criteria to prioritize SBA and MBDA capital access awards in regions participating in new or existing RIS programs.[115] In its oversight of the Regional Technology and Innovation Hubs and other programs, Congress may also consider a review of lender and investment partner participation data and how regional hubs coordinate with SBA- and MBDA-supported initiatives. In addition to the matter of integrating capital access programs with new RIS programs, Congress may continue to review federal options to support firm-level capital needs associated with specific phases of technology development and innovation processes (e.g., loan guarantee programs, grants for venture development organizations, capital for private sector venture funds).[116]

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[111] William R. Kerr and Ramana Nanda, "Financing Constraints and Entrepreneurship," *Handbook of Research on Innovation and Entrepreneurship* (Northampton, MA: Edward Elgar Publishing, 2011), among others.

[112] Robert W. Fairlie, Alicia Robb, and David T. Robinson, "Black and White: Access to Capital Among Minority-Owned Startups," NBER Working Paper No. 28154 (November 2020), https://doi.org/10.3386/w28154; V. Hwang, S. Desai, and R. Baird, "Access to Capital for Entrepreneurs: Removing Barriers," Ewing Marion Kauffman Foundation: Kansas City (2019); and Robert W. Fairlie, Alicia M. Robb, and David Hinson, "Disparities in Capital Access Between Minority and Non-Minority-Owned Businesses," Minority Business Development Agency (2010), https://www.mbda.gov/sites/default/files/migrated/files-attachments/DisparitiesinCapitalAccessReport.pdf.

[113] See, for example, the *National Venture Capital Association (NVCA) 2022 Yearbook*, an annual yearbook published by a national VC industry association that describes aspects of the U.S. venture capital industry, among others. The *NVCA 2022 Yearbook* noted that

> California, Massachusetts, and New York continued their dominance for [venture capital] VC activity; collectively, these three states accounted for 54% of total deal count and 73% of total capital invested in 2021, with both metrics on par with 2020 figures.

See NCVA, *NCVA 2022 Yearbook*, https://nvca.org/wp-content/uploads/2022/03/NVCA-2022-Yearbook-Final.pdf.

[114] During the 116th and 117th Congresses, the House Committees held hearings that noted capital access, workforce, and education challenges and their impact on U.S. competitiveness as well as the overall innovation and entrepreneurship ecosystems. See, for example, U.S. Congress, House Committee on the Judiciary, Subcommittee on Courts, Intellectual Property, and the Internet, *Lost Einsteins: Lack of Diversity in Patent Inventorship and the Impact on America's Innovation Economy*, 116th Cong., 1st sess., March 27, 2019; U.S. Congress, House Committee on Small Business, Subcommittee on Innovation, Entrepreneurship, and Workforce Development, *Enhancing Patent Diversity for America's Innovators*, 116th Cong., 2nd sess., January 15, 2020; and U.S. Congress, House Committee on Small Business, Subcommittee on Economic Growth, Tax, and Capital Access, *Innovation as a Catalyst for New Jobs: SBA's Innovation Initiatives*, 117th Cong., 1st sess., July 14, 2021; among others.

[115] For an example of this perspective and other federal roles in expanding access to capital in the RIS context, see Robert D. Atkinson, Mark Muro, and Jacob Whiton, *The Case for Growth Centers: How to Spread Tech Innovation Across America*, The Brookings Institution and The Information Technology and Innovation Foundation, Washington, DC, December 8, 2019, https://www.brookings.edu/research/growth-centers-how-to-spread-tech-innovation-across-america/.

[116] EDA defines a Venture Development Organization (VDO) as "a state or nonprofit entity that contributes to regional

Startups and Small Business Considerations

Economic development practitioners generally consider the growth and eventual sale or ownership transition of successful startups as beneficial to regional economies.[117] Experts on business startups note that there are many types of startups, but few are high-growth. Further, startups have a high rate of failure and it is difficult to predict which startups may affect productivity and/or employment growth.[118]

One method of supporting high-growth startups in RIS policies could be through size-neutral criteria such as the business's age or growth phase. For example, EDA's Seed Fund Support (SFS) program (part of its B2S/RIS program) provides funding for the creation or expansion of seed funds and entrepreneurial support organizations that focus on "innovation-based startups with a potential for high growth and job creation."[119] The SBA's Growth Accelerator Fund Competition (GAFC) funds business accelerators that provide technical support to small business startups. The GAFC program also targets accelerators that support businesses and/or geographies that traditionally face barriers in obtaining R&D funds and investment capital: businesses owned or led by women, minorities, and veterans, or businesses located in rural areas.[120]

In addition to startups, existing small businesses may support the development of RIS. Congress has long supported small businesses through various policies such as contracting preferences and technical assistance programs that prioritize small businesses.[121] Congress may consider whether and how to customize RIS policies to facilitate the growth and success of small businesses. For example, Congress could consider policies that encourage small business development in regional initiatives based on certain characteristics, such as the business's location, the background of its owner(s), or businesses in specific industries. Congress could consider establishing a goal for regional innovation programs to assist a certain number or percentage of small businesses based on these or other characteristics. Congress could direct existing business assistance programs, such as MBDA and SBA initiatives, to prioritize projects located in areas served by RIS projects.

To evaluate federal RIS programs' impact on small businesses, Congress may consider directing agencies to track metrics related to small business participation and job creation outcomes. For example, the SBA asked grantees setting up clusters in the Regional Innovation Clusters program

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or sector-based economic prosperity by providing services for the purposes of accelerating the commercialization of research. VDOs are defined in 15 USC § 3722(a)(4)." See EDA, "Economic Development Glossary," https://www.eda.gov/about/economic-development-glossary.

[117] U.S. Congress, Senate Committee on Science, Commerce, and Transportation, Subcommittee on Communications, Technology, Innovation, and the Internet, hearing on "Betting on the Rest: Expanding American Entrepreneurship Outside Traditional Hubs," 116th Cong., 2nd sess., December 15, 2020, https://www.commerce.senate.gov/2020/12/betting-on-the-rest-expanding-american-entrepreneurship-outside-traditional-hubs.

[118] Chen Yeh, "Why Are Startups Important for the Economy?" *Federal Reserve Bank of Richmond Economic Brief*, No. 23-06, (February 2023), https://www.richmondfed.org/publications/research/economic_brief/2023/eb_23-06.

[119] EDA, *2019 Regional Innovation Strategies Program, Notice of Funding Opportunity*, January 31, 2019, https://www.grants.gov/web/grants/view-opportunity.html?oppId=312519.

[120] For more information about the SBA's Growth Accelerator Fund Competition Program, see CRS In Focus IF12310, *The Small Business Administration's Growth Accelerator Fund Competition*, by Adam G. Levin.

[121] For example, since 1988, the federal government has maintained annual goals for small and small "disadvantaged" business participation in federal contracting. The goals, which are in statute, specify percentages of federal contracts that should go to certain businesses based on size or type of business owner. For more information, see CRS Insight IN12018, *Federal Small Business Contracting Goals*. Additionally, for decades, Congress has directed the SBA to provide small businesses with assistance through credit and technical assistance programs (e.g., the SBA 7(a) loan guarantee, the SBA 504 loan program, the SBA Microloan program).

to track metrics including growth in the number of small businesses participating in cluster partnerships and growth in job creation of small businesses participating in the cluster.[122]

Concluding Remarks

Concerns about declining U.S. economic competitiveness and technological leadership—and the potential implications for economic growth, productivity, employment, and national security—are not new. For example, in the late 1970s and 1980s, the United States faced growing trade deficits, slowing rates of productivity growth, and increased competition in industries such as automobiles, steel, consumer electronics, and semiconductors. Congress responded to those challenges, in part, by enacting legislation intended to improve U.S. development and commercialization.

Current concerns are centered on the rise of China, with some asserting that it will soon surpass the United States as the global leader in science and technology. Congress has responded to these concerns, in part, by enacting legislation that will improve the innovation capacity of the nation as a whole. The recent expansion of federal support for RIS policies may expand the nation's innovation capacity by helping regional economies address barriers to entrepreneurship and the development and commercialization of certain technology areas. As such, the effective implementation of regional innovation systems and strategies will likely remain an area of congressional interest for the foreseeable future.

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[122] SBA, *SBA—Regional Innovation Cluster Initiative Services—2018 Performance-Based Statement of Work*, 2018, https://sam.gov/api/prod/opps/v3/opportunities/resources/files/49614056be72fe01d0c5d49c3e0a2ab3/download.