NATIONAL ADVISORY COUNCIL ON
INNOVATION AND ENTREPRENEURSHIP

July 12, 2016

The Honorable Penny Pritzker
U.S. Department of Commerce
1401 Constitution Avenue NW
Washington, DC 20230

Dear Secretary Pritzker:

On behalf of the National Advisory Council on Innovation and Entrepreneurship, we are pleased to offer recommendations that aim to improve policymakers', practitioners', and others' understanding of innovation and its drivers as set forth in the attached proposal, "Tracking and Comparing Innovation: A Proposal to Create an Online Encyclopedia of Innovation Indices and Measurement Tools."

NACIE recommends the creation of an online, dynamic web resource that catalogues and curates the growing number of indices and tools that seek to measure innovation. NACIE supports the rationale and conclusions reached by the Advisory Committee on Measuring Innovation in the 21st Century Economy that innovation data need to be more usable and available for policy makers at all levels[1], and therefore NACIE proposes the collection of multiple types of innovation reports into one searchable, digital archive that can grow with the community of organizations that rely on this information. This represents a tangible step forward in addressing the need identified eight years ago.

This proposal differs in an important aspect from those that have come before that sought to define innovation in specific ways: rather than narrowly define innovation and measure it according to that definition, the proposed resource looks across the multiplicity of innovation measurement efforts to understand the ways that organizations—local, national, international—measure innovation *in practice.* The resource described in the attached document 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

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[1] THE ADVISORY COMMITTEE ON MEASURING INNOVATION IN THE 21ST CENTURY ECONOMY, INNOVATION MEASUREMENT: TRACKING THE STATE OF INNOVATION IN THE AMERICAN ECONOMY 11-12 (Jan. 2008), *available at*
http://www.esa.doc.gov/sites/default/files/innovation_measurement_01-08.pdf.

data 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.

We propose that Commerce dedicate resources, either financial or human, to develop the online framework for the proposed resource outlined in the attachment. Once the framework is built, Commerce would facilitate the gathering of a community of users to expand the resource through an open source model. Thus, the community itself will drive the resource's sustainability and relevance but would be enabled by a Commerce backbone.

NACIE believes that this resource would provide great value not just to the United States but also to the global community as we collaborate to refine our collective understanding of innovation, means to foster innovative economies, and innovation's impact on economic growth.

Respectfully submitted,
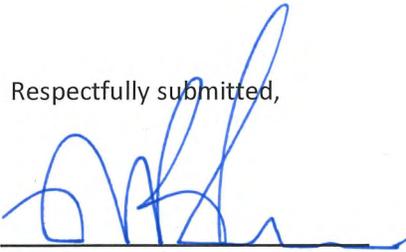
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TRACKING AND COMPARING INNOVATION: A PROPOSAL TO CREATE AN ONLINE ENCYCLOPEDIA OF INNOVATION MEASUREMENT TOOLS

Department of Commerce

National Advisory Council on
Innovation and Entrepreneurship

July 2016

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National Advisory Council on
Innovation and Entrepreneurship

About the National Advisory Council on Innovation and Entrepreneurship

The National Advisory Council on Innovation and Entrepreneurship (NACIE) is comprised of leading entrepreneurs, innovators, investors, and university and economic development executives. It is charged by the Secretary of Commerce to identify ways in which the United States may remain a source of paradigm-changing innovation and home to the companies that take them to market. NACIE offers policy recommendations to facilitate economic growth through entrepreneurial activity, the commercialization of new ideas into high-growth businesses, and job creation. NACIE is supported by the Department of Commerce's Office of Innovation and Entrepreneurship (OIE).

For more information about NACIE, see https://www.eda.gov/nacie.

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Innovation and Entrepreneurship

Table of Contents

1. Measuring and Analyzing Innovation

Currently in the United States, no overall measure of innovation exists although multiple organizations and government agencies produce indices according to their own criteria. This data is often limited in its scope, is not readily available, or presents a particular perspective based upon editorial priorities. Each of these measures is valuable, however, for different audiences and different purposes. The objective of this document is to present a prototype for an "Encyclopedia of Innovation Measurement Tools" that might be developed into a robust, online resource that gives local agencies and policy makers the opportunity to understand innovation in a way that best suits their local contexts by drawing on multiple reports on innovation.

This new resource would build on prior work from the U.S. Department of Commerce, in particular, its 2008 report on innovation measurement, which recommended taking steps toward creating a national innovation index and increasing the availability of innovation data, suggesting that "[i]n the absence of a single indicator, the committee proposes that the Department of Commerce take steps toward improving, integrating, and expanding on its current data collection efforts in the next few years while research is undertaken to better inform the task of measuring innovation."[1] The prototype described in this document makes tangible steps toward achieving these goals by collecting multiple types of innovation measurement tools and making them accessible through an interface that describes the core features of each resource. In this respect, the project proposed here becomes a means for policy makers at all levels—national, state, local—to easily access multiple ways of measuring innovation through one central resource that attempts to catalog as many innovation measurement tools as possible. Additionally, the project includes summary data on primary data sources, such as U.S. Census data, that serve as the foundation for many innovation measurement tools from various groups. Should they wish to understand how measurement tools are built or if they intend to construct their own, policy makers will have easier access to the vast amount of information available from governmental, non-profit, and private organizations through this summarized data source.

The prototype project outlined here takes concrete steps toward realizing the recommendations outlined in 2008. Within the United States and across the world, dozens of innovation measurement

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[1] The Advisory Committee on Measuring Innovation in the 21st Century Economy, Innovation Measurement: Tracking the State of Innovation in the American Economy xi (Jan. 2008), *available at* http://www.esa.doc.gov/sites/default/files/innovation_measurement_01-08.pdf.

tools and resources exist, yet no encyclopedia catalogs them. The proposed project helps to solve this problem and creates a platform for comparative dialogue on the topic of measuring innovation.

1.1 The Importance of Measuring and Analyzing Innovation

Multiple sources agree that innovation drives economic growth. However, the definition of innovation remains somewhat slippery with different agencies or organizations defining it in different ways. Rather than replay the conversations that seek to define innovation in one way or another, this report simply assumes that measuring innovation is important regardless of the way it is defined. The approach outlined in this report—an encyclopedia of innovation measurement tools—therefore proceeds from an inductive view of actual practice and how different organizations define and measure innovation. The inductive approach respects the multiplicity of efforts to measure innovation that already exist and by looking across the work that has already been accomplished, we can begin to understand how real organizations and agencies measure innovation in practice. This pragmatic approach proceeds from the understanding the measuring innovation is important regardless of its definition, yet, in the absence of a single definition and associated measure, we should look to existing practice to help move toward a theory of innovation instead of attempting to deduce that definition and measure.

1.2 Innovation Analysis Trends

When preparing this report, NACIE examined dozens of existing innovation measurement tools ranging from international measures such as the Global Innovation Index, to national measures such as StatsAmerica, and to local measures such as the North Carolina Innovation Index. We studied those produced by governmental agencies such as the NSF's Business R&D Innovation Survey, by non-profits such as the State New Economy Index, and by for-profit organizations such as The Money Tree Report produced by PWC in association with the National Venture Capital Association.

By looking across these multiple measures we observed several trends for measuring innovation that roughly collocate into the following categories:

Category	Examples of Indicators
Human Capital	Educational attainment, percentage of STEM degrees; average age; in/out migration
Innovation Ecosystem	Average SBIR/STTR awards; number of high growth technology businesses; patents per 1000 people; R&D Expenditures
Business Environment	Broadband access; higher education investment; venture capital dispersed; distribution of businesses; business size
Personal Economic Conditions	Per capita GDP; median household income; unemployment rate; consumer spending rates; job growth to population ratio

Table 1

While not definitive, these categories suggest the ways that innovation is currently understood and measured in practice and suggest that some agreement exists on how best to define innovation across multiple types of organizations with varying priorities. By collecting as many measurements as possible into the online encyclopedia outlined here, we can begin to refine our understanding of innovation and move toward an associated measurement tool built on a consensus of those who have already constructed such tools.

1.3   The Encyclopedia of Innovation Measurement Tools

Since we are proposing an encyclopedia that collects and describes the measurement tools available, the resource should be understood as a curated reference guide rather than a definitive statement on measuring innovation. As an open access resource, the Encyclopedia should be readily available online, dynamic, usable by multiple audiences with multiple purposes, and have robust search and cross-referencing capabilities. In the sections that follow, we present static snapshots of what might characterize an "entry" into the Encyclopedia starting with examples of a few indices taken from different perspectives (e.g. government, nonprofit and private) followed by primary data sources that many indices use as the basis for their measures (SBIR/STTR awards; World DataBank; Kauffman Foundation Index of Entrepreneurship).

Section 2 should, therefore, be understood as a paper-based prototype that we propose expanding into a fully online, fully open, curated collection of innovation measures and indices.

2. Snapshots: Innovation Measurement Tools

The Encyclopedia of Innovation Measurement Tools will present information that is both pertinent and useful to users that seek to understand how innovation is measured and reported across the global innovation community. The first version of the Encyclopedia will profile entries in two categories: (1) innovation measurement tools (e.g., indices, sets of metrics) and (2) sources for innovation data. The next two sections provide encyclopedia snapshots for innovation indices and sources for innovation data, respectively.

2.1   Innovation Indices

A primary category of innovation measurement tool is the innovation index. Innovation indices are typically used as a benchmarking tool or a reporting mechanism on innovation. Innovation indices are created in order to measure innovation in a more comprehensive way than a single metric and to address specific elements of innovation. As shown below, fields to be displayed in the Encyclopedia might include: author(s), funding source(s), first known use of index, level of analysis, focus (geography), comparative focus (geography), previous index releases, measures and sources, description, purpose, methodology, and citation.

2014 State New Economy Index
(website)

Authors:
The Information Technology and Innovation Foundation; Atkinson, R.D.; Andes, S.

Funding Source:
The Information Technology and Innovation Foundation

|	
First Known Use:	1999
Level:	State
Focus:	All 50 U.S. States
Comparative Focus:	U.S. States
Previous Releases:	1999; 2002; 2007; 2008; 2010; 2012
Measures & Sources:	<Link to measures>
Data:	<Link to data>

Description:
The State New Economy Index uses 25 indicators to assess states' fundamental capacities to successfully navigate the shoals of economic evolution. It measures the extent to which state economies are structured and operate according to the tenets of an evolutionary-based New Economy. In other words, it examines the degree to which state economies are knowledge-based, globalized, entrepreneurial, IT-driven, and innovation-based.

Purpose:
The purpose of the Index is to measure the economic structure of states. Unlike some other reports which assess state economic performance or state economic policies, this report focuses more narrowly on a simple question: to what degree does the structure of state economies match the ideal structure of the New Economy? For example, we know that a defining characteristic of the New Economy is that it is global. Therefore, the Index uses a number of variables to measure state economies' degrees of global integration.

Methodology:
Overall, the report uses 25 indicators, divided into five categories that best capture what is new about the New Economy: knowledge jobs, globalization, economic dynamism, the digital economy, innovation capacity.
<Link to methodology>

Citation:
Atkinson, R.D., and Andes, S. (January 2014). The 2014 State New Economy Index: Benchmarking Economic Transformation in the States. Washington, D.C.: The Information Technology & Innovation Foundation (ITIF).
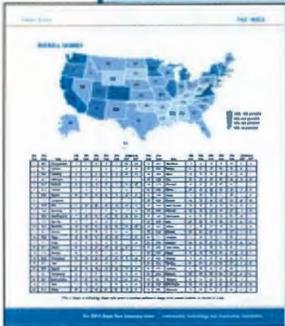
2015 Global Innovation Index
([website](#))

Authors:	Cornell University, INSEAD, and the World Intellectual Property Organization (WIPO), Confederation of Indian Industry, du, A.T. Kearney, IMP³rove -- European Innovation Management Academy
Funding Source:	Cornell University, INSEAD, and the World Intellectual Property Organization (WIPO)

First Known Use:	2007
Level:	Country
Focus:	141 countries
Comparative Focus:	Global economies
Previous Releases:	2007; 2008; 2009; 2010; 2011; 2012; 2013; 2014
Measures & Sources:	<Link to measures>
Data:	<Link to data>

Description: The Global Innovation Index (GII) 2015 covers 141 economies around the world and uses 79 indicators across a range of themes. Thus GII 2015 presents us with a rich dataset to identify and analyze global innovation trends. The theme for this year's GII is 'Effective Innovation Policies for Development'.

Purpose: The GII is concerned primarily with improving the journey towards a better way to measure and understand innovation and with identifying targeted policies, good practices, and other levers that can foster innovation. Written in a nontechnical language and style, the GII appeals to diverse groups including policy makers, business leaders, academics, and multiple organizations of civil society.

Methodology: The Global Innovation Index 2015 (GII) relies on two sub-indices, the Innovation Input Sub-Index and the Innovation Output Sub-Index, each built around key pillars. Five input pillars capture elements of the national economy that enable innovative activities: (1) Institutions, (2) Human capital and research, (3) Infrastructure, (4) Market sophistication, and (5) Business sophistication. Two output pillars capture actual evidence of innovation outputs: (6) Knowledge and technology outputs and (7) Creative outputs. <Link to methodology>

Citation: Cornell University, INSEAD, and WIPO (2015). The Global Innovation Index 2015: Effective Innovation Policies for Development, Fontainebleau, Ithaca, and Geneva.

2010 StatsAmerica Innovation Index
(website)

Authors: Purdue Center for Regional Development at Purdue University; Indiana Business Research Center at Indiana University's Kelley School of Business; Strategic Development Group, Inc.; Economic Modeling Specialists, Inc.; Center for Regional Competitiveness at the University of Missouri's Rural Policy Research Institute

Funding Source: U. S. Dept. of Commerce EDA; Indiana Office of Community and Rural Affairs
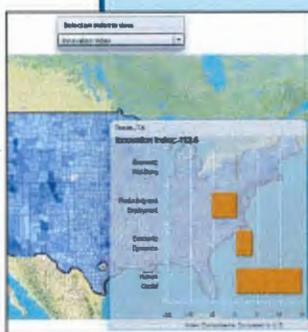
First Known Use:	2009
Level:	County, Metropolitan, Micropolitan, CSA, Economic Development District
Focus:	U.S. communities
Comparative Focus:	Across U.S.
Previous Releases:	2009
Measures & Sources:	<Link to measures>
Data:	n/a

Description: The Innovation Index compares regional performance to the United States and is calculated from 4 component indices (Human Capital, Economic Dynamics, Productivity and Employment, Economic Well-Being). The Index utilizes innovation activity and capacity, together with an interactive database containing the index and its component indicators for every county in the nation.

Purpose: The U.S. Economic Development Administration sponsored this project to develop new tools to support strategic economic development planning in rural regions. The goal of this work is to help rural planners assess their region's comparative strengths and weaknesses with respect to fostering innovation-based growth. The project's data and tools, however, can be used equally well in any type of region—urban, exurban, metropolitan or custom-based depending upon need and purpose.

Methodology: The Innovation Index compares regional performance to the United States and is calculated from 4 component indexes: human capital, economic dynamics, productivity and employment, economic well-being.
<Link to methodology>

Citation: Purdue Center for Regional Development, Indiana Business Research Center (IBRC), Strategic Development Group, Inc., Rural Policy Research Institute, Economic Modeling Specialists, Inc. (2009). StatsAmerica Innovation Index.

2015 North Carolina Innovation Index
(website)

Authors:	North Carolina Board of Science, Technology & Innovation
Funding Source:	North Carolina Board of Science, Technology, & Innovation; North Carolina Department of Commerce

First Known Use:	2000
Level:	State
Focus:	North Carolina
Comparative Focus:	CA, CO, GA, MA, VA, WA
Previous Releases:	2000; 2003; 2008; 2010; 2013
Measures & Sources:	<Link to measures>
Data:	n/a

Description: Tracking Innovation tracks North Carolina's performance across 39 innovation measures weighed against that of the United States overall, six key comparison states and leading countries. These measures provide insights into the links between innovation, resources, and economic results in the North Carolina economy. The report also identifies areas for improvement.

Purpose: The goal of Tracking Innovation 2015 is to provide that information in a systematic and accessible format, and therefore to help inform science, technology, and innovation planning and policy at all levels. It assembles information from a wide variety of sources to document innovation- related activity in North Carolina, six comparison states, and the U.S.

Methodology: 39 measures are summarized under 31 broad indicators of innovation, technology, and economic well-being. Each of the 39 indicators, in turn, falls into one of six general categories: economic well-being; research & development; commercialization; innovation organizations; education & workforce; environment & infrastructure.
<Link to methodology>

Citation: North Carolina Board of Science, Technology, & Innovation; North Carolina Department of Commerce (2015). Tracking Innovation: North Carolina Innovation Index.

U.S. Cluster Mapping Tool
(website)

Authors:	Harvard Business School; U.S. Department of Commerce; U.S. Economic Development Administration
Funding Source:	U.S. Department of Commerce; U.S. Economic Development Administration

First Known Use:	2013
Level:	State, County, Economic Areas, Metro/Micropolitan Statistical Areas (MSAs)
Focus:	Across the U.S.
Comparative Focus:	Across the U.S.
Previous Releases:	n/a
Measures & Sources:	<Link to measures>
Data:	n/a
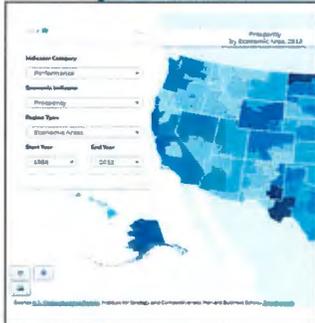
Description: The U.S. Cluster Mapping Project is a national economic initiative that provides over 50 million open data records on industry clusters and regional business environments in the United States to promote economic growth and national competitiveness. The project is led by Harvard Business School's Institute for Strategy and Competitiveness in partnership with the U.S. Department of Commerce and U.S. Economic Development Administration.

Purpose: This resource provides a modern web experience, integrating comparable data and metrics on economic performance to highlight regional strengths and opportunities and empower regions and businesses to make informed decisions. With an extensive organization registry, the platform also aims to connect businesses with the organizations that are promoting their clusters, as well as enable users to share and discuss best practices in economic development, policy and innovation.

Methodology: Researchers from Harvard Business School, MIT Sloan School of Management, and Temple University's Fox School of Business generated cluster definitions based on a novel algorithm that allows for the systematic generation and comparison of clusters across the U.S.
<Link to methodology>

Citation: Harvard Business School; U.S. Department of Commerce; U.S. Economic Development Administration (2013). U.S. Cluster Mapping Tool.

2.2   Data Sources

There exists an abundance of sources used for collecting information on innovation. Collecting and collating these data sources is a critical component of a creating a comprehensive encyclopedia, and aggregating and linking them together with measures and indices provides a valuable contribution to the innovation measurement community. Source fields to be displayed might include: name of database, author(s), funding source(s), first date of release, level of analysis, focus (geography), data time span, date of last update, frequency of update, measures and sources, description, purpose, and citation.

SBIR and STTR Awards
(website)

Authors:	Small Business Administration (SBA)
Funding Source:	U.S. agencies with research budgets exceeding $100 million (currently 11 participating agencies)
Level:	Country, state, county, city and zip code
Focus:	Across the U.S.
Data Time Span	One Year
Last Update	October 2015
Update Frequency	Annual

Description: The Small Business Innovation Research (SBIR) program is a highly competitive program that encourages domestic small businesses to engage in Federal Research/Research and Development (R/R&D) that has the potential for commercialization. The Small Business Technology Transfer (STTR) is another program that expands funding opportunities in the federal innovation research and development (R&D) arena. Central to the program is expansion of the public/private sector partnership to include the joint venture opportunities for small businesses and nonprofit research institutions. The unique feature of the STTR program is the requirement for the small business to formally collaborate with a research institution in Phase I and Phase II.

Purpose: The mission of the SBIR program is to support scientific excellence and technological innovation through the investment of federal research funds in critical American priorities to build a strong national economy. STTR's most important role is to bridge the gap between performance of basic science and commercialization of resulting innovations.

Measures: The SBIR/STTR website reports all awards given in a specific year including the funding agency, the amount of funding, and project description.

Citation: SBIR/STTR Awards Search. Accessed June 12, 2016, https://www.sbir.gov/sbirsearch/award/all

11

World DataBank
(website)

Authors: Development Economics Group

Funding Source: World Bank

Level: Country

Focus: Global

Data Time Span Depends on dataset

Last Update June 2016

Update Frequency Depends on dataset

Description: The Development Economics Vice Presidency (DEC) seeks to increase understanding of development policies and programs by providing intellectual leadership and analytical services to the Bank and the development community. DEC is the research and data arm of the World Bank.

Purpose: The World Bank's Open Data initiative is intended to provide all users with access to World Bank data, according to the Open Data Terms of Use. The data catalog is a listing of available World Bank datasets, including databases, pre-formatted tables, reports, and other resources.

Measures: DEC pursues four main business lines:
- Development Research (research and knowledge creation)
- Development Data (international statistics, statistical capacity building and results monitoring)
- Development Prospects (global monitoring and projections)
- Global Indicators (cross-country comparable measures on a range of policy issues)

Citation: World Bank Data Site. Accessed June 12, 2016, http://data.worldbank.org

Kauffman Foundation Index of Entrepreneurship
(website)

Authors:	Arnobio Morelix, Robert W. Fairlie, E.J. Reedy, Josh Russell
Funding Source:	Ewing Marion Kauffman Foundation

Level:	National, state, metro area
Focus:	United States
Data Time Span	1982-2015; 1997-2015
Last Update	2015
Update Frequency	Annual
First Known Use:	1982; 1997

Description: The Kauffman Index of Entrepreneurship series offers in-depth measures of the people and businesses that contribute to America's overall economic dynamism. The series consists of reports and accompanying interactive data visualizations presenting entrepreneurial trends nationally, at the state level, and for the 40 largest metropolitan areas.

Purpose: The Kauffman Index of Entrepreneurship series is an umbrella of annual reports that measure U.S. entrepreneurship across national, state and top 40 metro levels. Rather than focusing on inputs, the Kauffman Index focuses primarily on entrepreneurial outputs—the actual results of entrepreneurial activity, such as new companies, business density and growth rates.

Measures: The Kauffman Index series consists of three in-depth studies:
- The Kauffman Index of Startup Activity is an early indicator of the beginnings of entrepreneurship in the United States, focusing on new business creation, market opportunity, and startup density.
- The Kauffman Index of Main Street Entrepreneurship, introduced in 2015, measures business ownership and density of established, local small businesses.
- The Kauffman Index of Growth Entrepreneurship, debuting in 2016, looks at growth business activity for startups, scale ups and by industry.

Citation: Kauffman Index of Entrepreneurship Series. Accessed June 12, 2016, http://www.kauffman.org/microsites/kauffman-index

3. Steps Toward the Future of the Encyclopedia

In order to best position the Encyclopedia of Innovation as a useful resource to researchers of innovation across the world, it must be (1) dynamic, (2) informative, and (3) easy to use. Envisioned as an open source, community-driven, platform-enabled website, the encyclopedia should deliver accurate and uniquely presented information about innovation measures and indices.

3.1   The Platform and Features

The Encyclopedia will allow primary organizations and/or authors to populate information directly from their measurement tools and data sources. Information will be posted to the platform once approved and curated by the Encyclopedia team, which will verify the data entered by submitting parties. To meet basic user requirements, the website must be searchable, informative, and useful:

Searchable: The Encyclopedia will be searchable across the various fields collected for each source, measure, and index.
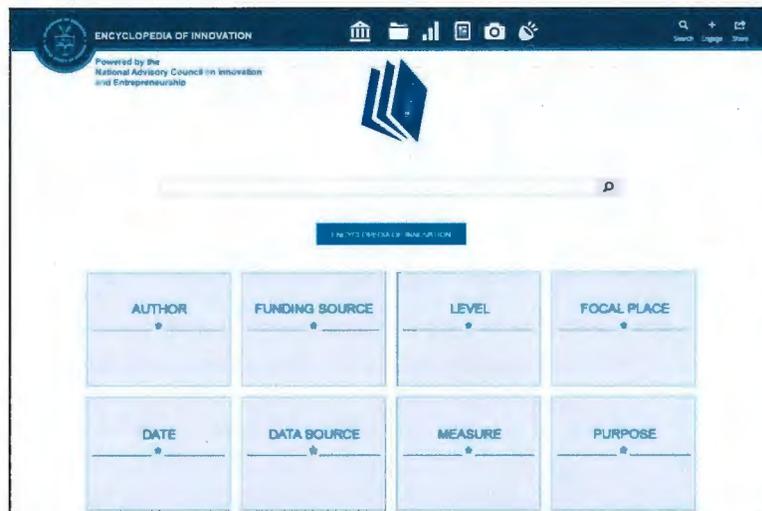

Figure 1: Encyclopedia of Innovation Homepage

For example, a user might be interested in searching for indices that contain information about the global innovation ranking of the United States in the year 2015. The search would result in a list of indices that rank the United States compared to other countries.
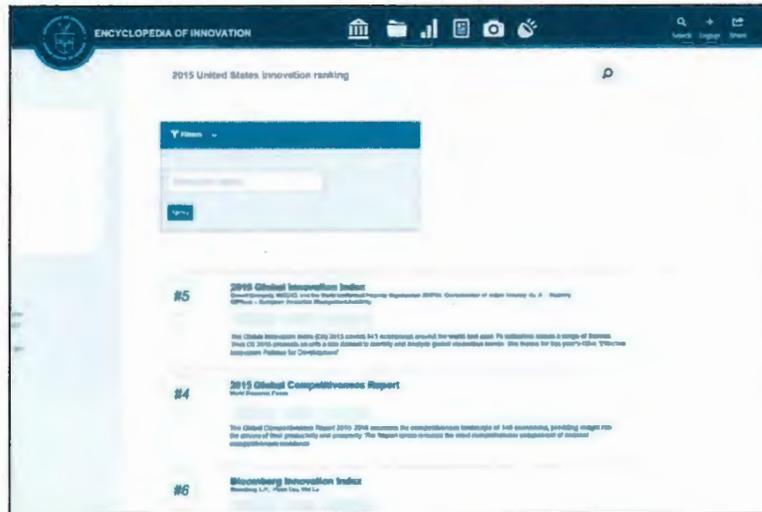
Figure 2: Search results for "2015 United States innovation ranking"

Informative: Beyond providing a platform where users can find what they are searching for, the Encyclopedia should present the most pertinent information for measures, indices, and sources. As the author and user communities provide feedback, fields will be updated and modified to reflect what users find to be informative.
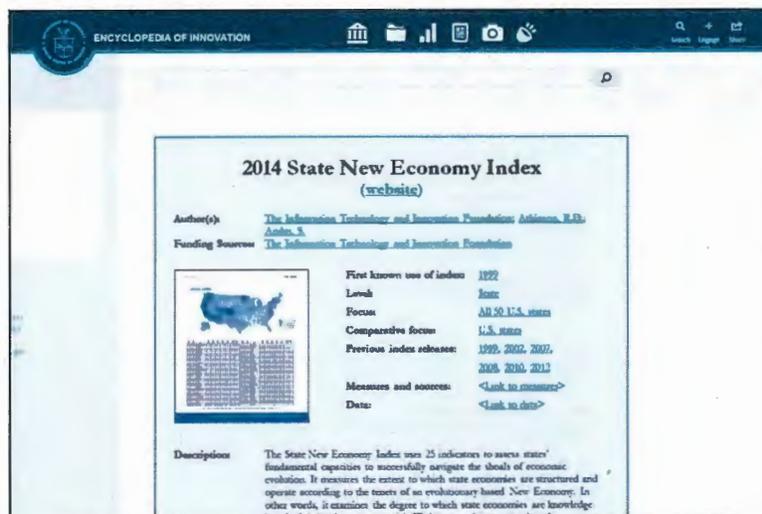

Figure 3: Selection of the "2014 State New Economy Index"

Useful: The Encyclopedia will present source data so that it can be exported easily to various formats. This valuable functionality will also apply to those measures and source data that are used to create each innovation index.

Figure 5: Selection of "Link to data" field for the "2014 State New Economy Index"

The Encyclopedia will be catalogued and linked in a way that permits users to seamlessly obtain information in different fields, as well as to connect common field data across measures, indices, and sources. For instance, a user may search the measures and sources for the 2014 State New Economy Index and develop interest in "Information Technology Jobs," which is a measure used in that index. The website can then display all innovation indices that include "Information Technology Jobs."
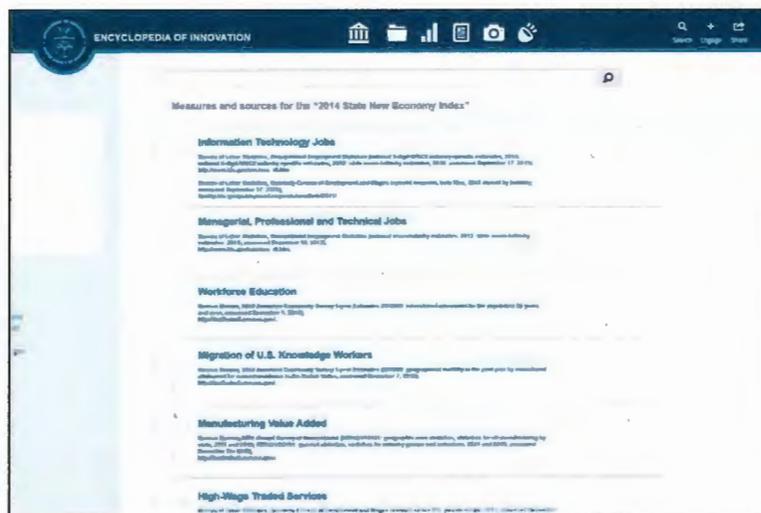

Figure 4: Selection of "Measures and sources" field for the "2014 State New Economy Index"

3.2   International Integration

Because innovation happens throughout the world, foreign and international approaches to innovation measurement could lead to collaboration and coordination. The Encyclopedia of

Innovation seeks to create a global user community that will discuss and debate innovation measurement issues. Socializing the platform through and collaborating with organizations such as the G20, the Organisation for Economic Co-operation and Development (OECD), the World Economic Forum (WEF), and others can help increase the Encyclopedia's utility and increase its participating user community.

3.3 Next Steps and Timeline

We propose that the Encyclopedia of Innovation Measurement Tools be developed under the oversight of NACIE with a goal of an alpha release in late 2016 and with further development to follow. This alpha release will include the essential features outlined in Section 3.1 of this document. The project team proposes the following timeline:

Task	Goal
Continue data collection	Create 100+ innovation index profiles, 100+ innovation measures, 50+ innovation data sources
Engage web development team	Develop alpha version of website by NACIE meeting in October
Populate author/user community database	Create author/user community of 100+ authors and users that can provide feedback for the beta version of the website

Table 2

17

National Advisory Council on
Innovation and Entrepreneurship

https://www.eda.gov/nacie