

EPSCoR Evaluation Conceptual Framework

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I. Purpose for the Evaluation Conceptual Framework

The framework is to be used by the National Science Foundation (NSF) Experimental Program to Stimulate Competitive Research (EPSCoR) to guide its collection and reporting of evidence on the value of the program. The main purpose of the evaluation, based on this framework, is to report on the effectiveness of the EPSCoR program in meeting its goals and objectives. The framework itself is to identify major components of the evaluation that then can be used to structure an effective evaluation study of EPSCoR.

The NSF EPSCoR evaluation process has been divided into three stages. Stage I is the development of a conceptual framework for the evaluation. This document completes Stage I. Stage II will entail the development and testing of a set of metrics based on the indicators described in this document. Stage III will entail the development of a full implementation plan, including data collection and analysis, for the evaluation. Jurisdictions will not be asked to modify their current Research Infrastructure Improvement (RII) project reporting methods until Stages II and III have been completed, and the concomitant metrics and reporting requirements have been disseminated.

The main objective of the overall evaluation is to produce information and sound data that can be used to report on the value of the EPSCoR program to its stakeholders and funding sponsors. These stakeholders include, but are not restricted to, Congress, the participating jurisdictions, the National Science Foundation, and the National Science Board. As such, the evaluation needs to produce findings that are readily consumable, relevant, useful, reliable, and efficient.

Some of the information described in this framework will come from national databases, but much of the data will come from the EPSCoR jurisdictions. The purpose of the evaluation framework is to identify a common format that can be used to collect data and information from all jurisdictions. The common format is required so that data can be aggregated and reported at the EPSCoR program level to its stakeholders.

The EPSCoR program evaluation will not be sufficient to replace the need for each jurisdiction to do its own evaluation to meet local needs. With this understood, it should be noted that the data required for the program evaluation from the jurisdictions will have to be data that are important to the jurisdictions. The aggregated data across jurisdictions should be useful to all of the jurisdictions in meeting their evaluation needs.

II. Program Goals

EPSCoR was established by the National Science Foundation (NSF) in 1978 in response to Congressional mandate: “. . . it shall be an objective of the Foundation to strengthen research and education in the sciences and engineering, including independent research by individuals, throughout the United States, and to avoid undue concentration of such . . .” (U. S. Congress, 1978, as reported in Dietz, 2000)

The mission and goal statements for EPSCoR are:

- To assist the National Science Foundation in its statutory function “to strengthen research and education in science and engineering throughout the United States and to avoid undue concentration of such research and education.”
- To provide strategic programs and opportunities for EPSCoR jurisdictions that stimulate sustainable improvements in their research and development (R&D) capacity and competitiveness.
- To advance science and engineering capabilities in EPSCoR jurisdictions for discovery, innovation, and overall knowledge-based prosperity.

The program objectives are:

- To catalyze key research themes and related activities within and among EPSCoR jurisdictions that empower knowledge generation, dissemination and application;
- To activate effective jurisdictional and regional collaborations among academic, government and private sector stakeholders that advance scientific research, promote innovation and provide multiple societal benefits;
- To broaden participation in science and engineering by institutions, organizations and people within and among EPSCoR jurisdictions;
- To use EPSCoR for development, implementation and evaluation of future programmatic experiments that motivate positive change and progression.

III. Process for Deriving the Framework

The process for identifying the EPSCoR evaluation framework was initiated by NSF EPSCoR Office Head, Sherry O. Farwell, in November, 2005. He formed a Steering Committee of EPSCoR jurisdictional directors chaired by Paul Hill, Executive Director of the West Virginia EPSCoR project. Along with forming the Steering Committee, the National Science Foundation contracted with Norman Webb, Wisconsin Center for Education Research, and Rose Shaw, Greeley, Colorado, to develop an Evaluation Framework for the EPSCoR national program. The scope of work for developing the evaluation framework as described in the proposal to NSF included:

. . . to develop an evaluation framework that can be used by the Experimental Program to Stimulate Competitive Research (EPSCoR) program to guide the collection and reporting of evidence on the value of the program. The main purpose of the evaluation described by the framework is to report on the effectiveness of the EPSCoR program. The framework is to be developed with a significant input of the leaders from the local jurisdictions that participate in the program. The products of the proposed project will be a written evaluation framework that will meet the reporting needs of the program and produce hard evidence about how the EPSCoR program is progressing in meeting its stated goals and in making a contribution to the science and mathematics research in this country.

At a meeting on December 6, 2005, Dr. Farwell described the expectations for the evaluation framework to Paul Hill and Norman Webb. He requested that a process be defined that would produce an evaluation framework by the end of June, 2006. In order to obtain input from leaders of local jurisdictions, three regional workshops were planned. These workshops were held in Albuquerque, New Mexico, on March 15, Charleston, South Carolina, on March 17, and Little Rock, Arkansas, on April 4. In preparation for the three workshops, jurisdictional leaders were asked to provide a two-page written response to four questions:

- A. What are the major goals and expectations for your jurisdiction?
- B. What are the major activities for your jurisdiction?
- C. What are the major outputs and outcomes for your jurisdiction?
- D. What evidence do you have that your outputs and outcomes are directly linked to your activities?

Each of the three workshops was structured in the same way. However, differences in participants and dynamics at each workshop produced some variation from one to the other. The workshops were designed to elicit comments and input on: project expectations and goals; project implementation and theory of change; attribution of outcomes to project activities; and generalizing from evidence at the project level to the program level. Extensive notes were recorded at each workshop.

On the basis of the input received from the three workshops and at subsequent meetings with NSF Program Directors, Program Evaluation Managers and EPSCoR Program Officers, Webb and Shaw produced some primary ideas for the evaluation framework that were sent to the Steering Committee members on April 28. The evaluators then met with the Steering Committee at NSF on May 2. Based on the committee's feedback and input, the ideas were modified and further developed. A second draft was sent for the Steering Committee's review on May 8.

On June 2, another draft of the evaluation framework was sent to the Steering Committee members and NSF staff with a request for feedback. This draft included sample metrics for the six indicators and other information on the design of the data collection system. The June 2 draft presented some details on the data collection and

analysis, but was still considered as a rough draft. Feedback from committee members and NSF was mixed. In general, people felt more detail was needed and more time was needed to specify the most important metrics. In a June 13 conference call it was acknowledged that the six-month timeline to develop a full evaluation framework was ambitious. A three stage plan for developing the evaluation was laid out and agreed upon. Stage I is to complete a conceptual framework for the evaluation. Stage II will be to develop and test a set of metrics. Stage III will be to develop a full implementation plan. The group noted a number of areas that needed greater description in what is now called the conceptual framework for the evaluation. This document is in response to feedback from this group and from members of the Steering Committee and was submitted to NSF for comment on July 24, 2006.

IV. Evaluation Questions

Derived from the EPSCoR mission statement, the ultimate evaluation question is:

What has been the impact of the EPSCoR program on strengthening research and development in science and engineering in the United States?

According to its mission statement, EPSCoR can be effective by strengthening research and development and by assuring that this research and development is distributed across the nation. Thus, the ultimate evaluation question can be addressed by considering the EPSCoR program's impact on the nation and by helping NSF to fulfill its mission by answering these two long-range questions:

1. How has the EPSCoR program strengthened research and development in science and engineering nationwide?
2. How has the EPSCoR program helped to avoid undue concentration of research and development in science and engineering nationwide? (National Science Foundation Act of 1950)

These two questions can only be answered over spans of time consisting of five or more years. The answers to these two broad questions address the major program outcomes. Here *outcomes* refer to long-term attainments produced or related to EPSCoR's efforts to strengthen research and development. For example, one outcome is a productive research infrastructure in a jurisdiction catalyzed in part through EPSCoR funding that is able over a sustained period of time to generate sufficient funding and to produce world-competitive research.

Although these questions should shape the program evaluation, their answers will be derived over a period of time with an accumulation of data and information. Any systematic assessment of EPSCoR's program operations and outcomes should generate useful data and information that will contribute to answering these far reaching outcome questions. In addition, more specific questions directed towards intermediary outcomes

and program theory are needed to guide collection and analysis of data. The program evaluation should help answer these six program questions:

1. *Improve capacity of jurisdictions*
How has the EPSCoR program contributed to sustainable improvements in the capacities of eligible jurisdictions to generate, disseminate, and apply knowledge related to key research themes in science and engineering?
2. *Improve competitiveness of jurisdictions*
How has the EPSCoR program contributed to increasing the research and development competitiveness of the eligible jurisdictions?
3. *Increase collaboration within and among jurisdictions*
How has EPSCoR advanced collaboration among academia, government, and the private sector in the eligible jurisdictions leading to science and engineering research, innovation, social benefits, and overall knowledge-based prosperity?
4. *Broaden participation in research by institutions, organizations and people*
How has the EPSCoR program broadened participation in science and engineering by institutions, organizations, and people within and among its jurisdictions?
5. *Increase experiments leading to improved research*
To what degree has EPSCoR developed, implemented, and evaluated future programmatic experiments that motivate positive change and progression in research?
6. *Improve program effectiveness*
How can the EPSCoR program operate more effectively to achieve its mission and goals?

By structuring the EPSCoR program evaluation to answer these two tiers of questions (long-range and program), information will be produced to respond to whether the program is meeting its mission, goals and four objectives. The answers to the two long-range questions will produce evidence of the degree to which the EPSCoR program is contributing to research and development in the nation. These questions will be answered by evidence of what research and development has been produced through the EPSCoR program and its jurisdictions. Such evidence could include a measure of the amount of research that is being conducted through EPSCoR, the number and quality of innovative research findings, the additional resources for research that are leveraged through EPSCoR, and unique fields of study motivated by jurisdictional needs that vary from larger populated areas. In responding to the long-range questions, the evaluation will need to consider both geographical and field-of-study distribution of research and development through EPSCoR. The answers to the two long-range evaluation questions will respond to the major stakeholders' inquiry about how the EPSCoR program has made a contribution to the nation.

Answers to the six program questions will directly address the program goals and objectives. These questions are directed toward providing information about jurisdictional activities and outcomes that need to be in place to produce high quality research and development. Many jurisdictional efforts are devoted towards developing capacity, increasing participation in research, and furthering collaboration among individual researchers and institutions. In answering the program questions, the evaluation will need to consider how activities of the NSF EPSCoR office through its infrastructure grants, outreach, and co-funding contribute to productive jurisdictional efforts. The evaluation will also need to consider the effectiveness of the EPSCoR program in achieving its goals and objectives and how the program considers new approaches in working with jurisdictions to advance research and development.

V. Program Theory

The theory of the EPSCoR program can be depicted with a very simple diagram:



Each of these program components, of course, is very complex, along with interactions between the components. But in general, the National Science Foundation EPSCoR office is responsible for finding strategic ways of funding jurisdictions to increase their capacity to do research and development in science and engineering. In turn, jurisdictions are to engage in appropriate activities that will leverage NSF funding they receive to improve the research and development infrastructure in their jurisdictions, develop human resources, seek collaboration, and improve the climate and culture for doing research and development. These and other jurisdictional activities are then to lead to strengthening research and development in science and engineering in the jurisdictions and ultimately contribute to the nation's innovation and competitiveness. A more detailed logic model for EPSCoR is given in Figure 1.

The assumptions depicted in Figure 1 outline those upon which the EPSCoR program is created. Research and development in the nation can be improved by working through universities and other institutions of higher education that are in partnership with government agencies and businesses. The EPSCoR invention, through establishing local leadership, will shape public and academia policies that will influence research and development. Catalytic efforts will contribute to stimulating sustained efforts leading to improvements in research and development. And, research and development in science and engineering are necessary if jurisdictions are to improve their innovation process and become more economically competitive.

Inputs are the resources that go into the program. Inputs depicted in the logic model include financial resources and intellectual resources, as well as directives from

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NSF and strategic planning within the EPSCoR program office. The activities represent what the program does, the program components, and the strategies employed. Activities are divided between those of the EPSCoR program office at NSF and those of the jurisdictions. Outputs are closely associated with the activities and represent intermediary consequences of the activities. For example, the jurisdiction's EPSCoR director and committee decide to use existing funds to help improve the number of researchers in the jurisdiction. They use EPSCoR and other funds for start-up packages to motivate qualified researchers to join the faculty at their universities. The intermediary result (output) of the program's funding is the start-up packages.

Figure 1. EPSCoR Program Logic Model

Assumptions	Inputs	Activities		Outputs	Outcomes	Impact
		EPSCoR	Jurisdictional			
<p>Science research is a state and national issue. Universities, governments, and businesses will form partnerships to advance knowledge-based prosperity.</p> <p>EPSCoR leadership can influence and shape public research policy at the university and state levels.</p> <p>NSF, working in partnership with EPSCoR jurisdictions, can serve as a catalyst for stimulating sustainable improvements in R & D capacity, capability and competitiveness.</p> <p>Competitive science research is required for states to remain economically competitive in the future.</p>	<p><i>NSF Funding</i></p> <p><i>Other Related Funding</i></p> <p><i>NSF Directives</i></p> <p><i>NSF Initiatives</i></p> <p><i>Strategic Planning</i></p> <p><i>Congress</i></p> <p><i>Jurisdictions' Initiative and Funding</i></p>	<p>Research Infrastructure Improvement Grants</p> <ul style="list-style-type: none"> • Requirements • Provide funds <p>Outreach</p> <ul style="list-style-type: none"> • Notification of opportunities • Networking • Provide support <p>Cofunding</p> <ul style="list-style-type: none"> • Link to other programs • Funding <p>Management</p> <ul style="list-style-type: none"> • Strategic planning • Reporting of impact • Program evaluation 	<p>Management</p> <ul style="list-style-type: none"> • Strategic planning • Networking • Write proposals • Appraise research climate • Leverage funds • Provide funds • Build alliances with NSF and other partners <p>State Committee</p> <ul style="list-style-type: none"> • Set policy • Networking • Strategic plan • Capital campaign <p>Researchers</p> <ul style="list-style-type: none"> • Submit proposals • Conduct research • Network 	<p>Research Products</p> <ul style="list-style-type: none"> • Publications • Intellectual property (patents, products) • Implementation of collaborative research and innovation <p>Research Funding</p> <ul style="list-style-type: none"> • Production of state/local financial support • New funding <p>Research Personnel</p> <ul style="list-style-type: none"> • Start-up packages • Training, proposals, and awards • Post-doc, graduate and undergraduate financial support and outreach • Focused recruitment, hiring and support of research faculty <p>Research Equipment</p> <ul style="list-style-type: none"> • Purchasing • Technology transfer <p><i>NSF Centers</i></p>	<ol style="list-style-type: none"> 1. Research production 2. Research portfolio quality 3. Human resource development 4. Research investments and materials 5. Research collaboration and networking 6. Research climate, culture and communications 	<p>Strengthened research and education in science and engineering for the US, avoiding undue concentration of such research and education.</p> <p>Improved economic development, support for research, and status within the research community for the jurisdictions.</p>

Outcomes are the end results produced by the program. These results can be intended or unintended. In striving to develop an infrastructure for research, positive outcomes include: having sufficient researchers and the necessary support staff in place to conduct research; collaboration among researchers and institutions; an informed and supporting state government; adequate research facilities; and an established research portfolio that generates innovation and research findings.

The impact of the NSF EPSCoR program can be measured by the net effects of the program achieved over a period of time. The net effect that the program has on research and development in science and engineering in the nation and its concentration represents an impact for the program. The more significant this effect is, the greater the impact.

VI. Benefits of the Evaluation

The proposed program evaluation will be designed to produce data and information that can be used by the EPSCoR program to report on its effectiveness to the NSF, Congress, and other stakeholders. Both quantitative and qualitative data will be collected, analyzed, and reported. The indicators for the evaluation described in this document are defined as data and information that can be used by jurisdictions to meet their evaluation needs while at the same time meeting program evaluation needs. Of course, a credible evaluation of the program has the potential of contributing to the continuation and even expansion and/or optimization of the program. Furtherance of the program will directly benefit jurisdictions. In addition, metrics that will be defined to produce data on the six indicators will be selected on the basis of their relevance and on other criteria, including the feasibility of collecting the data. Reports of metrics and indicators will be produced and made available to all jurisdictions. These reports then can be used by jurisdictions for local needs and reporting.

The NSF EPSCoR office will be responsible for attaining, processing, and reporting data at both the national and jurisdictional levels from existing databases (e.g., federal funding to jurisdictions). The evaluation design will include methods for making data from national databases accessible to all jurisdictions for local use. Standardizing metrics across jurisdictions as much as possible will reduce redundancy among jurisdictions by more systematically providing needed and useful data. This reduction in redundancy should lessen the effort needed by jurisdictions for evaluation.

Jurisdictions will need to do certain data collection to produce quality data for the program evaluation. These data will be considered part of annual reporting by jurisdictions to NSF and will be coordinated with other reporting requirements, such as the current annual report. The NSF-wide FastLane reporting requirements will still need to be met, but the planned data collection for the EPSCoR program evaluation will meet portions of this requirement. Some FastLane reporting will be enhanced because additional comparative data will be available.

VII. Methodology

Annual Data Survey

The primary means for collecting data from the jurisdiction will be an annual data survey. The time period for the annual data reported will be determined with input from the jurisdictions. This electronic survey, administered in an identified month of each year, will provide a list of questions for jurisdictions to fill in the blanks or download from a database to provide data on each defined metric. It should be possible for jurisdictions to download information from existing databases into the electronic survey. The purpose of the electronic survey is to gather timely information from the jurisdictions in a common format. The data collected will then be aggregated across the jurisdictions and transformed into metrics and indicators to produce a summary report for the EPSCoR program and for the jurisdictions.

Jurisdictions will be given adequate notice of the data they will need to produce for program evaluation and in what form. This means that jurisdictions can accumulate at least some data throughout the year, when it becomes available. This should lessen the reporting burden on jurisdictions.

For the first year program evaluation data is collected, it will be necessary to gather specific data from previous years in order to perform trend analyses. Not every jurisdiction will have collected all of the data required; some will only be able to provide data that was collected after being informed of what is expected and for the existing year. But if some trend data are available from jurisdictions, these data will be requested for the relevant metrics.

The precise metrics are yet to be defined. One aspect of a metric that needs further definition is how each one will be normalized or standardized so that comparisons can easily be made with a control group or with national trends. Defining metrics will require considering national data that are available for making a comparison and data available at the jurisdictional level that could be used for a comparison. The number of metrics will be kept to a minimum to reduce data burden. Each metric will have to pass a test of its utility as well as of its efficiency in data collection.

Quality controls will be employed to assure that data are valid and reliable. Data from only credible national databases will be used. While every attempt will be made to only seek existing data, there will be some data that will require administration of instruments such as a questionnaire. For example, a questionnaire may be prepared for jurisdictions to send to all EPSCoR researchers to attain a list of their publications for the years. If a jurisdiction has to engage in data collection, it will be necessary to have some indication of how representative the data are of the population. For example, since proposals have to be submitted through a central office at most universities, attaining the number of participants and requested dollar amounts can be done fairly efficiently and reliably. However, acquiring the number of publications authored by EPSCoR researchers in a year may require gathering information directly from each researcher.

For the number of publications to be used as data for a metric, there has to be some assurance that the information was gathered from an adequate sample of EPSCoR researchers. Quality assurance and quality control guidelines will be developed and issued by NSF for this purpose as a part of the implementation plan (see section IX, next steps).

Unit of Analysis

The unit of analysis for data collection will be the jurisdiction. Data will need to be collected and reported as it relates to EPSCoR activities in the jurisdiction.

Time Frame

Data for one year will be requested for each annual survey in a designated month. The time period will be for a given 12 months, to coincide with what has been agreed on with input from the jurisdictions.

Important outputs and outcomes from EPSCoR funding in a jurisdiction can occur over time and as a result of activities and support over a number of years. The extended time period between initiating EPSCoR support and reporting a significant impact means that the analytic horizon (the period of time after funding when outcomes can accrue and are measured) needs to be considered. For example, a researcher hired by a university with a start-up package provided through EPSCoR funds may require six or more years before being awarded a large research grant. Such delayed outcomes will be captured through maintaining the annual data collection over a number of years for the program evaluation.

Data collection will have to incorporate a means for jurisdictions to use in reporting outcomes during the year that are associated with intervention in previous years. However, other important outcomes will require backward mapping techniques where derivation of an outcome, such as funding for a large research consortium, or an important research breakthrough, is established by tracing the cause and effects back in time to critical instances. Backward mapping techniques will be standardized so that information can be aggregated more easily across jurisdictions.

Some jurisdictions have received EPSCoR funding ever since the program's inauguration in 1978, while others have participated for shorter times. The funds available to jurisdictions have varied. A jurisdiction's length of time in the program, the amount of funds awarded, and other variables among jurisdictions will need to be considered in reporting and interpreting findings. It is possible that variability in dosage of the EPSCoR program (e.g. duration and level of funding) can lead to natural experiments—for example, contrasting outcomes from a set of jurisdictions that have received funding for more than 10 years with those who have received funding for less than 5 years. Such analyses can be done by the NSF EPSCoR office using data provided from the jurisdictions through the annual data collection.

Classification of Data

EPSCoR activities and operations will vary by jurisdictions. Because of this variation, some means for considering the link of data and results to EPSCoR is necessary. Some data and outputs can be directly related to strong results, showing a clear impact of EPSCoR. These data and outputs include research that is the direct result of an EPSCoR grant or funding, or that was conducted by persons/programs directly supported by EPSCoR. However, some important strategies employed by jurisdictions are to form collaborations among institutions (not all funded by NSF EPSCoR), leverage funds by using EPSCoR human resources and funding to initiate an activity supported in part by funding from other sources, or co-funding research. In reporting data on activities, outputs, and outcomes, jurisdictions will be asked to distinguish between a direct or indirect relationship to EPSCoR funding. For example, a direct relationship between EPSCoR funding and an output is if the EPSCoR director or governing board initiates and facilitates bringing together and provides seed money to a group of researchers who write a successful proposal. Without EPSCoR it is highly unlikely that this particular interdisciplinary group of researchers would ever get together. An indirect relationship is if EPSCoR funds are used to purchase new equipment for a laboratory that is one reason a well renowned researcher comes to a university and brings sizable funding. EPSCoR funds contributed to conditions that attracted the researcher and improved the research climate at the university.

Capturing the Important Stories

Important data and information come from narratives, in addition to quantitative data. The data collection survey will have the capabilities for jurisdictional staff to enter descriptions of the linkages among EPSCoR sponsored activities, outputs, and outcomes. A standard format will be used to facilitate the aggregation of information from these stories across sites. It is expected that jurisdictional staff will need to enter a brief summary or one-line description of the story, keyword descriptors, and then a narrative describing who did what and when. This will be followed by what were the consequences of the activities, what was the link to EPSCoR, and what was the strength of evidence. If for some reason, an important narrative cannot be put in a standard format, then an alternate form of retrieving the information will be available.

VIII. Evaluation Framework

Major Program Indicators Defined by More Specific Metrics

To answer the evaluation questions, six major program indicators will be used to organize the data collection and reporting. An indicator in this context represents a broad area for reporting information about EPSCoR that is important to the program's mission, goals and objectives. Each indicator will be further defined by specific metrics, or measures, that can be produced by each jurisdiction or by NSF and that can be aggregated across the jurisdictions to create a meaningful way for tracking the EPSCoR program's

impact over time. These six indicators have been identified by the input received from the three regional workshops, the jurisdictions' responses to the four questions, discussion with NSF staff, and input from the Steering Committee. Each of the six indicators can be measured by a number of metrics and variables. These metrics will be defined and tested in the next stage of the evaluation planning.

1. **Research Production**

Research Production represents the outcome from the research conducted that is associated with the EPSCoR program. Although the products from research can be numerous and take on many different forms, the basic metrics that will be used to report on research production will be publications and evidence of intellectual property generation.

2. **Research Portfolio Quality**

Research Portfolio Quality represents in some way the nature and value of the range of the research that is being conducted in relationship to EPSCoR's mission and goals. This indicator is to provide evidence of the range of research that is being conducted within a jurisdiction and across the aggregate of the jurisdictions. The main metrics that will be used as evidence of research portfolio quality are the number of competed and funded awards from NSF and other agencies and the number of competitively-funded federal centers in operation.

3. **Human Resource Development**

Human Resource Development is the human capacity and capability that is being developed through the effort and funding from the EPSCoR program. A major goal of each jurisdiction is to have and develop qualified and competitive researchers. Jurisdictions also focus on developing research capacity for the future by nurturing and providing research experiences for undergraduate and graduate students, as well as for K-12 teachers and students. The main metrics to be used to represent human resource development will be the number of researchers supported at least in part by EPSCoR; the number of graduate students, post-doctoral researchers, and undergraduate students engaged in research; and the number of K-12 teachers and students who are reached through the jurisdictions' efforts. Other potential metrics are inclusion of members of underrepresented groups and STEM degrees awarded. Human Resource Development also can include efforts and results directed toward increasing and broadening those engaged in STEM research through work in K-12 education to increase the pool of those going into science and mathematics including those from underrepresented groups.

4. **Research Investments and Materials**

Research Investments and Materials are critical for developing research capacity and conducting research within a jurisdiction, a state, and the nation. One of the elements of investing in research is leveraging funds received from awards that serve as a catalyst for research activities. Another important part is investing in facilities for conducting research, state-of-the-art equipment, and technology. The

main metrics to be used to represent research investments and materials are the dollar amount raised for conducting research, the funds that are allocated for research facilities (space and equipment), and the funding that is used to attract and retain highly qualified faculty and staff.

5. Research Collaboration and Networking

Research Collaboration and Networking is a major strategy for strengthening the research within and across the EPSCoR jurisdictions. Collaboration and networking can be used to leverage research efforts, increase competitiveness for large research projects, improve capability for doing research, and generate research capacity. Metrics for measuring research collaboration and networking include proposals and awards with multiple principal investigators; proposals and awards with more than one institution; and the number of existing projects that incorporate more than one institution (IHEs, national/regional laboratories, industry, etc.).

6. Research Climate, Culture, and Communications

Research Climate, Culture, and Communications represent the social, organizational, and political will within a jurisdiction or state to support research. Climate includes legislation and rules that help to provide incentives for institutions to engage in research. Culture is the belief and values among leaders and the citizens within a jurisdiction that it is critical to develop collective knowledge about research, that research is important, that research should be well supported, and that research is the basis of innovation that leads to economic growth. Communication is represented by the existing links and flow of information about research and research endeavors among different agencies, organizations, and institutions within a jurisdiction. Climate, culture, and communications can be tracked by analyzing the policies, incentives, rules, and the social network within a jurisdiction. Some of the quantified metrics that represent these include the amount of jurisdictional funding allocated to research and the amount of university funding allocated to research.

Metrics for Each Indicator

The metrics for each indicator that will guide the data gathering will be defined over the next six months. Defining the appropriate metrics requires additional investigation into the existing data sources that can be used, how data should be normalized, and what the most meaningful ways are for analyzing, reporting and using the data.

Reporting

Data and information collected from the annual survey will be reported in a variety of ways depending on the audience. Tables will be produced of the aggregated information collected from the jurisdictions. A desired design feature of the data system is to produce at least some of the tables reporting information across jurisdictions

automatically. With this feature, some tables and information should be available in a short time after all of the jurisdictions have submitted the required data. However, with any data collection and aggregation across multiple sites, some time is needed to clean the data and to assure the information produced is accurate. Other data and information will require more analysis and a longer time to process. A report will be prepared on the six indicators that will be available to those in the program for review. Hopefully a draft of the report could be ready in six months after the data have been submitted. The indicators report will be revised and finalized based on comments received from the jurisdiction. Other reports will be generated from the indicators report and database to meet the needs and fulfill the requests of others, such as congressional inquiries.

IX. Next Steps

This document is designed to identify the concept of data collection and metric definition for an evaluation of the NSF EPSCoR program. The intent of establishing this conceptual framework (Stage I) is to propose the major components for the evaluation. The framework will be given to NSF staff and jurisdictional leaders for their comments and feedback before being considered final, hopefully toward September 30, 2006. Douglas MacTaggart, Rose Shaw, and Norman Webb will then continue their efforts to define the specific metrics for the indicators with input by the Steering Committee. Defining the metrics (Stage II) will include consulting existing databases and developing prototypes of the analyses and tables. After the metrics have been defined and tested, the implementation plan and guidance (Stage III) for the data collection and analysis will be prepared. The first submission of data should be in the fall of 2007.

Questions and feedback should be sent to Norman L. Webb (nlwebb@wisc.edu) or Rose Shaw (roseshaw@cybox.com).

Possible Resources

This is the beginning of a list of resources important to consult in designing the EPSCoR Evaluation Framework.

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