Concentration vs. Decentralization in National Science Funding: A study on the Experimental Program to Stimulate Competitive Research (EPSCoR)

Youngsun Baek

School of Public Policy, Georgia Institute of Technology

gth733f@mail.gatech.edu

youngsun.baek@pubpolicy.gatech.edu

March 31, 2007

Working paper to be presented at

Science and Technology in Society:

An Interdisciplinary Graduate Student Conference

The American Association for the Advancement of Science (AAAS)

Title: Concentration vs. Decentralization in National Science Funding: A study on the Experimental Program to Stimulate Competitive Research (EPSCoR)

Abstract

The Experimental Program for the Stimulate Competitive Research (EPSCoR) was started with Congress's recognition of undue concentration of national research funding. When the first awards were made to five states to commence a five-year program, people hardly expected that the program would be continued beyond the time. At that time, developed states like California and New York and even National Science Foundation (NSF) viewed the program as a "one-shot scientific bootstrapping operation" or literally "experimental" catalytic initiative (Lambright, 1996). However, about 30 years after it was started, EPSCoR became a consistent US science program and 25 states are involved in it. In this paper, I probe the logics underneath the argument of each different stakeholder group around the EPSCoR with different theoretical lenses such as 1) the function of science in National Innovation System (NIS) and Regional Innovation System (RIS), 2) social accountability of science, and 3) elitism in S&T policy. In addition, I try to answer two puzzles related with EPSCoR, which is 1) how EPSCoR has done long run despite the initial skeptical anticipation of science community and 2) why, even though many other countries have tried to benchmark EPSCoR for their regional innovation and economic development, there have been very few success cases. Unique characteristics of EPSCoR are worth investigating in that it has been successfully evolving in spite of its intrinsic limitation.

1. Introduction

The Experimental Program for the Stimulate Competitive Research (EPSCoR) was started with Congress's recognition of undue concentration of national research funding. Before EPSCoR initiated by National Science Foundation (NSF) first, 18 nation's poorest states[1] which have nearly 20 percent of the US population and Puerto Rico receive only about 4 percent of the annual federal R&D investment (Strobel, 1996). When the first awards were made to five states[2] to commence a five-year program, people hardly expected that the program would be continued beyond the time. At that time, developed states like California and New York and even NSF viewed the program as a "one-shot scientific bootstrapping operation" or literally "experimental" catalytic initiative (Lambright, 1996). However, about 30 years after it was started, EPSCoR became a consistent US science program and 25 states are involved in it[3]. Now, 7 other federal Research and Development (R&D) agencies[4] also operate their own EPSCoR programs and objectives.

However, there is chronic debate around the propriety of EPSCoR among different stakeholders. Underdeveloped states supported by EPSCoR claim that they are still have-nots and the gap between rich states and poor states in research funding and R&D infrastructure is still substantial. In 2005, California received 576 million dollars from NSF, which is almost double of the 311 million dollars that went to all the EPSCoR states combined (Brainard, 2006). Arguing that the inequality between poor states and rich states would be serious without the

[1] The states are Alabama, Arkansas, Idaho, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, Nebraska, Nevada, North Dakota, Oklahoma, South Carolina, South Dakota, Vermont, West Virginia, and Wyoming.
[2] The states are Arkansas, Maine, Montana, South Carolina, and West Virginia.
[3] EPSCoR states are like as follows: Alabama, Alaska, Arkansas, Delaware, Hawaii, Idaho, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Dakota, Oklahoma, Puerto Rico, Rhode Island, South Carolina, South Dakota, Tennessee, U.S. Virgin Islands, Vermont, West Virginia, and Wyoming\
[4] the National Science Foundation; the National Institutes of Health; the Departments of Defense, Energy, and Agriculture; the National Aeronautics and Space Administration; and the Environmental Protection Agency

EPSCoR, the supporters have claimed that Regional Innovation System (RIS) rooted in local universities is effective to solve the imbalance of R&D infrastructures among states. On the other hand, rich and developed states like California and Massachusetts argue that the EPSCoR is not efficient for enhancing national competitiveness in Science and Technology (S&T). They argue that almost all other countries have adopted the mechanism of selection and concentration in order to catch up with leading status of the United States in S&T. Even European countries, which used to have diversified and decentralized S&T policy, are currently returning to the strategically focused policy. In 2005, German Government launched "excellence initiative" intending to make at least a few universities to achieve world-class status (Vogel, 2006). Decentralization in funding is still regarded as a risky Research and Development (R&D) investment portfolio by countries outside the US.

In this paper, I probe the logics underneath arguments of each different stakeholder group around the EPSCoR with various theoretical lenses such as 1) function of science in National Innovation System (NIS) and Regional Innovation System (RIS), 2) social accountability of science, and 3) elitism in S&T policy. In addition, I try to answer two puzzles related with EPSCoR, which is 1) how EPSCoR has done long run, despite the initial skeptical anticipation of science community and 2) why there have been very few success cases, even though many other countries have tried to benchmark EPSCoR for their regional innovation and economic development. Unique characteristics of EPSCoR are worth investigating in that it has been successfully evolving in spite of its intrinsic limitation.

2. Brief overview of EPSCoR[5]

NSF initiated EPSCoR (the Experimental Program to Stimulate Competitive Research) to boost relatively underdeveloped states in R&D infrastructure and economic innovation in 1978 in response to Congressional mandate (NSF, 2006):

"… 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 State, and to avoid undue concentration of such…" (US Congress, 1978)

EPSCoR is a rare and unique nationwide program for enhancing regional competitiveness through R&D infrastructure building specially focused on improving of relatively underdeveloped states. The first awards were made to only five states to commence a five-year program, 25 states in the US states and territories currently benefit from the program[6]. NSF stated that economic growth of the poor states is the ultimate purpose of the EPSCoR. It is designed to improve and expand the research ability of scientists in the states which traditionally have suffered from shortage of support. The EPSCoR focuses on local R&D infrastructure through partnerships among universities, industry, and state government.

Since NSF started the EPSCoR, there have been three main principles in funding. The first is Research Infrastructure Improvement (RII) Grant for sustainable improvement in research infrastructure, competitiveness, and capacity. The second is Co-Funding Assistance which is aimed to distribute grants to more researchers in EPSCoR regions by offering partial support for

[5] I overview EPSCoR mainly based on NSF EPSCoR Website

[6] EPSCoR states are like as follows: Alabama, Alaska, Arkansas, Delaware, Hawaii, Idaho, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Dakota, Oklahoma, Puerto Rico, Rhode Island, South Carolina, South Dakota, Tennessee, U.S. Virgin Islands, Vermont, West Virginia, and Wyoming

the proposals. NSF has internally employed this funding mechanism. The third is Outreach Initiative. NSF sends its staffs to investigate researchers in the EPSCoR states for developing its funding strategy and building its funding portfolio. It helps NSF to understand their current research activities, facilities, and potential of the EPSCoR jurisdictions. From the beginning in FY 2007, NSF EPSCoR applied Strength-Based Research Collaborations (SBRC) to its funding. It is complementary to the RII grant by "providing a mechanistic linkage between building capacity and attaining national competitiveness" (Arkansas EPSCoR Web Site). Along with SBRC, the Arkansas EPSCoR submitted its 2006 proposal which contained collaboration plan with other EPSCoR states.

3. Issues around EPSCoR

3.1. Different view of stakeholders

3.1.1 Poor states and supporters of EPSCoR

Before EPSCoR initiated by NSF, 18 nation's poorest states[7] which have nearly 20 percent of the US population and Puerto Rico received only about 4 percent of the annual federal R&D investment (Strobel, 1996). Those states points it out that their relative share of NSF awards has reached only about 7 percent, which is only about two percent point increase from their portion combined when they initiated the program (Brainard, 2006). Unlike other countries, the United States has very strong federalism. In the viewpoint of poor EPSCoR states, the small share of R&D funding is viewed as a non-sense because federal tax money gathered across the nation has invested only on the specific states that already have ample S&T infrastructure. For that reason,

[7] (The states are Alabama, Arkansas, Idaho, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, Nebraska, Nevada, North Dakota, Oklahoma, South Carolina, South Dakota, Vermont, West Virginia, and Wyoming)

the poor states have claimed that Regional Innovation System (RIS) rooted in local universities is effective to solve the imbalance of R&D infrastructure among states.

Supporters of the EPSCoR emphasize that it successfully applies RIS concept to economic development of each state. RIS has currently become important in NIS. Dietz (2000) illustrates a diagram (Figure 1) and explains that there are several potential ways for a state to foster its own R&D competitiveness. He emphasizes the route from social capital formation followed by enhanced research capability and enhanced research quality and finally reached to economic and social development[8] (Follow thick arrows in Figure 1). Sexenian (1994) also argues that universities actively collaborate with the newly created actors and conduct research projects, the collaboration enhances local research capacity and final achieves regional economic development. Radosevic (2002) assumes, "RIS emerges as a result of mutual interactions between national, micro, sectoral and region-specific determinants", analyzing the determinants of regional systems of innovation. It means that RIS is hardly far from NIS. On balance, building local R&D infrastructure is necessary for economic growth of each state.

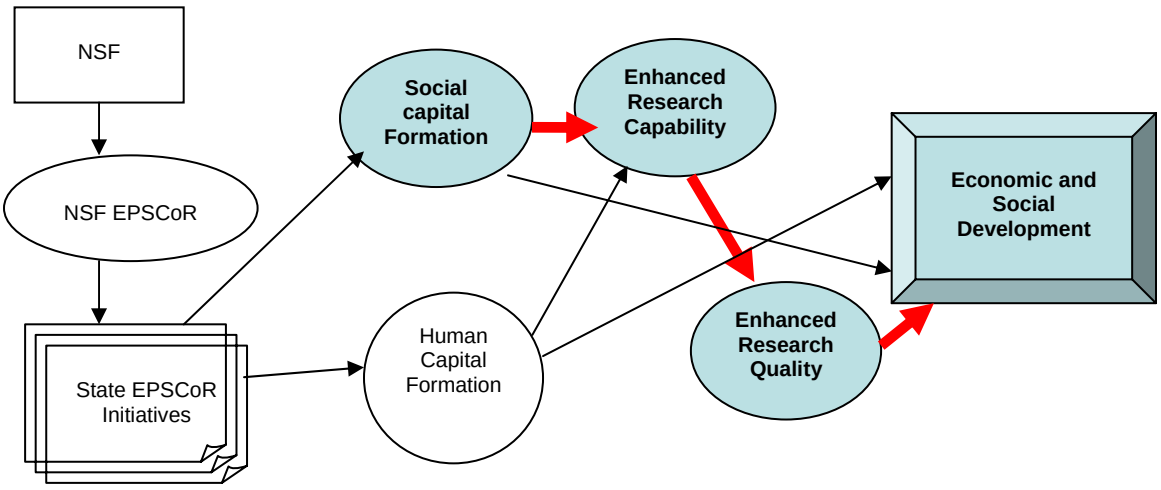

Figure 1. Social Capital EPSCoR concept model (Source: Dietz, J., 2000)

[8] Take a look at the thick and red arrows in Figure 1.

3.1.2 Top schools, rich states, and opponents to EPSCoR

Under the fixed amount of national R&D budget, increased funding for universities in underdeveloped states means that top competitive schools are relatively less funded than before. Considering international competition, opponents of EPSCoR claim that decentralized support would dampen the rapid development of science and technology in the US. After WWII, Vannevar Bush, the presidential science advisor of Truman's administration argued that research money should go to the best performing scientists with best research ideas. Elitism has actually been widely applied to the funding mechanisms of many other nations. Germany is currently showing a movement returning to the elitism in R&D policy. German government launched an "excellence initiative", whose aim is to make at least limited number of universities world-class leading research schools. German higher education communities have sought to decentralized and well-balanced university-system across the country, but they currently have realized it was too ideal plan which did not consider R&D budget constraint (Vogel, 2006).

Rich non-EPSCoR states also stress that EPSCoR states too much rely on the special protection. Since 2004, NSF has encouraged scientists supported by EPSCoR to make a gradual movement from the program to the agency's open competition (Brainard, 2006). However, EPSCoR states still want to stay under the warm nest, even though some of them like Alabama already improved in R&D infrastructure throughout the past 30 years.

3.2. Puzzles of EPSCoR

About 30 years after it was started, EPSCoR became a consistent US science program and 25 states are currently involved in it, even though it has been criticized by people who believe that

innovation is led by only limited number of excellent science elites. The success has inspired some European countries and they have tried to benchmark the EPSCoR. However, there are very few successful programs comparable to the EPSCoR outside the US. Unique characteristics of EPSCoR in administrative proceeding are worth investigating in that it has been evolving well for its efficient management.

3.2.1. Success factors

What are the reasons of EPSCoR's successful long-run disproving initial skepticism of science community? First of all, logic underneath the program, which is to redistribute undue concentration of R&D investment, was attractive to politicians in underdeveloped stats. However, it could not be possible for the program to survive only with the political support. Yin and Feller (1997) evaluated EPSCoR and concluded that funding on universities (not on individual projects or researchers) was one of the main distinguishable success factors because current human capital in R&D (e.g. scientists and engineers) is viewed as mobile resource. The strategy was determinant to boost research capability in each EPSCoR state so that the state could attain its own R&D infrastructure. If a researcher who conducts a project supported by EPSCoR moves to other position in a developed and non-EPSCoR state, the R&D would hardly be utilized for boosting the original EPSCoR state. On balance, EPSCoR has successfully met the objective to enhance regional competitiveness through supporting groups of related research projects within and across universities (research clusters) rather than funding individual scientists .

I also think that the reason why EPSCoR lasts over 20 years is that it has managed problems caused by relationship between principal (federal government) - agent (scientific community) under social contract for science well. Both Guston (2000) and Lubchenko (1998)

point out that asymmetric information and goal difference between principle and agent hamper the function of social contract for science. EPSCoR adopted several strategies to solve the asymmetric information problem. First, through "Outreach Initiative", NSF has sent its staffs to each state and let them investigate researchers conducting EPSCoR research projects in order to develop its funding strategy and build its portfolio. In addition, EPSCoR has required each state to participate in the EPSCoR steering committee consisting of various members from academia, industries, and state government (Yin and Feller, 1994). It can also be interpreted as an EPSCoR's effort to establish a sustainable and long term social networks to underpin the program.

3.2.2. Other countries

1) Germany[9]

EPSCoR is very rare and unique, but there is a regional innovation program supported by central government in Germany. About 15 years after German reunification, the eastern German regions still suffer from regional deficits that hamper innovation of that area. The central German government realized that a key basis for economic success is effective local cooperation between science sector and industrial companies. BMBF (Bundesministerium for Bildung und Forschung: Federal of Education and Research) initiated InnoRegio program to establish regional innovative alliances of the eastern Germany in 1999. InnoRegio program annually spend 98 million euro to support research, development, and education projects for creating partnership between industry and science. Like EPSCoR, InnoRegio program emphasizes practical and substantial connection

[9] I summarize InnoRegio program based on the BMBF (Bundesministerium for Bildung und Forschung: Federal of Education and Research) website (URL: http://www.bmbf.de/en/2945.php

between R&D and economic development. BMBF has supported 23 regions through InnoRegio since 2001.

It is true that BMBF started InnoRegio program benchmarking NSF's EPSCoR. However, InnoRegio has developed its unique funding and operating strategies like as follows:

i. **Innovative Regional Growth Centers** – InnoRegio was initially designed to build long term regional R&D infrastructure, but it also considers short and medium term business potential. All of its initiatives are supported and examined by professional advising services in the demanding concept phase. To be accepted in a subsequent support phase, an initiative must indicate a clear plan of theoretical orientation and practical commercialization.

ii. **Interregional Alliances for the Market of Tomorrow (IAMT)) -** It is aimed for building innovative networks. IAMT are focused on alliances consisting of local firms, academic research institutes and organizations in other regions. For IAMT, InnoRegio holds "Innovation Forum" to promote technology transfer and collaboration.

iii. **Centers for Innovation Competence program** – It supports outstanding research efforts at eastern German universities and research institutes to make them internationally competitive research centers. InnoRegio expects that the academic research centers can be engines to develop underdeveloped eastern German industry. The centers are also expected to attract young excellent scientists to Germany.

InnoRegio is very similar to EPSCoR in that it puts great emphasis on 1) comercializtion of science research, 2) advisory committee consisting of university, industry, and local government, 3) university-centered innovation. I think InnoRegio program requires each research project to submit more concrete commercializtion plan than EPSCoR does. At the same time, the program assists academic researchers to commercialize their new technologies in the market by professional advising services.

2) UK and Central and Eastern Europe (CEE)

In the UK, the DTI (Department of Trade and Industry) examined an idea of Capabilities Fund for seeding basic scientific research in less favored areas, which is inspired by the success of EPSCoR. However, the DTI finally rejected the proposal because investment on underdeveloped areas still risky national R&D portfolio strategy to them[10]. Central and Eastern Europe (CEE) has also been realized that long term growth and sustainability of economic recovery of CEE would rest on an innovation system which includes not only regional but also national and sectoral innovation systems (Radosevic, 2002). He also points out that regional innovation in CEE should be based on a central organization to control the whole network building.

Then, why is it hard for other countries to implement programs comparable to the EPSCoR, even though they already realized its necessity. The main reason is that investment on underdeveloped regions is a sort of gamble to the countries with limited budget. For that reason, they carefully select prospective research fields and well-performing clusters and concentrate their funds on the reliable projects. It is hard for underdeveloped CEE countries to assign their

[10] I overview the DTI (Department of Trade and Industry) proposal about benchmarking of EPSCoR based on DTI website (http://www.dti.gov.uk/)

R&D budget to support undue regions. Therefore, EPSCoR is a rare and unique in the world as a nation wide program to boost underdeveloped regions.

4. Proposed Solutions for future development of EPSCoR

One of the main concerns of EPSCoR is how to share and utilize research results in national level. Dietz (2000) argues that R&D diffusion among states should be encouraged in national level. In this context, NSF EPSCoR planed to focus on Strength-Based Research Collaborations (SBRC) from the beginning in FY 2007. It is complementary to the Research Infrastructure Improvement (RII) grant by "providing a mechanistic linkage between building capacity and attaining national competitiveness" (Arkansas EPSCoR Web Site). Along with SBRC, the Arkansas EPSCoR submitted its 2006 proposal which contained collaboration plan with other EPSCoR states.

It is true that EPSCoR helped underdeveloped states to win more funds. However, there is a criticism that they too much depend on the program. Program graduations problem is another problem that EPSCoR have to solve. In their EPSCoR evaluation report, Yin and Feller (1997) points out that there are no criteria made for judging when a state is deemed grown enough to "graduate" from the program. Dietz (2000) argues that traditional evaluation tools based on publications, citations, and patents are inappropriate to evaluate science development projects such as EPSCoR, because the tools are not likely to capture the improvement in R&D capacity in the long term. He mentions that EPSCoR would be evaluated by a tool considering social capital model he suggested (See Figure 1), in that its central objective are capacity generation and institution building. Even though it is hard to make a specific tool kit for EPSCoR evaluation, many people agree with that the evaluation criteria are required to meet the following

ideas. First, scientific achievement in a jurisdiction has to serve some economic or social end (Lambright, 1996). That is, the progress in a state should be connected to substantial economic growth. Secondly, the relationship among social, economic, and scientific development may be recursive or reciprocal (Lambright, 1996). In other words, the route to the economic end may be scientific and social and, reversely, the route to the scientific end may be economic and social as well. Thirdly, EPSCoR needs to consider not only funding research but also how research is utilized (Lambright, 1996).

5. Conclusions

The Experimental Program to Stimulate Competitive Research (EPSCoR) is an unique S&T policy program worth probing since it became a consistent S&T policy, even though it was started as a literally "experimental" to support underdeveloped states. In addition, it is evolving well as a stable regional innovation system, even though there is chronic debate about its propriety between EPSCoR states and non-EPSCoR states. Poor states stress that the stubborn gap in governmental financial R&D support has not been reduced. They claim that EPSCoR is effective to enhance local R&D infrastructure based on regional innovation system. On the other hand, rich states like California, New York, and Massachusetts argue that the program would loosen the US leadership in R&D.

In my opinion, EPSCoR is a meaningful and successful R&D policy in the perspective of public management. The program has actively improved its funding strategies to solve asymmetric information problem occurring in relationship between principal (government)-agent (scientific community) under social contract for science. Through Outreach Initiative, NSF has sent its staffs to each state to investigate researchers conducting EPSCoR projects. The program

has met its main objective to enhance regional competitiveness through supporting groups of related research projects within and across universities (research clusters) rather than funding individual researchers. EPSCoR has also required each state to participate in the EPSCoR steering committee consisting of various members from academe, industry, and state government (Yin and Feller, 1994). It can also be interpreted as an EPSCoR's effort to establish a sustainable and long term social networks to underpin the program.

Then, why is it hard for other countries to implement a similar type of program to EPSCoR, even though they already realized necessity of a central R&D boosting program for underdeveloped regions? The main reason is that investment on underdeveloped areas is still risky to other countries with limited budget. For that reason, they carefully select prospective research areas and well-performing clusters and concentrate their funding on the reliable projects. It is also the reason why CEE countries (and even UK) could not start a comparable program to EPSCoR. InnoRegio in Germany is very similar to EPSCoR in that it puts great emphasis on 1) commercialization of science research, 2) advisory committee consisting of university, industry, and local government, 3) university-centered innovation. InnoRegio seems to require each research project to submit more concrete commercialization plan than EPSCoR does.

EPSCoR is still challenged by some issues. EPSCoR have to develop effective administrative tools to transform human capital improved by its support into social capital in a certain jurisdiction (Dietz, 2000). Making a set of criteria for determining when an EPSCoR state to graduate from the program is also one of the future goals (Yin and Feller, 1997).

Reference

Arkansas EPSCoR Web Site (URL: http://www.alaska.edu/epscor/) accessed 12/03/06

BMBF (Bundesministerium for Bildung und Forschung: Federal of Education and Research) website (URL: http://www.bmbf.de/en/2945.php) accessed 12/03/06

Brainard, Jeffrey (1999) Reassessing an NSF Program for Research Have-Nots. Chronicle of Higher Education, Vol. 46 Issue 8, pp. 31-34

Brainard, Jeffrey (2006) The Stubborn Geographic Gap in Research. Chronicle of Higher Education, Vol. 52 Issue 46, pp.12-12

Department of Trade and Industry (DTI: UK) website (http://www.dti.gov.uk/) accessed 12/03/06

Dietz, J. (2000) Building a social capital model of research development: the case of the Experimental Program to Stimulate Competitive Research. Science and Public Policy, Vol. 27, No. 2, pp.137-145

Strobel, G. A. (1996) Lessons from the EPSCoR States. Science, Vol. 272 (31 May 1996), p.1245.

Vogel, G. (2006) A German Ivy League Takes Shape. Science Vol. 314 (20 October 2006) p.400

Guston, D. (2000) Retiring the Social Contract for Science. Issues in Science and Technology, Summer 2000 (http://www.issures.org/issues/16.4/-_puston.htm)

Lambright W. H. (1996) "Developing science: notes from the states", Competitiveness in Academic Research edited by Teich A. H., American Association for the Advancement of Science, Washington, DC

Lubchenko, Jane (1998) Entering the century of the environment. A new social contract for science, Scienc 279, 491-497

NSF (2006) Electronic website of EPSCoR, (URL:http://www.nsf.gov/div/index.jsp?div=EPSCOR) date

Saxenian, A. (1994) Regional Advantage: culture and community in Silicon Valley and Route 128, Harvard University Press, Cambridge

Yin, R. K. and Feller, I. (1997) EPSCoR Evaluation, Cosmos Corporation, Bethesda, MD