



Athena Alliance

Rethinking Innovation Policy:

Response to Department of Commerce Request for Comment on the Strategy for American Innovation

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The following is a response to the Request for Comments on the Strategy for American Innovation (FR Doc. 2011–2558) issued on February 4, 2011 by the Office of the Secretary, Department of Commerce. The response contains two sections: comments on the overall framework of the Strategy for American Innovation and comments on specific questions raised within the Request for Information (RFI).

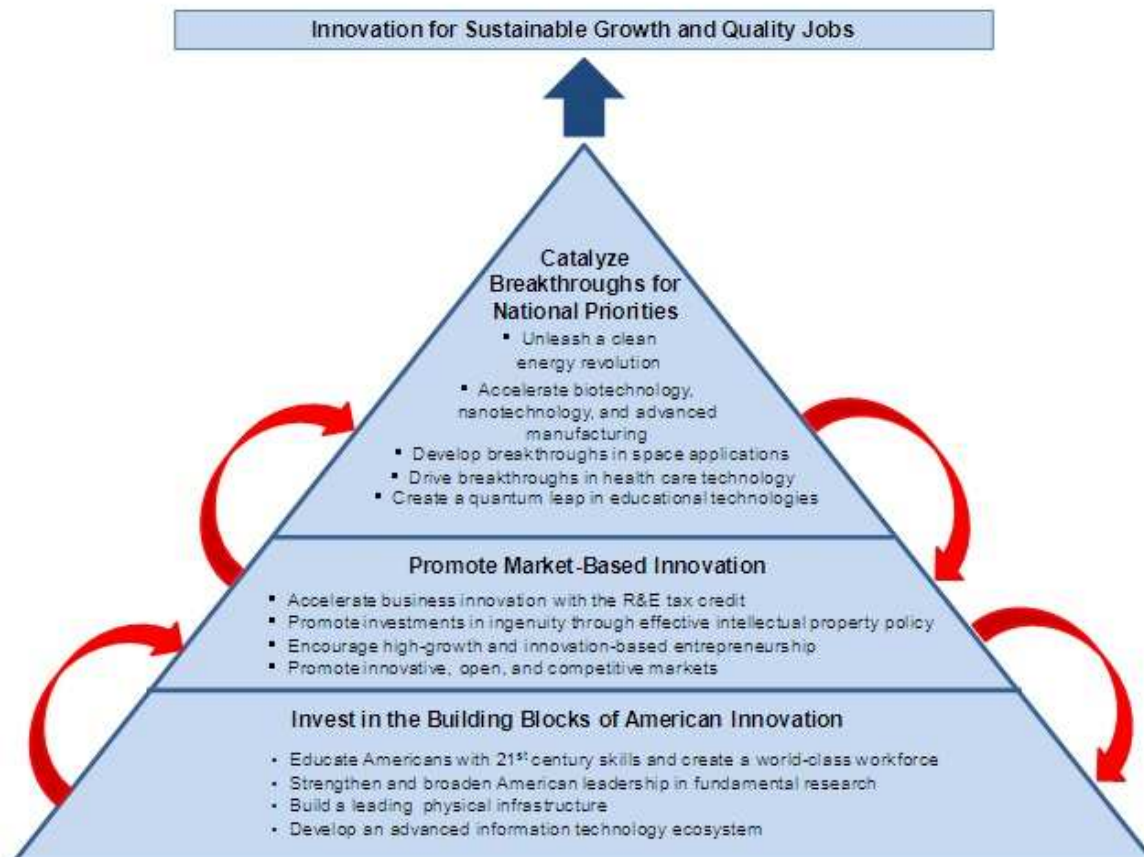
Summary

The President's [*Strategy for American Innovation*](#) and Request for Comments/Request for Information provide an important framework for thinking about U.S. innovation policy. However, both the framework presented in the *Strategy* and as articulated in the set of questions contained in the RFI are too narrow in their scope. Throughout my comments, I have sought to refashion the questions to broaden the focus.

The RFI is specifically seeking comments as part of a broad study of the competitiveness of the U.S. economy as required by Section 604 of the America COMPETES Reauthorization Act of 2010. I urge the Department of Commerce to use the Congressionally mandated study to undertake a broad analysis and rethinking of our innovation policy. The restated questions contained below are an attempt to articulate a starting point for that analysis.

Comments on the overall framework

The [Strategy for American Innovation](#) has three major components: Investing in building blocks of education, basic research and infrastructure; Promoting market-based Innovation; Catalyzing breakthroughs for national priorities. They form a pyramid type arrangement, with basic foundations leading to market commercialization and then focusing on specific areas of special interest within that broader market framework.



Source: White House, *Strategy for American Innovation*

This framework is fine as far as it goes. It is useful for tying together the Administration's policy initiatives. But the framework and those initiatives don't go far enough to effectively foster innovation in the new I-Cubed (Innovation-Information-Intangibles) Economy.

The foundation of the pyramid is called, fittingly enough, "Building Blocks." The framework describes three basic foundations: education, R&D and infrastructure (which now divides into physical infrastructure and the "IT ecosystem"). Each of these touch upon an important area, but are too narrow in their scope. The first building block is "Educate the next generation with 21st century skills and create a world-class workforce." This focuses on activities such as improving STEM (Science, Technology, Engineering, Mathematics) education, reforming elementary and

secondary education, expanding early education, expanding access improving collage education, and strengthening community colleges.

Then, as the last sentence in the paragraph on college attainment, as almost a throwaway line, is this comment, "Finally, the Task Force on Skills for America's Future will build and improve partnerships between businesses and educational institutions to train American workers for 21st century jobs." Only in this one sentence does the document even begin to hint at the needs to the vast majority of workers who won't get college degrees. And even this does not recognized that that there is more to this building block that just formal education -- such as life-long learning.

Rather than focus on "education" or even the broader concept of life-long learning, I suggest the strategy should take a step back and look at the intangible asset involved. The building block is developing and utilizing human capital. Education --- and especially formal institutional degree-granting education -- is only one part of that process. A broader view is needed.

The next building block is fundamental research. The document talks about boost spending at universities, federal labs and industrial laboratories. Again, basic research is an important part of this building block. But it is only one part. There is more needed in the research endeavor to create of new technologies. And innovation is more than new technologies -- a point we will return to later. Again, stepping back, the intangible asset is the creation, dissemination and utilization of knowledge.

The final building block is infrastructure -- which the most recent document breaks into investing in physical infrastructure and the IT ecosystem. Both of these are critical. But, as research has shown over and over again, much of the gain from IT comes from accompanying organizational and institutional shifts. Nothing in the document speaks to the need to include the organizational (intangible) infrastructure.

The next level of the pyramid is "Market Based Innovation." Much of this focuses on getting the "business climate" policies correct in intellectual property rights, competition policy, international trade, spectrum auctions, corporate taxation, and regulatory law. There are numerous good programs and initiatives cited here.

But the innovation ecosystem is more than just creating the climate. It includes creating various forms of incentives and assistance. The strategy recognizes this with the Startup America and Regional Cluster initiatives. More can be done in this area, especially in the key area of incentives to cooperate. For example, the Research and Experimentation (R&E) tax credit could be modified to encourage cooperative activities. I was also surprised that the strategy is silent on strengthening the Small Business Innovation Research (SBIR) program. The program is mentioned as part of one of the successful case studies -- but not included in the policy activities and initiatives.

Likewise, there is little discussion of how other areas -- such as regulatory policy and procurement policy -- can be used to create incentives for innovation. The next level of the pyramid does talk about using energy standards to foster innovation - but this section treats regulations as a barrier to innovation.

Finally on this area, the strategy contains a large missing component. Innovation is also more than technology development. It is also more than start-ups and entrepreneurship. The strategy needs to embrace a broader vision on innovation and an explicit recognition of the goal of helping existing companies become more innovative and productive. Other than promoting exports, there are few parts of the strategy that are geared toward helping established companies grow.

The top level of the pyramid is "Breakthroughs for National Priorities." This section outlines a number of priority technology projects. It is a wonderful statement of how technology can be used in key areas. It is also an important, if implicit, statement of how these technology project can have a dual purposed of spurring technological advances for both economic competitiveness reasons and for specific meeting important national needs.

However, it is a statement of technology policy, not a statement of innovation policy. There is nothing about how non-technology projects can contribute to innovation in general and to the specific goals of innovation in the priority areas of energy, health and education. In addition, while harnessing technology is important, reaching national priorities will require more than just strategic investments in key technology areas.

Thus, the strategy document is a wonderful compendium of important Administration initiatives. But it leaves out other important components needed if it is to be a full-blown innovation strategy. Two changes at the level of conceptualizing the issue would help:

- 1) Take a broad view of innovation, not just technology development.
- 2) Look at the ways to strengthen the assets (tangible and intangible) needed to promote innovation, improved productivity and foster economic growth, including (but not limited to):
 - Human capital
 - Knowledge creation and utilization
 - Organizational development.

Comments on specific questions raised in the RFI

The RFI asks a series of 10 sets of questions on different topic. For the purposes of commenting on these questions, I have grouped the topics in four categories: manufacturing and services; entrepreneurship, education and exports (the three E's); knowledge creation and dissemination; and, the innovation process.

Manufacturing and services

For topic #6: Manufacturing, the RFI asks the following questions:

What is the role of advanced manufacturing in driving American economic growth and international competitiveness, and what are the key obstacles to success at advanced manufacturing? In which manufacturing industries will our nation have comparative advantages?

The short answer to the first question is simple: manufacturing will continue to play a major role in American economic prosperity. It will be a different role. As we pointed out a year ago in our Policy Brief--[Intellectual Capital and Revitalizing Manufacturing](#), manufacturing is in the process of being transformed into a much more knowledge-intensive activity. The process is analogous to the transformation of agriculture in the early 20th century. Farming did not simply move to other nations with lower-cost producers using the traditional techniques. Agriculture was mechanized--or industrialized, if you prefer. That transformation led to efficiencies that revolutionized the production of commodities and contributed to U.S. economic growth.

Understand this transformation, and you will understand that the last question -- about comparative advantage -- needs to be rephrased. As it now stands, it focuses on the output of the manufacturing process. The issue is not just what products we will compete in. It is about the changes in the production process. Production is moving toward greater customization -- "just-it-time; just-for-me". Customers are becoming more active in the production process as prosumers. Virtual reality is beginning to revolutionize the product design process and 3-D printing has the potential for changing the production process. The transformation will affect all sectors and all industries.

As manufacturing is transformed into a much more knowledge-intensive activity, it will require attention to all the inputs to the production process -- technology, worker skills, and cooperative/collaborative organizational structures. All of which are key intellectual capital and intangible assets.

Embracing the role of intellectual capital and intangible assets in manufacturing requires going beyond the narrow view of formal intellectual property. Scientific and creative property are valuable assets that include product development activities beyond the patent, new architectural and engineering designs, and social and organizational sciences research. Computerized information, including customized software and databases, are other important company assets that go beyond our definitions of intellectual property. Specific business models, organizational structures, and organizational capabilities are key elements of any company's ultimate success. Worker skills and tacit knowledge--both general and firm-specific--are assets that managers describe as leaving the company every evening and returning every morning. Brand equity, reputation, and relationships with customers and suppliers are all important. All of these forms of intellectual capital need to be explicitly developed and managed by successful manufacturing companies.

Thus, the key question is not which industries. The question is how do we position American manufacturers to make the transformation. It will not be an overnight leap, but a gradual process

that will require sustained attention. At the heart will be helping companies understand the transformation and how to best utilize their intellectual capital.

There are a number of specific actions that could be taken to support the transformation. We should expand the Manufacturing Extension Partnership (MEP) services to explicitly include assistance in indentifying and managing their intellectual capital. Likewise, we should include intellectual capital management in Small Business Administration (SBA) training programs and Economic Development Administration (EDA) business incubator programs. We could also create a specific award and assessment program similar to the Baldrige Award.

Assistance for on-the-job training should be expanded. We should also create a program to allow businesses to use their intangible assets, specifically their intellectual property, as collateral on loans. This could provide an important source of capital to help companies finance the transformation. The government could also do more to promote innovative manufacturing through its procurement process and through the establishment of demonstration and technology diffusion programs.

Research on the manufacturing transformation should also be undertaken. But this should go beyond the traditional advanced manufacturing concept to embrace the entire transformation. For example, the concept of "design thinking" is becoming increasingly important in product development. Just like we have created Engineering Research Centers in a number of areas (including advanced manufacturing), we should create one for design thinking. Likewise, research need to be continued on new manufacturing business models and the linkages between services and manufacturing.

That last point is especially important as the RFI also raise an important subject in a corollary area. Topic #9: Innovation in services asks the following questions:

What sectors of the economy have gained less from innovation in the past and--to the extent that innovation could have sustained competitiveness--what are the obstacles to their progress? What are the policy issues that are raised by the nature of innovation in the service sector?

First, we should recognize that the barriers between "manufacturing" and "services" are eroding. Service activities are increasingly linked manufacturing activities. In fact, companies such as the German Mittelständler companies are successfully competing in "old" industries based on that linkage. They offer knowledge -- not low cost. Knowledge is what gives them a superior product and knowledge is what makes their services so valuable. But is it not just generic knowledge. They are selling their knowledge as a means to create solutions for their customers. Their customers want the knowledge to be specifically applied to them - not some abstract concepts. That is the "service" part of the equation. So, all of the activities described above for helping manufacturing should recognize that these manufacturing companies are already in the "service" business.

Next, it should be recognized that all of the activities described above for helping manufacturing also apply to services. Service industries are becoming more knowledge-intensive and need to understand and better their intangible assets. MEP could be further expanded to a offer assistance

to service providers -- just as the Baldrige Award was opened up to service businesses. Promoting innovative service delivery activities through the government procurement process and through the establishment of demonstration and technology diffusion programs is also just as important as in manufacturing. Likewise, research on the organizational and business model aspects of service delivery should be undertaken.

The bottom line answer to both questions is as follows: our goal should be to help American companies make the transformation to a more knowledge-intensive, information-fueled innovative production process -- in all sectors and in all industries. Some of those industries will be labeled "manufacturing." Some will be labeled "services." Some will be a combination of both. What we label it is less important than the action we take to help make the undertaking of these activities here in America as productive, competitive and wage/job creating as possible.

Entrepreneurship, education and exports (the three E's)

In topic #2: Entrepreneurship, the RFI asks the following questions:

Through what measures can government policy better facilitate the creation and success of innovative new businesses? What obstacles limit entrepreneurship in America, and which of these obstacles can be reduced through public policy? What are the most important policy, legal, and regulatory steps that the federal government could take to expand access to capital for high-growth businesses?

In order to comment on the questions relating to entrepreneurship, we must first separate out various concepts:

- 1) start up versus growth
- 2) entrepreneurial growth (through new business opportunities) versus market expansion (through expanding into new markets geographically or serving an underserved market or by capturing market share or simply through an expanding customer base).

The start up process concerns establishing a new entity. There are numerous specific issues associated with forming a new entity -- business or non-profit.

The growth process may or may not be associated with that start up process. For example, Google is not a start up. Yet it is a very entrepreneurial company. It is entrepreneurial because it seeks to identify and exploit new business opportunities. A new coffee shop is a start up, but probably not an entrepreneurial growth company under this definition - even though it may be a coffee shop in an underserved market.

Entrepreneurial growth has two phases: identification of the new business opportunity and exploiting that opportunity.

It should be noted that innovative companies are not necessarily either start ups or entrepreneurial (under the above definition). Ford is certainly no longer a start up. Nor is it necessarily entrepreneurial. But it is innovative. Thus, there needs to be a separate set of

questions as to how to help established companies use innovation to maintain or improve their competitive edge (which will be covered in topic #8 of this RFI).

Therefore, the question on entrepreneurship needs to be rephrased to focus on the start up and the entrepreneurial growth parts of the process. Below are the relevant 3 questions:

1) What are the government policies that can facilitate the process of creating a new entity? There are a number of programs already in place at the federal, state and local levels to assist new entity creation. These include reducing or simplifying regulatory requirements, providing technical assistance, helping reduce risk (such as through insurance programs), assist in finding suitable facilities and providing access to capital. These programs should be expanded -- but focused on local activities. These "here is how to start a business" activities are most effective when they are targeted to and carried out at the grassroots level.

2) What are the government policies to help entrepreneurs identify new market opportunities? Here one of the keys is access to information and knowledge. For example, the technology transfer process is an important factor in this process. Information about university and government-created technologies can help the entrepreneur spot new opportunities. Technology transfer activities should not be just about closing the deal - but transferring information. Other forms of information, such as market analysis, is also important. Most important is maintaining the flow of information. As is addressed elsewhere in the question #10 of the RFI, enhancing the exchange of ideas is a key part of any policy to support entrepreneurs.

3) What are the governmental policies and activities that can help entrepreneurs exploit the new business opportunities? This question has both a resources-push and a demand-pull component. On the input side, key is identifying and accessing the resources needed. This may include technology, capital and workers. Government programs to provide resources for the development of new technologies - such as the Technology Innovation Program (TIP) and SBIR - are important elements of this policy. Policies that promote access to new government and university developed technologies are also important. Obviously, programs that help provide access to capital and specific worker training activities are critical. With respect to worker training, it is important that industry/company specific and on-the-job training are emphasized. Similar to "start-a-business" assistance, this level of specific worker training is most effective when targeted to and carried out at the grassroots level.

On the demand pull side, some areas to be examined would be government procurement and regulations/standards. Government procurement has served as the "thin-opening wedge" needed by many technologies to and regulations can create new opportunities as well. Regulations and standards can create new business opportunities by redefining the market or creating markets for new goods and services.

In some cases, a modification of regulations and government policies may be needed to account for the new activity and to help create the market. A regulation or a policy that was appropriate under one set of circumstances and activities may -- inadvertently -- become a barrier to new activities. For example, the regulation that limits the use of financing under Industrial

Development Bonds to only facilities producing tangible goods means that this program is not available to finance software development or bio-medical research facilities.

Another activity would be technical assistance beyond the "here is how to start a company" -- technical/scientific help (connecting with experts in universities and national labs) and business/organizational (mentoring). One specific way might be in helping provide technical assistance in identifying and better managing a company's intangible assets. By understanding their intangible assets, a company will better understand where the new business opportunities lie based on their asset base and what resources (existing or to be acquired) would be needed to exploit that opportunity.

Topic #4 asks about education:

How important is catalyzing greater interest and training in science, technology, engineering and mathematics (STEM) fields? What strategies can be most effective on this score? Can educational technologies be better utilized to this end? What are the critical opportunities and limitations to the creation and adoption of effective education technologies? How can investments in community colleges better leverage public-partnerships to better train Americans for the jobs of today and tomorrow?

As I noted earlier in my overview comments, all of these are good questions -- but they are far too narrow. The focus should be broader on the development of the important intangible asset of human capital. Formal education is only on part of that process. The topic should also include on-the-job training, non-traditional education, and areas beyond STEM. Such a broader focus would lead a modification of the questions above. For example, what are the critical opportunities and limitations to the creation and adoption of effective education and training technologies -- and their utilization in multiple settings (classroom, individual learning, on-the-job training)?

Starting with a human capital focus would also broaden the field of view go beyond the training and education parts of workforce development. What are the organizational changes that are needed to better improve and utilize human capital - such as the development of high-performance work organizations? What are the labor force policies that either help or hinder human capital development? Such a broader focus would breakdown the policy silos that hinder an effective policy toward our most important asset -- people. (From more on the need for an overall policy approach to high-performance work organizations, see Jarboe and Yudken, "[Time to Get Serious About Workplace Change](#)," *Issues in Science and Technology*, Summer 1997.)

The third "E" is covered in topic #7: Exports. The RFI asks:

How could the government better assist small and medium-sized domestic firms sell their products abroad? What policies can be pursued that would help all U.S. businesses increase their exports?

Once again, the question needs to be framed in broader terms. Exports are only part of international trade. The broader question is as follows: how can the government help companies win in the international trade game? There are 4 reasons why companies don't benefit from international trade.

1) They are not in the game. Many companies simply don't sell outside of a limited geographically areas. In this case, the first question is appropriate: How could the government better assist small and medium-sized domestic firms sell their products abroad? Export promotion activities need to be better coordinated and made more effective.

2) There are trade barriers and unfair trade practices that keep U.S. goods and services out of other markets. Here is the role for trade negotiations and trade enforcement. But the activities need to go beyond lower barrier to trade (i.e. trade agreements). Agreements are meaningless if there is no enforcement.

Likewise, bilateral trade agreements do not cover third-country markets. Aggressive export promotion activities, including matching of export financing, may be required. For example, the creation of an export financing warchest might be needed to bring more countries into the OECD export financing disciplines.

3) There are unfair trade practices in home markets. Exports are only half of the international trade picture. Competing in U.S. market is increasingly no different than competing in international markets. Facing unfair trade practices at home -- such as dumping and illegal subsidies -- are the equivalent of facing trade barrier abroad. It is a government-created competitive disadvantage for U.S. firms. Mercantilist practices are the same whether they are applied against U.S. companies in a foreign market or in the U.S. market. The broader question that needs to be asked is as follows: What are the policies and actions need to counter mercantilist practices of other nations both in markets abroad and within the U.S.?

4) The companies' good and service are not competitive. It may be that some U.S. companies' products are more expensive and/or not as good as their competitors. Companies with uncompetitive products will simply not benefit from international trade no matter how much the government promotes the product, lowers trade barriers or defends it against unfair trade practices. In these case, the remedies are mostly a private sector matter. But, as the last three decades have indicated, there are multiple areas where government can help. These are range from cost of capital to increasing productivity through worker training to business support activities such as MEP -- and is the overall purpose of this RFI.

Addressing the fundamental competitiveness of American companies will help ensure that American business and workers benefit from international trade both at home and abroad.

Knowledge creation and dissemination

The questions posed in topic #1 (government R&D) and #5 (incentives to innovate) can be taken together.

Topic #1 - Government research and development - asks the following questions:

How can the economic impacts of basic research funding (e.g., NSF, NIH) be better measured and evaluated? What methods can the Federal Government use to prioritize funding areas of basic research, both within an area of science and across areas of

science? How can existing Federal government institutions (not just organizations, but also programs, policies, and laws) devoted to basic research and innovation be improved? Are there new institutions of these types that are needed to achieve national innovation goals? How could the government increase support for industry-led, pre-competitive R&D?

Topic #5 - Incentives to innovate - asks:

How could the government better use incentives (including but not limited to procurement, Advanced Market Commitments, incentive prizes, and aggregation of demand) to promote innovation? Are there other economically-sound incentives that the government should provide?

Taken together, these cover the push and pull of technology development. The government R&D questions cover funding resource in. The incentives questions cover the demand pull. But, as I noted in the overview, the formulation of these questions are too narrow -- especially the focus on basic research. We need to take a step back as ask what is the intangible asset we wish to create. From that point of view, the intangible asset is the creation, dissemination and utilization of knowledge. The first question to be asked what is the role of the government in the creation and diffusion of knowledge? What resources can the government provide to the creation process? What governmental actions can create a demand for the creation and utilization of knowledge?

To answer those question there should first be an inventory of all government support for the creation intangible knowledge assets - directly and indirectly. By looking at this inventory, it will become clear that the government is involved in much more that support for basic research. The federal government creates important knowledge assets in the form of government statistics. It creates other forms of information assets in the form of standards. It supports organizational research and evaluation activities -- both academic and for agencies purposes.

The review would provide a basis for understanding the range and types of knowledge creation and dissemination activities and mechanisms. That would include creating a better understanding of support for non-scientific and technical research and place such support in its proper context. In the context of the broader goal of knowledge creation and dissemination,

A review would also place in context the demand side questions of how to use most effectively use procurement and activities that aggregate demand. Different forms and areas of knowledge creation might require different types of demand side incentives. The review would be a starting point of understanding the different needs and effectiveness of the different approaches.

Topic #3 covers Intellectual Property (IP) and is related to the question of incentives. The questions the RFI ask are:

What are the key elements of any legal reform effort that would ensure that our intellectual property system provides timely, high quality property rights and creates the best incentives for commercial innovation? How can the intellectual property system better serve the dual goals of creating incentives for knowledge creation while also

ensuring that knowledge is widely diffused and adopted and moves to its best economic and societal uses?

IP is a key incentive that is a legal market creating activity rather than a direct financial means of creating a market. IP is essentially a government-grant of a monopoly right, granted, as Article I, Section 8, Clause 8 of the Constitution states, "To promote the Progress of Science and useful Arts." "By securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries", as the rest of Clause 8 states, IP regulates the marketplace to create a financial incentive for invention and creation. The questions in this area should be seen in this context of the overall goal of creating incentives to innovation.

But the structure of IP in the specific form of patents covers both incentives for creation and incentives for dissemination. The alternative IP protection to patents is trade secrets -- which are very different in terms of dissemination. To obtain a patent, the knowledge must be disclosed - rather than be kept secret. The implicit trade off in patents is that protection is granted in return for disclosure. That disclosure is critical for the information flow needed to support entrepreneurial activities, as discussed above. Transfer of knowledge become next to impossible if there is no knowledge about the knowledge. To be effective, however, the IP system must work with other forms of dissemination. Merely disclosing may not be enough to induce dissemination.

Thus, an additional question is in order. How do the incentives for knowledge creation and dissemination under the intellectual property system either support or conflict with other forms of incentives and mechanisms for knowledge creation and dissemination?

The final part of the set of knowledge creating topics in the RFI is #10: Enhancing the exchange of ideas. The RFI asks the following:

How can public policy better promote the exchange of ideas among market participants-- that is, support "markets for technology"--that enhance the social value of innovations? Similarly, how can the government assist in the diffusion of best practices? Given that ideas and knowledge cannot be traded as readily as are physical goods, what is the government's role in supporting more effective markets?

The first two topics of focus on the creation part of the issue of knowledge creation and dissemination. IP has a dual focus of creation and dissemination. This last set of questions hones in on the dissemination issue. Yet, it seems to look at only one mechanism of exchange: knowledge markets. Knowledge markets is an important concept. But it is only one form of knowledge exchanges. The question should be broadened. How can public policy promote the exchange of ideas and the flow of knowledge? What policies, programs and activities can help or hinder the dissemination of knowledge? What are the various mechanisms for knowledge flows and dissemination and which are best suiting in which circumstances?

Under this broader question should be a review of the range of government policies affecting the flow of information and knowledge. Currently, these policies are in separate silos such as privacy, intellectual property rights, "right-to-know" policies, terms of access to government data and data collection/statistical policy. All of these policy areas approach knowledge, information

and data as an intangible asset. But they assess and value that asset in very different ways. A common approach to this intangible assets across the various silos may not be either possible or desirable. But a more coordinated approach that is at least cognizant of the overlap and tensions among the various policy areas would help ensure that more nuanced and appropriate policies could be crafted.

Innovation Process

The last, and most far reaching, set of questions are covered in topic #8: Implications of changes in the innovative process. The RFI asks the following questions:

In recent years, some experts have noted that the innovation process itself is changing, and that approaches such as user-driven innovation, open innovation, design thinking, combinatorial innovation, modularity, and multi-disciplinary innovation are growing in importance. What are the policy implications of these and other changes in the innovation process? Should policy makers be thinking differently about our approach to industrial organization and competition policy in light of these changes?

The answer to the last question is a resounding yes. Yes, policy makers should be thinking differently about approached to not only industrial organization and competition policy -- but to every other part of innovation and competitiveness policy as well.

As currently framed, the question focuses on anti-trust/competition policy. But the shift in the nature of the innovation process has profound implications for all of innovation policy. Our current policy is still an artifact of the industrial era linear model of innovation. Under that model basic research leads to applied research leads to technology development leads to product development lead to product demonstration which finally leads to commercialization. The key elements of that policy are resources in at the front end (funding, STEM educated personnel), technology transfer activities in the middle and IP protection at the end.

Innovation is not this neat progress. Even when it follows this path, there are numerous feedbacks loops and cases of starting over. But in many case, innovation is more like a stew - with various elements -- technology, business models, financing, organizational structure, marketing concepts -- being combined to create the end product. An entrepreneur pulls together a previously uncoordinated hodgepodge of ideas and technologies into a product or service that customers demand. Pieces of technology are combined in new ways (such as combining lasers and compression algorithms to create the compact disk). In some cases, the technology is secondary to and a means of facilitating the business model -- for example ZipCar or even iPods.

In fact, technology may not even play a role. As Professor Christopher Hill has noted: "In the post-scientific society, the creation of wealth and jobs based on innovation and new ideas will tend to draw less on the natural sciences and engineering and more on the organizational and social sciences, on the arts, on new business processes, and on meeting consumer needs based on niche production of specialized products and services in which interesting design and appeal to individual tastes matter more than low cost or radical new technologies."

("The Post-Scientific Society," *Issues in Science and Technology*, Fall 2007)

Innovation policy needs to catch up to the innovation process. For example, a demand driven model innovation shows that government procurement and regulations can drive innovation. Government as a demanding customer can create the "thin opening wedge" -- new products and services that have a specialized use. Once that specialized use is established, the product or service can be refined and adopted to a broader customer base. The demanding customer in fact becomes a co-creator. Regulations can serve the same function by creating demanding customers.

To take another example, we have Engineering Research Centers in a number of areas. Why don't we have one for design thinking? Or why aren't we also funding research on and demonstration of new business methods and organizational mechanisms as part of the "Catalyze Breakthroughs for National Priorities" element of the innovation strategy? Why aren't we funding more organizationally-focused challenges, such as the DARPA "Red Balloon" challenge?

These are but two of numerous examples of how thinking toward innovation policy needs to be expanded. Throughout the comments I have made on the RFI, this theme of thinking in a more broad context has repeated itself over and over again. This last topic highlights that concern. Thus, the basic question underlying the entire RFI is a modification of the one stated above: In light of the changes in the innovation process, how should policy makers be thinking differently about our approach to innovation policy?

This question is worth of study and intense discussion in and of itself. Posing the question in this RFI is a good starting point. But only a starting point. I would urge the Department of Commerce to undertake that specific dialogue, discussion and examination.