Government as Entrepreneur:

Public Sector Support of Innovative Firms in the United States

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I. Introduction

Thinking of government as entrepreneur is a unique lens through which we characterize a specific subset of government policy actions that support innovative firms.[1] Our viewpoint underscores the purposeful intent of government, its ability to act in new and innovative ways, and its willingness to undertake policy actions that have uncertain outcomes.

In Section II, we provide an overview of the Schumpeterian view of innovation. Our model of government as entrepreneur is based on Schumpeter's dynamic view of innovation as reflected by his characterization of entrepreneurship and creative destruction. In Section III, we offer a framework that characterizes government as entrepreneur, namely government as entrepreneur in the provision of technology infrastructure when its involvement is both innovative and characterized by entrepreneurial risk. We illustrate five U.S. public/private partnerships in the United States that can be characterized as examples of government as entrepreneur. Finally, the paper concludes in Section IV with a summary statement.

II. The Schumpeterian View of Innovation[2]

Our argument to support the idea of government as entrepreneur builds directly on Schumpeter's dynamic view of innovation. For Schumpeter, the main instrument of change in the theory of economic development is the entrepreneur. Development is a dynamic process, a disturbing of the economic *status quo*. He viewed economic development not as a mere adjunct to the central body of orthodox economic theory, but as the basis for reinterpreting a vital process that had been crowded out of mainstream economic analysis by the static, general equilibrium approach of his predecessors. The entrepreneur is the key figure for Schumpeter because, quite simply, he is the *persona causa* of economic development.

Schumpeter combined ideas from many earlier writers but mostly from the Germanic tradition. His entrepreneur is a disequilibrating force. For Schumpeter, the concept of

[1] This paper draws directly from Link and Link (2009).
[2] For an intellectual history of entrepreneurship see Hébert and Link (2009).

equilibrium that dominated 20th century economics served as a mere point of departure. The phrase he coined to describe this equilibrium state was the circular flow of economic life. Its chief characteristic is that economic life proceeds routinely on the basis of past experience; there are no forces evident for any change of the *status quo*—cumulative drift in a sense. Within this system, the production process is invariant; although factor substitution is possible within the limits of known technological horizons. The only real function that must be performed in this state is "that of combining the two original factors of production, and this function is performed in every period mechanically as it were, of its own accord, without requiring a personal element distinguishable from superintendence and similar things" (Schumpeter 1934, p. 45). In this situation, the entrepreneur is a nonentity. "If we choose to call the manger or owner of a business 'entrepreneur'," wrote Schumpeter (1934, pp. 45–46), then he would be an entrepreneur "without special function and without income of a special kind."

For Schumpeter, the circular flow is a foil. The relevant problem, he wrote in *Capitalism, Socialism and Democracy* (1950, p. 84), is not how capitalism administers existing structures, but how it creates and destroys them. This process—what Schumpeter called "creative destruction"—is the essence of economic development. In other words, development is a disturbance of the circular flow. It is a process defined by carrying out of new combinations in production. It is accomplished by the entrepreneur.

Schumpeter admitted that the essential function of the entrepreneur is almost always mingled with other functions, such as management. But management, he asserted, does not elicit the truly distinctive role of the entrepreneur. "The function of superintendence in itself, constitutes no essential economic distinction," he declared (1934, p. 20). The function of making decisions is another matter, however. In Schumpeter's theory, the dynamic entrepreneur is the person who innovates, who makes new combinations in production.

Schumpeter described innovation in several ways. Initially he spelled out the kinds of new combinations that underlie economic development. They encompass the following: (1) creation of a new good or new quality of good; (2) creation of a new method of production; (3) the opening of a new market; (4) the capture of a new source of supply; (5) a new organization of industry. Over time, the force of these new combinations dissipates, as the new becomes part of the old circular flow. But this does not change the essence of the entrepreneurial function. According to Schumpeter (1934, p. 78), "everyone is an entrepreneur only when he actually

'carries out new combinations,' and loses that character as soon as he has built up his business, when he settles down to running it as other people run their businesses." In Schumpeter's theory, successful innovation requires an act of will not of intellect. It depends, therefore, on leadership, not intelligence, and it should not be confused with invention.

The leadership that constitutes innovation in the Schumpeterian sense is not homogeneous. An aptitude for leadership stems in part from the use of knowledge, and knowledge has aspects of a public good. People of action who perceive and react to knowledge do so in various ways; each internalizes the public good in potentially a different way. The leader distances himself from the manager by virtue of his aptitude. According to Schumpeter (1928, p. 380), different aptitudes for the routine work of "static" management results merely in differential success at what all managers do, where different leadership aptitudes mean that "some are able to undertake uncertainties incident to what has not been done before; [indeed] … to overcome these difficulties incident to change of practice is the function of the entrepreneur."

III. A Framework for Thinking about Government as Entrepreneur

Public/private partnerships are the relevant programmatic mechanism or organizational structure discussed in this paper through which government acts entrepreneurially.

We use the term *public* to refer to any aspect of the innovation process that involves the use of governmental resources, be they federal, state, or local in origin. *Private* refers to any aspect of the innovation process that involves the use of private sector resources, mostly firm-specific resources. And, *resources* are broadly defined to include all resources—financial resources, infrastructural resources, research resources, and the like—that affect the general environment in which innovation occurs. Finally, the term *partnership* refers to any and all innovation-related relationships, including but not limited to formal and informal collaborations or partnerships in R&D.

A framework that defines our view of the focus of public/private partnerships is presented in Table 1. The first column of the table describes the nature and scope of government involvement in a public/private partnership. Government involvement could be indirect or direct; if it is direct, there is then an explicit allocation of financial, infrastructural, and/or research resources. The second and third columns in the table relate to the economic objective of the public/private partnership. Of course, with any innovation-related activity there are

spillovers of knowledge and thus economic objectives are multi-dimensional. However, for illustrative purposes, a single overriding economic objective is assumed. Broadly, the objectives are to leverage public-sector R&D activity or to leverage private-sector R&D activity.

Our grounding for the argument that a public/private partnership framework is the relevant mechanism for conceptualizing government as entrepreneur, at least with respect to the United States, is based on extant U.S. technology policies. The Office of Technology Policy (1996) classified public/private partnerships in the United States along a time spectrum in order to illustrate and emphasize that public/private partnerships have evolved from a relationship in which the government was merely a customer of private-sector research to a relationship in which the government is a partner in that research. In other words, the Office of Technology Policy's taxonomy is one that stresses the evolution of the public-sector's role in partnerships. Specifically (Office of Technology Policy 1996, pp. 33–34):

> By the late 1980s, a new paradigm of technology policy had developed. In contrast to the enhanced spin-off programs—enhancements that made it easier for the private sector to commercialize the results of mission R&D—the government developed new public-private partnerships to develop and deploy advanced technologies. … [T]hese new programs … incorporate features that reflect increased influence from the private sector over project selection, management, and intellectual property ownership. Along with increased input, private sector partners also absorb a greater share of the costs, in some cases paying over half of the project cost. … The new paradigm has several advantages for both government and the private sector. By treating the private sector as a partner in federal programs, government agencies can better incorporate feedback and focus programs. Moreover, the *private sector as partner* [emphasis added] approach allows the government to measure whether the programs are ultimately meeting their goals: increasing research efficiencies and effectiveness and developing and deploying new technologies.

Figure 1 illustrates this Office of Technology Policy view. There are several salient and subtle features in the figure. First, the federal government has changed from being a customer

for the technology output of industry programs, which it often financed, to a partner in the programs. And second, not only does this role change increase the ability of industry to focus its efforts more efficiently on government needs, but also it speeds up the technology diffusion process.

Five examples from recent U.S. technology policy illustrate government as entrepreneur. They are summarized in Tables 2 and 3, and each is briefly discussed below.

A. Research Joint Ventures

Public and private organizations participate in research joint ventures (RJVs), and public resources are indirectly used to encourage the partnership formation. The use of public resources, meaning the lessening of prevailing antitrust laws, creates a legal environment conducive for cooperative research. It is this legal environment that is the technology infrastructure. The so-called legitimization of RJVs (i.e., the relaxation of antitrust laws to stimulate private-sector R&D) was the innovative policy action. It removed the innovation barriers that were suspected of causing an underinvestment in private-sector R&D. The entrepreneurial risk is characterized by the likelihood that the benefits to firms from participating in an RJV outweigh the costs.

Through RJV activity, firms potentially benefit from the opportunity to capture knowledge spillovers from other members of the venture, reduce innovation costs due to a lessening of duplicative research, realize faster commercialization because the fundamental research stage is shortened, and realize the opportunity to develop an industry-wide competitive vision. These potential benefits are based on the theoretical literature, anecdotal evidence from the successful Japanese experience with research collaborations in the mid- to late-1970s and early 1980s, and a few limited empirical studies.

The realization of these potential benefits is subject to entrepreneurial risk because, in fact, they might not be realized, and if they are realized, the benefits might not be appropriable without a cost. This cost includes appropriability loss because research results are shared among participants in the venture, and it includes the inevitable managerial tension among venture participants as each learns to trust the others and work in concert. Anticipation of such categories of cost could deter initial participation in the venture.

B. Advanced Technology Program

The Advanced Technology Program (ATP) was established within the National Institute of Standards and Technology (NIST, discussed below) through the Omnibus Trade and Competitiveness Act of 1988, and modified by the American Technology Preeminence Act of 1991. The goals of ATP, as stated in its enabling legislation, are to assist U. S. businesses in creating and applying the generic technology and research results necessary to commercialize significant new scientific discoveries and technologies rapidly, and refine manufacturing technologies.

ATP's public financial resources leverage private-sector R&D. The use of public resource, legislated through the Omnibus Trade and Competitiveness Act of 1988, to leverage private-sector R&D that would not otherwise have been undertaken lessens barriers to innovation (and barriers to innovation lead to market failure) and creates a cost-sharing environment conducive for cooperative research. It is this cost-sharing environment conducive for cooperative research that is the technology infrastructure. The entrepreneurial risk associated with the activities of the ATP is if the jointly-funded research will be successful and if so, whether it will in fact accelerate the development of generic technology.

C. National Institute of Standards and Technology

The concept of the government's involvement in standards[3]—mandatory standards rather than voluntary standards—traces to Article 1, § 8 of the Constitution of the United States: "The Congress shall have power … [t]o coin money, regulate the value thereof, and of foreign coin, and fix the standard of weights and measures … ."

Following from a long history of U.S. leaders calling for uniformity in science, it was inevitable that a standards laboratory would need to be established. The political force for this laboratory came in 1900 under President William McKinley. The National Standardizing Bureau would maintain custody of standards, compare standards, construct standards, test standards, and resolve problems in connection with standards. Finally, the Act of March 3, 1901, also known as the Organic Act, established the National Bureau of Standards within the Department of the Treasury, where the Office of Standard Weights and Measures was

[3] A standard is a prescribed set of rules, conditions, or requirements concerning: definitions of terms; classification of components; specification of materials, their performance, and their operations; and delineation of procedures, and measurement of quantity and quality in describing materials, products, systems, services, or practices.

administratively located. The National Bureau of Standards was renamed the National Institute of Standards and Technology (NIST) under the guidelines of the Omnibus Trade and Competitiveness Act of 1988.

NIST leverages public-sector and private-sector R&D through the direct provision of infrastructural and research resources that reduce the technical and market risk of developing infrastructure technologies—infratechnologies—that become the technical basis for standards, voluntary standards in particular. This is necessary because infratechnologies and hence standards are quasi-public goods and they result in underinvestment by the private sector. The innovative policy action of using public resources toward voluntary industrial standards, the technology infrastructure, lessens barriers to innovation by reducing both technical risk (e.g., through public-sector research that diffuses through the private sector) and market risk (e.g., through the promulgation of voluntary standards). The entrepreneurial risk associated with the activities of NIST is if the promulgated voluntary standard will be accepted by industry, and if accepted in a timely manner, whether it will enhance competitiveness.

D. University Research Parks

Government, primarily state government in the United States, allocates funds to support university research parks (URPs)—a public/private partnership. The allocation of these funds is direct, in terms of state resources earmarked for the creation of a park, as well as indirect in the sense that a state university allocates its operating funds for the creation and ongoing activities of the park. Here we focus on the government's indirect involvement.

Among the many objectives of a park, one important one is that the park serves as an environment conducive for industry/university research collaboration and academic entrepreneurship. Thus, the environment created by the park is a technology infrastructure that facilitates leveraging both public (i.e., the university or public-sector tenants in the park) and private R&D. The innovation policy action of using public resources to establish and/or expand existing parks is The Building a Stronger America Act.

The Building a Stronger America Act—that is aimed at expanding the size and scope of existing URPs and helping to create new URPs—is currently pending in the U.S. Congress. Unlike in the previous three examples in which we discussed public sector initiatives from a retrospective point of view and accordingly offered descriptive commentary on the extent to

which tenants affected or targeted were inhibited by the entrepreneurial risk germane to the innovative policy, in this example a prospective point of view is taken because of the topical nature of the innovative policy action discussed.

The Act authorizes a federally-guaranteed loan program to expand or build URPs which is the innovative policy action. The resulting environment—technology infrastructure—is expected to lessen technical risk through expanded R&D activities. The entrepreneurial risk associated with the expansion and creation of new URPs is if the new park facilities will be a technological milieu to attract tenants, and if so, will those tenants actively participate in the two-way flow of knowledge between the university and the park.

E. Small Business Innovation Research Program

The Small Business Innovation Research (SBIR) program helps to fulfill the government's mission to enhance private-sector R&D and to complement the results of federal research. Legislatively, the U.S. Congress passed the Small Business Innovation Development Act of 1982; it required all government departments and agencies with external research programs of greater than $100 million to establish their own SBIR program and to set aside funds equal to 0.20 percent of the external research budget. The 1982 Act stated that the objectives of the program are:

(1) to stimulate technological innovation
(2) to use small business to meet Federal research and development needs
(3) to foster and encourage participation by minority and disadvantaged persons in technological innovation, and
(4) to increase private sector commercialization of innovations derived from Federal research and development.

As part of the 1982 Act, SBIR program awards were structured as defined by three phases. Phase I awards are small, generally less than $100,000 for the six month award period. The purpose of Phase I awards is to assist businesses as they assess the feasibility of an idea's scientific and commercial potential in response to the funding agency's objectives. Phase II awards typically range up to $750,000 over two years.[4] These awards are for the firm to develop

[4] On March 30, 2010 the Small Business Administration amended the SBIR Policy Directive to allow the threshold amounts for Phase I awards to be increased to $150,000 and to $1,000,000 for Phase II awards.

further its proposed research, ideally leading to a commercializable product, process, or service. The Phase II awards of public funds for development are sometimes augmented by outside private funding. Further work on the projects launched through the SBIR program occurs in what is called Phase III, which does not involve SBIR funds. At this stage businesses needing additional financing—to ensure that the product, process, or service can move into the marketplace—are expected to obtain it from sources other than the SBIR program.

In 1992, the SBIR program was reauthorized and the set aside had increased to 1.25 percent, and that percentage was legislated to increase over time to 2.5. Pending is legislation that will increase the set aside from its current 2.5 percent to 3.5 percent over the next ten years.[5]

In terms of our framework, the SBIR program leverages, through the direct provision of financial resources, private-sector R&D in small firms. The use of public resource to target and support private-sector R&D in small firms lessens barriers to innovation and creates a funded environment conducive for commercializable research that would not otherwise have occurred. It is this funded environment conducive for commercializable research that is the technology infrastructure. The entrepreneurial risk associated with the activities of the SBIR program is if the funded research will be successful, meaning that it will result in a commercializable product, process, or service.

IV. Summary Statement

The theme of our paper is that government acts as entrepreneur in the provision of technology infrastructure when its involvement is both innovative and characterized by entrepreneurial risk. Thinking of government as entrepreneur is a unique lens through which to view particular government policy actions.

We do not take the position, much less advocate, that government should be more or less entrepreneurial. Rather, we argue that a new aspect of a taxonomy of government policy actions should be considered, and we are sanguine about its usefulness. Viewing particular policy actions through an entrepreneurial lens could be useful in at least two broad dimensions. One, viewing particular government policy actions as entrepreneurial underscores the forward looking

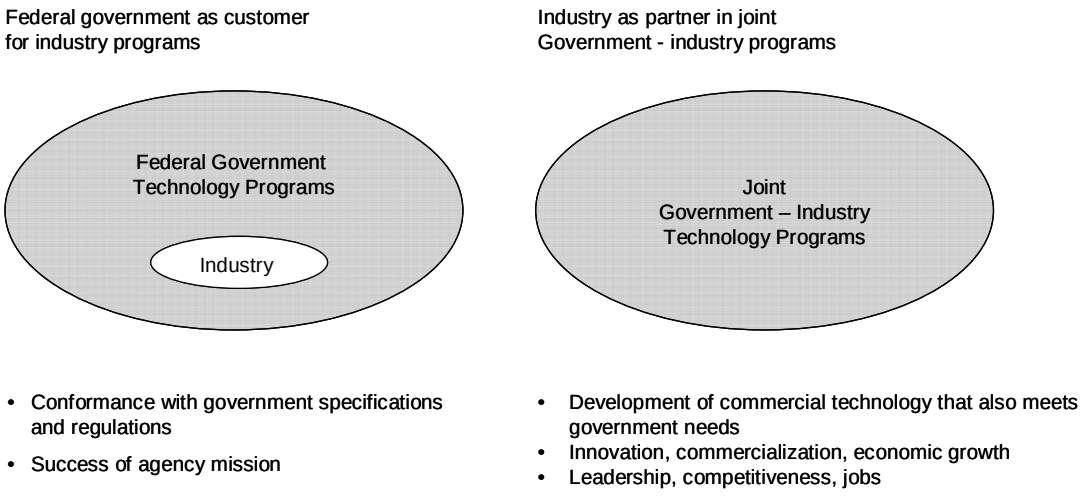
[5] Eleven agencies currently participate in the SBIR program, the Department of Defense being the largest. The others are: the Environmental Protection Agency, the National Aeronautics and Space Administration, the National Science Foundation, and the Departments of Agriculture, Commerce, Education, Energy, Health and Human Services, Transportation, and Homeland Security.

nature of policy makers as well as the need to evaluate the social outputs and outcomes of their behavior in terms of broad spillover impacts. Two, government acting as entrepreneur parallels in concept similar activities that occur in the private sector. And three, viewing government as entrepreneur, albeit in selected areas and for selected policies, places a realistic spin on such activities because it equates entrepreneurial government policy actions with the spirit of the private sector that has led to economic growth and prosperity in all industrial nations.

Table 1
Taxonomy of Public/Private Partnership Mechanisms and Structures

	Economic Objective	
Government Involvement	Leverage Public-Sector R&D	Leverage Private-Sector R&D
Indirect	…	…
Direct		
Financial Resources	…	…
Infrastructural Resources	…	…
Research Resources	…	…

Figure 1
Innovative Paradigm for Technology Partnerships



- Conformance with government specifications and regulations
- Success of agency mission

- Development of commercial technology that also meets government needs
- Innovation, commercialization, economic growth
- Leadership, competitiveness, jobs

Source: Office of Technology Policy (1996, p. 34).

Table 2
Public/Private Partnership Mechanisms and Structures

	Economic Objective	
Government Involvement	Leverage Public-Sector R&D	Leverage Private-Sector R&D
Indirect	*university research park*	*research joint venture structure* *university research park*
Direct		
Financial Resources		*Advanced Technology Program* *Small Business Innovation Research program*
Infrastructural Resources	*National Institute of Standards and Technology*	*National Institute of Standards and Technology*
Research Resources	*National Institute of Standards and Technology*	*National Institute of Standards and Technology*

Table 3
Examples of Government as Entrepreneur

Public/Private Partnership	Technology Infrastructure	Innovative Policy Action	Entrepreneurial Risk
RJV structure	Legal environment conducive for collaborative research	National Cooperative Research Act of 1984: use of antitrust laws to stimulate private-sector R&D	If the benefits to firms from participating in an RJV outweigh the costs
Advanced Technology Program	Cost-sharing environment conducive for cooperative research	Omnibus Trade and Competitiveness Act of 1988: use of public resources to leverage private-sector R&D, that would otherwise not have been undertaken, through cooperative research	If the jointly-funded research will be successful and if so, whether it will accelerate the development of generic technology
National Institute of Standards and Technology	Voluntary industrial standards	Organic Act of 1901: use of public resources to promulgate voluntary standards to reduce the technical and market risk of private-sector R&D	If the promulgated voluntary standard will be accepted by industry, and if accepted in a timely manner, whether it will enhance competitiveness
University research park	Environment conducive for industry/university research collaboration and academic entrepreneurship	The Building a Stronger America Act: use of public resources to establish and/or expand existing parks	If the new or expanded park will attract tenants, and if so, whether they will actively participate in the two-way flow of knowledge between the university and the park
Small Business Innovation Research program	Funded environment conducive for commercializable research	Small Business Innovation Development Act of 1982: use of public resources to target and support research in small firms	If the funded research will result in a commercializable product, process, or service

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