LEARNING FROM VENTURE CAPITAL
Procurement Programs as a Way to Promote Innovation

by

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B.A., Political Science
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ABSTRACT

This thesis explores how government efforts to spur the commercialization of "green" technologies might be improved by understanding the practice of venture capital. Both state and federal governments currently support the commercialization of such technology through funding programs called demonstration projects, which allow manufacturers to develop and test new products that might otherwise be prohibitively expensive to build. The limited flexibility of these programs, however, limits their overall effectiveness because they are unable to continually address the wealth of unexpected problems that emerge throughout the process of technological development. Although organizational management literature suggests that organizations that can 1) gather and 2) react to new information are best at nurturing technological innovation, the notion of more flexible bureaucracy challenges our notions of democratic accountability. Because venture capital provides an example of a process of flexible resource management designed to nurture innovation, better understanding its practice might help to address the accountability problems posed by a more flexible public sector.

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INTRODUCTION

Government programs designed to promote innovation in "green" technologies have resulted in mixed success since their advent in the early 1970s. After initial breakthroughs in the 1970s associated with the extension of existing technologies like the combustion engine, the 1990s witnessed a decline in the rate of innovation required to address a host of remaining environmental problems. Many claim that this lack of progress is explained by the difficulty of commercializing new technologies that conflict with existing modes of practice and production. Technologies such as fuel cell engines that pose radical changes to existing production and service techniques, for example, face much greater hurdles than those such as the catalytic converter that fit within the current technological paradigm.

The government currently uses a variety of funding programs typically called "demonstration projects" to catalyze the commercial deployment of new technologies that diverge from current modes of practice. Funded at both the state and federal level, the central impetus of these programs is to test technologies that require entirely new production processes to manufacture.[1] Purchasing or renting a portion of these devices is therefore intended to push manufacturers down the learning curve to developing cost-effective production processes for them. Building on the example of fuel cell vehicles, a government demonstration project of several of such vehicles would allow manufacturers to explore necessary design changes to equipment, reorganize tasks in the assembly process, and redefine tasks assigned to employees.[2]

Demonstration projects often have secondary goals. The programs may be used to test which of two competing technologies (such as different energy sources for fuel cells) represents the most commercially viable alternative. They also generate information about the operation of the technologies in everyday situations, such as what maintenance and operations procedures would be necessary to bring the device into regular use. Primarily, therefore, demonstration projects represent information gathering exercises. The government provides funding to private manufacturers with the expectation that the information garnered through the production of the technology will be sufficient to standardize new methods of development and commercialize the product. The failure of these programs to produce dramatic change, however, has focused attention on how they might be improved.

This thesis explores the tie between innovation and the institutional context in which programs are administered. The traditional notions of public administration that guide the agencies overseeing these projects stand in direct conflict with the organizational traits that best promote innovation. Although innovation best occurs in organizations characterized by the flexibility in responding to new information, the agencies overseeing demonstration projects are designed to promote predictability and continuity. Due to the rigidity of these organizations, the public officials who manage demonstration projects cannot work proactively to solve problems that emerge throughout the development

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[1] Linda R. Cohen and Roger G. Noll, *The Technology Pork Barrel* (Brookings, 1991), pp. 38-39.
[2] Ibid.

process of the nascent technologies. The result is that the programs chiefly act as information gathering exercises rather than robust efforts at commercializing the technologies.

Although providing more discretion to these public managers would allow them to more actively engage in promoting innovation, the notion of a more flexible bureaucracy greatly challenges current notions of public management. Charged with more responsibility over the management of demonstration programs, public officials would have to develop new skills and expertise to successfully participate in developing new technologies. Perhaps more importantly, granting such discretion would raise important challenges to our notions of democratic accountability. Indeed, the current rigidity of these organizations stems from the intention to eliminate discretion, and thus the potential for personal favoritism, from the civil service. Granting more flexibility to public managers might reduce their accountability to the public and provide more opportunity for corruption within these agencies.

In order to explore these managerial and administrative questions, this thesis details the practice of venture capital, which represents a flexible organizational practice designed to promote innovation. The venture capital process provides an alternative practice with which to compare with the current management of demonstration projects, and understanding how venture capitalists manage new ventures and establish a system of accountability for their employees might yield insights into improving the management of public demonstration projects.

The first chapter explores the organizational characteristics that best promote innovation, and proposes how these characteristics could be applied to demonstration projects. The second chapter outlines the notion of entrepreneurial government and the challenges posed by the notion of a more flexible executive branch. The third chapter investigates the current operation of demonstration programs and the sources of the administrative inflexibility experienced by their managers. The fourth chapter explores the practice of venture capital through several interviews with venture investors, and highlights how these investors nurture new companies and develop systems of accountability. The fifth chapter then examines what lessons the public sector might learn from the practice of venture capital, and underscores some remaining problems of problem-centered demonstration projects.

CHAPTER 1: THINKING ABOUT INNOVATION

The past decade has witnessed an important intellectual shift in the focus of environmental policy intended to promote innovation in "green" technologies. Generally speaking, this shift can be characterized as a movement from *regulation to collaboration.*[3] Traditional regulatory policies force companies to innovate technologically by mandating compliance with specific requirements, such as cutting pollution by selling a certain number of electric vehicles per year. Rather than forcing such change, academics and policymakers have begun to suggest that the public sector might more effectively promote innovation by building partnerships with industry in order to participate more directly in the process of technological innovation.

Two factors largely explain this shift in emphasis from regulation to collaboration. First, and most importantly, these policymakers and academics argue that these partnerships are more effective in producing environmental benefits than regulation. They suggest that regulation fails to adequately tap the wealth of creative solutions to environmental problems located within the private sector, government, and civil society. By enforcing inflexible goals, regulatory programs presuppose solutions to a problem and obfuscate other more creative alternatives that might more effectively address environmental concerns. Moreover, they frustrate the effort to invent such options. This frustration over the performance of regulation in promoting innovation has underscored the importance of pursuing other avenues for achieving environmental goals.

Second, because these collaborative strategies for promoting innovation are seen as more effective than regulation, they are viewed as essential to addressing the magnitude of environmental problems faced by the world community. Since the World Conference on the Environment in Rio de Janeiro in 1992, technological innovation has been viewed as central to reaching sustainability goals. The lack of progress in reaching these goals, however, has focused attention on more effective means of promoting technological innovation. Because of the relative failure of regulation to promote such change, many observers suggest that a more proactive public sector involvement in technological development represents the most promising means to speeding up innovation.

Despite the promise of these collaborative approaches, however, the emphasis on promoting innovation within formerly regulatory institutions poses significant challenges to this new mode of policymaking. Indeed, as discussed below, many of the characteristics of regulatory institutions are antithetical to forms of institutional arrangements that are best at promoting innovation. Although regulation is characterized by predictability and clear standards for accountability, innovation best occurs in a more flexible, open-ended institutional environment. Therefore, even as governments have moved to promote greater collaboration with the private sector over technological innovation through initiatives such as demonstration projects, the organizational structure of these programs and the agencies that oversee them preclude public managers from effectively participating in these partnerships. The lack of success of these programs

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[3] Cary Coglianese and Jennifer Nash, *Regulating from the Inside: Can Environmental Management Systems Achieve Policy Goals?* (Resources for the Future, 2001).

raises the question of what types of organizational and institutional arrangements and policy practices are most suited to promoting innovation.

Innovation as a Problem of Governance

Further understanding the process of technological innovation represents a plausible first step in exploring what forms of institutional arrangements would best suit these collaborative forms of policymaking. Although innovation has been of importance to political economists and organizational theorists for quite some time, the past two decades has witnessed increasing attention to innovation due to perceived widespread changes in the economy. Much of this literature emerged in response to the work of Michael Piore and Charles Sabel, who argue that new economic forms of production based on flexible specialization are replacing traditional forms of mass production because of their ability to produce more innovative products.[4] The rigidity and hierarchy of the mass production process, they argue, is too inflexible to respond quickly enough to shifts in consumer demand in an information-based economy.[5] Because flexible organizations can react to information more quickly, they are more likely to produce innovation.

In order to innovate, however, organizations need not only to be flexible but also to be skilled at gathering and using new information. In this regard, Piore and Sabel emphasize the importance of informational networks to the innovation process. They argue that the organizations that are best at innovating situate themselves within an intricate network of professional and social relations that allow for collaboration across groups. Innovation is said to occur mainly at the interstices of these relationships, as the process of sharing information creates learning and new insights that none of the parties would have developed previously. Innovation occurs as managers allow these new insights to feed back into their product development processes.

This insight raises interesting questions about the organization of government programs designed to encourage technological innovation. If the agencies that manage these programs are expected to effectively participate in and promote innovation processes, should these agencies build the organizational competencies necessary to work within the professional and social networks that develop around particular technologies? Do these agencies currently have the flexibility to act on the information they gather through such participation? Piore and Sabel focus on the characteristics of firms seeking to promote innovation, and do not comment on how these networks could be established within the context of public agencies.

The burgeoning body of literature on *entrepreneurial government* may help to answer these organizational questions. Over the past three decades, academics and policymakers writing within this paradigm have argued that the performance of government agencies

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[4] Walter W. Powell and Laurel Smith-Doerr, "Networks and Economic Life," in Neil Smelser and Richard Swedberg, eds., *Handbook of Economic Sociology* (Princeton University Press and Russell Sage Foundation, 1994), p. 370.

[5] Ibid.

has suffered due to their lack of organizational flexibility.[6] Not surprisingly, the organizational traits of governmental agencies are much more similar to traditional, hierarchical management processes than those based on flexible specialization. This organizational structure was deliberate, as bureaucratic hierarchy is intended to guard against corruption and insure that the government treats its citizens equitably.[7] These authors, however, have argued that the inflexibility engendered by hierarchy inhibits the bureaucracy's ability to respond to new information in a timely manner and has therefore severely hindered its ability to solve societal problems.[8] In order to respond to these shortfalls in performance, they propose a new paradigm of public management focused on building a more entrepreneurial executive branch. Broadly speaking, entrepreneurial government would provide more discretion to public managers to make decisions and react to new information, acting to replace rigidity with flexibility.

The rigidity of public administration seems most problematic for programs intended to encourage and participate in innovation processes. Because these programs rely on ongoing collaboration with the private sector, such inflexibility means that public managers cannot work actively to respond to and solve problems that emerge throughout this partnership. In short, they cannot fully participate in the network of relationships that develop around the technology.

Demonstration Projects

Understanding the operation and management of demonstration projects represents one way of highlighting the problems associated with current institutional approaches to innovation. These funding programs represent the primary means in which the government catalyzes the commercial deployment of new technologies that diverge from current modes of practice. However, the institutional context for these programs limits the discretion of the public managers who oversee them to react to new information and meaningfully engage in the networks that develop around the technologies. These limitations are in turn reflected in the modest goals of the programs and their ineffectiveness in producing immediate technological change. Because public managers cannot meaningfully collaborate with the private sector in commercializing the technologies, demonstration projects are typically organized as short-term information gathering exercises. The intention is that companies will internalize this new information and eventually produce the new technologies. Although this process may eventually help to speed commercialization, it provides a fairly weak mechanism for changing modes of practice and production in the near term. Producing information about new types of photovoltaic cells in use is unlikely to address the variety of social and institutional transitions necessary to successfully commercializing the product, for example.

Providing the institutional flexibility to create *problem-centered* demonstration projects therefore seems to represent one possible way to improving the effectiveness of these programs. With greater discretion to react to new information, public managers could

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[6] Donald F. Kettl, "The Global Revolution in Public Management: Driving Themes, Missing Links," *Journal of Policy Analysis and Management*, Vol. 16, No. 3, pp. 446-447.
[7] Robert Behn, *Rethinking Democratic Accountability* (Brookings, 2001), p.22.
[8] Donald F. Kettl, p. 447.

work to build relationships with companies based around solving barriers that emerge in implementing specific new technologies. Rather than simply generating information, the project would work to actively surmount barriers to production through a process of creative problem solving. The public sector would assist in nurturing the technology throughout the lifespan of its development, rather than hoping that the information produced by demonstration programs will be sufficient to produce technological change.

Developing such problem-centered demonstration projects would greatly challenge current notions of public management, however. In order to build and maintain active relationships with the private sector, officials would require more discretion both in choosing projects to fund and managing resources throughout the development process. Public managers would also need to develop new skills to be able to collaborate meaningfully with the private sector. Rather than simply administering funding decisions, problem-centered demonstration projects would require public managers have the expertise to provide useful advice in solving problems faced by the private sector.

These challenges raise several important questions. Would the public trust public managers with more discretion to dispense funding fairly? How could the government develop the ability to commit itself to projects that are inherently risky and might be viewed as a waste of taxpayer money? If more proactive demonstration projects would result in a more effective investment of public money, why doesn't the government operate this way now? Do we want public officials to be more active in the management of technological development? Could these public managers really develop skills or resources that would be useful to the private sector?

In general, these questions amount to two major concerns. The first *administrative* concern relates to the institutional environmental in which these funding programs operate, asking how public managers might be provided more discretion. Because the impediments to discretion provided by bureaucracy are intended as safeguards against corruption, and altering them pose significant tradeoffs that should be acknowledged. The second *managerial* concern relates to the skills public managers would need to act effectively within a more flexible and collaborative policymaking environment. Asking these officials to hold more responsibility in the management of public funds underscores the need to understand what competencies they would need to be effective in these tasks. Moreover, if we encourage public managers to more actively collaborate with companies, we need to understand what expertise they might offer to the private sector.

Learning From Venture Capital

One way to answer these questions is to examine how other organizations characterized by flexible specialization organize and deploy their resources, and maintain a system of accountability for their employees. Of these relevant practices, venture investing seems the most similar to the notion of more problem-centered demonstration programs. Rather than provide a source of passive funding, venture capitalists (VCs) form ongoing relationships with the companies that they fund, and use their expertise to help to solve problems that emerge throughout the development process.

The two core competencies that define the venture capital process are similar to those of flexible specialization as detailed by Piore and Sabel. First, venture capital provides a model of *flexible resource management.* Venture companies and investors engage in a project-centered development process wherein resources are tailored to particular projects in order to specifically engage the characteristics of that problem. Drawing on a flexible pool of resources, venture capitalists are deeply involved in nurturing new technologies rather than simply monitoring the firm's progress.

In order to successfully manage these resources, however, venture capitalists must, second, *generate and analyze information about their projects.* Again, in contrast to the passive role exhibited by many existing governmental programs designed to promote technological innovation, venture capitalists develop a common understanding with their entrepreneurs to continually monitor the development of the company. Venture capitalists often talk to the managers to start-ups on a daily basis, and call frequent board meetings to discuss strategic management issues. Such communication is required to manage the risk associated with these ventures by mitigating the uncertainty characterizes new ventures. Without such a relationship, the venture capitalist would be unable to embrace the risk inherent in the development process.

Entrepreneurial Government

Before exploring the practice of venture capital, however, we need to first understand the institutional context of demonstration projects, and how this context inhibits these projects from promoting innovation. As the next chapter demonstrates, the inflexibility that characterizes the agencies that oversee demonstration projects stems from the traditional notions of public administration that guide our government institutions. In order to create a system of accountability for these public managers and guard against the potential for corruption, traditional public administration limits their flexibility through a system of rules governing expectations for behavior. Granting greater discretion to public managers might result in what some authors have called a more entrepreneurial government, which would be central building problem-centered demonstration projects. However, again, this added flexibility poses administrative and managerial questions that need to be addressed before building a more flexible bureaucracy.

CHAPTER 2: THE CHALLENGES OF ENTREPRENUERIAL GOVERNMENT

The first step in seeking to answer the administrative and managerial questions that face the idea of problem-centered demonstration projects is to better understand the notion of entrepreneurial government. The concept is not a new one. In 1993, David Osborne and Ted Gaebler, two local civil servants from California, first popularized the term with their best-selling book *Reinventing Government*. The success of the book not only sparked the Clinton Administration's National Performance Review, which sought to build on many of its recommendations, but also prompted significant debate among academics and public officials about the idea of providing more discretion to public managers. Despite the visibility this book provided to these ideas, however, academics had been discussing thee challenge of building a more flexible bureaucracy since the 1970s. These proposals came in a variety of guises, with some calling for a "new public management," "managerialism"[9] or "deregulated government."[10] Although the approaches have important substantive differences, all share a similar focus on improving the performance of government agencies by giving public officials more discretion to think creatively about problems. David Osborne sums up the argument by noting, "If you want better management, untie the managers' hands and let them manage. Hold them accountable for results – not for following silly rules."[11]

In order to better understand the notion of entrepreneurial government and begin to answer both the administrative and managerial questions posed by this institutional framework, this chapter first outlines the discussion of this new paradigm in public management, and second, elaborates on the two sets of issues raised by this public management framework.

The Call for Entrepreneurial Government

The call for entrepreneurial government begins with the belief that the performance of government has been hampered by its allegiance to the principals of traditional public administration.[12] Developed in the late nineteenth century in response to the corruption that characterized American government, traditional public administration sought to create an apolitical civil service where strict procedural rules and hierarchy limited discretion (and hence the likelihood of personal favoritism) on decisions about personnel, procurement, finance, and service delivery. The organizational structure succeeded in achieving these goals. Adherence to these policies dramatically reduced the amount of government corruption during the twentieth century, but also constrained the flexibility of public managers to act innovatively.

Advocates of entrepreneurial government argue that the government now faces less of a problem with corruption than with performance. In fact, the groundswell of interest in entrepreneurial government reflects an increasing disappointment with the performance

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[9] Ibid.
[10] John DiLulio Jr., ed., *Deregulating the Public Service: Can Government be Improved?* (Brookings 1994), p. 1.
[11] David Osborne, "Bureaucracy Unbound," *Washington Post Magazine*, October 13, 1996.
[12] Robert Behn, *Rethinking Democratic Accountability*, p. 23.

of the federal government. In 1964, about three-quarters of the public said they trusted American government to do the right thing most of the time, while only about one-quarter expressed such trust in 1997.[13] Underscoring disappointment with the effectiveness of government institutions, the three most cited reasons for distrusting government were that it is inefficient, wastes money, and spends on the wrong things.[14] As Derek Bok concluded, "If one thing has become clear about the federal government, it is that Americans have little regard for its performance."[15]

Entrepreneurial government would provide more discretion to public managers by focusing on their performance rather than their observance of procedures and rules. Because these rules are intended to insure that public managers act in an appropriate and fair manner, moving away from them would require a dramatic shift in thinking about governmental accountability. As Robert Behn points out, there are three main types of organizational accountability: accountability for finance, accountability for fairness, and accountability for performance.[16] Accountability for finances relates to expectations about how taxpayer money should be used, which are usually defined through specific rules and monitored through reporting standards. Accountability for fairness insures the equitable treatment of citizens, government employees, and others affected by the actions of government institutions. Accountability for performance relates to the results of government action, which, much different than the other two types of accountability, cannot be established through rules and procedures. Institutions must instead use benchmarks that change over time in order to measure whether they have achieved the goals set out for them.

Traditional public administration focuses on accountability for finances and fairness. In order to guard against corruption, public managers must to adhere to carefully delineated obligations about what services they provide and how they provide them. However, proponents of entrepreneurial government contend that focusing heavily on these two types of accountability hinders the performance of agencies. Although all three of these forms of accountability are important and praiseworthy, there is an explicit trade-off between accountability for finances and fairness, and accountability for performance. Working primarily to comply with rules governing behavior stifles innovation and productivity, thereby reducing performance. Moreover, the government extends these rules into private activity through demonstration projects and other programs. Paul Volcker, former chairman of the Federal Reserve states that:

> Not even the most public-spirited government workers can succeed if they are hemmed in on all sides by rules, regulations, and procedures that make it virtually impossible to perform well. The most talented, dedicated, well-compensated, well-trained, and well-led civil servants cannot serve the public well if they are subject to perverse personnel practices that

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[13] Derek Bok, "Measuring the Performance of Government," in Joseph S. Nye Jr., Philip D. Zelikow, and David C. King, eds., *Why People Don't Trust Government* (Harvard University Press, 1997), p. 55.
[14] Ibid., p. 1
[15] Ibid., p. 55.
[16] Robert Behn, *Rethinking Democratic Accountability*, p. 6.

> punish innovation, promote mediocrity, and proscribe flexibility . . . [The] detailed regulation of public employees is not compatible with productivity, high morale, and innovation.[17]

Promoting a more entrepreneurial public sector therefore requires a change in emphasis on the types of accountability demanded of our public managers. But such a change faces important challenges related to the characteristics of each type of accountability. Because expectations can be made much more clear for fairness and finances than they can for performance, there exists what Robert Behn calls an "accountability bias."[18] Public managers face an easier time focusing on the former types of accountability because their targets are more objective and measurable. It is far easier to determine whether money has been allocated properly than whether a school reading program has improved literacy rates. Concentrating on finances and fairness is also much more straightforward for the interest groups, reporters, and members of Congress that constantly oversee these agencies. Rather than looking for real fraud or malfeasance, these groups can make political headlines by showing that an official has failed to fill out forms properly or follow an accounting procedure.

Such absorption with finances and fairness creates perverse incentives for public managers that further undermine potential performance innovations. First, as James Q. Wilson suggests, officials can expect to be punished if they do something wrong, but fail to receive any praise if they think of a more effective way of implementing policy.[19] Staying out of trouble means following the rules, and managers open themselves to criticism if they attempt to go beyond them. Second, in order to protect themselves from accusations of impropriety, public managers face incentives to create even more rules. Pointing to a rule to explain their behavior provides a political shield but further reduces their ability to act flexibly. Taken together, these two incentives encourage agencies to act extremely cautiously. This organizational environment also makes it difficult for the government to attract highly qualified people from the private sector, because working for government opens them to criticism even if they act judiciously.

Although the notion of a more entrepreneurial government seems appealing, the drive to provide more discretion to public officials is not without major unresolved problems. As stated previously, these problems can be grouped into two categories: administrative concerns and managerial concerns. The first set of questions asks whether more entrepreneurial public managers could mesh with our system of governmental institutions, while the second ask whether public managers would have the skills necessary to manage in a more flexible policymaking environment.

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[17] Paul A. Volcker and William F. Winter, "Introduction: Democracy and Public Service," in DiLulio, *Deregulating the Public Service*, pp. xv-xvi. Also quoted in Behn, *Rethinking Democratic Accountability*, p. 11.

[18] Robert Behn, *Rethinking Democratic Accountability*, p. 13.

[19] This is a guiding theme throughout Wilson's publications.

Administrative Concerns

Although trading off some accountability for finances and fairness in order to encourage public entrepreneurship seems attractive, it raises important questions about the overall accountability of our institutions. How can we increase the discretion of public officials and still hold them accountable? How can we insure that our institutions will remain equitable without rules governing their behavior? Indeed, the rules governing public officials are designed to maintain their political accountability to the electorate. As Guy Peters notes, "If civil servants and other appointed officials are indeed to become entrepreneurial then they must become less dominated by the dictates of these masters. If this approach were practiced, it would fundamentally alter ideas of accountability."[20]

Accountability within traditional public administration springs from laws established by Congress that guide bureaucracies. In a strict hierarchical pattern, the electorate informs Congress of its priorities or grants the legislature the discretion to make judgments about these questions, which are passed into law and implemented by the bureaucracy. Within this system, the rules established by Congress provide the most important means to achieving accountability to the electorate. Is it not surprising, then, that critics of entrepreneurial modes of policymaking contend that the loosening of these rules would amount to a political disconnection between public agencies and citizens.[21] Without laws guiding the actions of public managers, who will decide what results will be produced? Most advocates of public entrepreneurship assume that these officials will set these expectations themselves, but what would authorize them to make these decisions? Despite its promise of improving the performance of our bureaucracies, these criticisms underscore the fact that public entrepreneurship needs to develop some theory that explains its congruence with democratic accountability.

Robert Behn suggests that the resolution of this question may reside in developing accepted methods of measuring the performance of public agencies.[22] In a more performance oriented policymaking setting, the legislature could establish goals for managers to accomplish and monitor them periodically to see whether these goals had been fulfilled. Agencies that develop a strong track record of producing performance innovations while maintaining accepted standards of fairness and finance would be rewarded with greater discretion. However, as Behn points out, such a system would be difficult to achieve given the inherent difficulty of measuring policymaking outcomes. How can one measure whether a specific policy has resulted in cleaner air? Knowing what would serve as sufficient performance therefore represents a significant step in establishing moving away from an emphasis on accountability for finance and fairness. Behn explains this measurement problem by writing:

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[20] B. Guy Peters, *The Future of Governing: Four Emerging Models* (University of Kansas Press, 1996), p. 12. Also quoted in Behn, *Rethinking Democratic Accountability*, p. 35.

[21] Robert Behn, *Rethinking Democratic Accountability*, pp. 35-36.

[22] Robert Behn, "The Big Question of Public Management," *Public Administration Review*, July 1995

> If the desired outcomes could be measured, legislatures might be much more willing to trust the executive branch; after all, they would then have the ability to determine whether or not the executive was, in fact, actually achieving whatever objectives the legislature (or individuals legislators) had laid out. Legislatures impose so many rules, in part because they cannot measure results, and in part because they do not know what results they want to measure. If they cannot determine that the executive has produced the right outcome, they can at least determine if the executive has pursued the outcome in the right way[23]

The measurement problem is more dramatic when considered in relation to programs such as demonstration projects that are intended to encourage technological development. If we acknowledge that our institutions need to adapt to the uncertain nature of such development and work more flexibly with entrepreneurs to address unforeseen circumstances, how can we measure whether or not they are performing well? In any given year, unexpected results may hamper the development of a specific technology, but that "failure" may yield unexpected insights that prove vitally important in years to come. In any development process, therefore, a fine line exists between the failure to achieve pre-specified goals, and the ability to capitalize on this failure to achieve something even more valuable.

Managerial Concerns

In addition to these administrative concerns, building a more entrepreneurial executive branch also raises several managerial concerns. Given an environment with specific goals but broad discretion to achieve them, these officials would require a new set of core competencies to not only to deal with the new flexibility provided to them, but the potential risk of failure. With less guidance from rules about what actions they should pursue, these public officials would largely face three important questions.

First, they would need to determine how they would choose which projects to fund. Without being hampered by programmatic criteria, public managers would assume new responsibility for defining where their resources (including money, time, and expertise) should be spent. Given the ability to choose between an enormous number of projects dealing with similar technologies, how would officials choose a set of projects to support and justify its decision? Government agencies currently attempt to avoid responsibility in choosing winners and losers, worrying that making such choices will result in fairness objections from politicians and interest groups.

Second, public managers would have to develop the skills to help to steer projects characterized by high uncertainty. The development of new technologies is extremely volatile because unexpected information arises throughout the process. Because of this volatility, the best strategy to reaching the desired outcome (in this case, commercialization) is highly uncertain and often shifts throughout the process. In contrast with traditional public involvement in projects, which would likely be terminated if the process takes an unexpected turn, public entrepreneurs would need to learn to

[23] Ibid.

accept these uncertainties and adjust the process accordingly. Given a more open attitude toward uncertainty, moreover, public managers would be faced with an even more difficult time of determining when to end public involvement.

Third, despite their greater tolerance for uncertainty, public managers would nevertheless need to measure whether or not the project has been successful. If the goal of public entrepreneurship is to improve the performance of government agencies, officials will need to be able to illustrate such an improvement in order to justify their increased discretion. These measurement skills will also enable them to become more adept at justifying their decision to fund certain projects at the expense of others.

Entrepreneurial policymaking therefore requires the government (and a network of other actors in the private and nonprofit sector) to develop a series of new skills that are more facilitative than managerial in character. Rather than simply mandating change, officials must learn to form relationships with the private sector and promote learning and problem solving rather than preformed solutions.

CHAPTER 3: THE MECHANICS OF DEMONSTRATION PROGRAMS

The added managerial flexibility central to the notion of entrepreneurial government seems especially important for improving the effectiveness of programs designed to encourage technological innovation such as demonstration projects. Such discretion would allow public managers to engage in the tasks seen as important to promoting technological innovation, namely the ability to gather and feedback information into the organization. But simply arguing that greater discretion would amount to more effective demonstration projects ignores great complexities about the operation of these programs and our current system of public administration in general. Indeed, what exactly do we mean when we call for increased discretion? Don't public managers already exercise flexibility in how they implement policy? How would these programs operate differently if their mangers were granted greater discretion?

As this chapter shows, the variety of demonstration projects sponsored by the government differs greatly in their management, organization, and overall goals. Some projects focus simply on deploying and monitoring the projects for short, fixed period of time. Others, however, represent long-term efforts at building successive prototypes of technologies, with public managers interacting with specific companies for as much as a decade. Particularly in these longer-term projects, the public managers who oversee these projects gather information about their progress and assist in reorienting them periodically throughout development. Demonstration projects therefore in fact exhibit some flexibility to react to changing market circumstances and new information. The level of this flexibility, however, is not sufficient to fully engage the volatility and uncertainty of the development process. Due to the thicket of procedural rules and congressional mandates that shape choices about which projects to fund and how to manage these projects, public managers cannot reorient these programs quickly enough to solve the multitude of problems that emerge throughout development. Rather than represent robust attempts at commercializing the technology, therefore, the demonstration projects chiefly serve as passive, information gathering exercises.

Although producing information about the production, maintenance, and operation of these technologies may indirectly promote commercialization, it fails to directly address the transition that must occur between development of prototypes and actual deployment in the marketplace. Demonstration projects assume that companies will integrate this information into their organization and alter their modes of practice and production, but are not designed to assist in solving the multitude of problems that emerge throughout this transition. As the next chapter underscores, the practice of venture capital is oriented toward managing these transitions by constantly reframing nascent technologies in response to practical barriers to their commercialization. The goal of venture capital is not only to develop new technologies, but also to successfully deploy them in the marketplace.

In order to better understand how these administrative factors influence the management of demonstration projects, this chapter first discusses the organizational structure of these programs. The second section outlines the day-to-day management tasks of public

managers in three different government agencies with the intention of underscoring how this institutional context limits their ability to engage in the development process. The discussion provides a background against which to view and assess the practice of venture capital in the next chapter.

Government Research and Development Initiatives

Demonstration projects represent one portion of the broader research and development (R&D) efforts funded by the federal government. Largely administered by the three agencies seen to have the clearest link to technological development, the Department of Energy (DOE), the Department of Transportation (DOT), and the Department of Defense (DOD), R&D programs have been used throughout the past century to fund a host of technologies now integrated into everyday use. The Eisenhower administration, for example, had a direct role in developing semiconductors, while the Roosevelt and Truman administrations supported the birth of the computer industry.[24] The origins of government funded R&D can be traced even further to congressional support for the development of Samuel Morse's first telegraph in 1836.[25]

The basic rationale for R&D programs is to promote economic development by correcting market failures that create a problem of chronic under investment in R&D in the private sector. These market failures are generated by the inability of companies to appropriate many of the benefits generated by the development of new technologies. In most cases, important scientific breakthroughs cannot be patented, and even when they can be, others can easily imitate the innovation by "working around" the patent.[26] In other situations, the importance of disseminating the new knowledge is of such societal importance that allowing a particular company to monopolize the innovation is seen as objectionable. The "invention" of gene splicing illustrates such a situation. In either case, however, the inability of private companies to recoup their research costs for a new technology will result in under investment in such development.

With environmental technologies, these spillover benefits additionally include the externalities generated by a particular product. Because automobile manufacturers, for example, cannot benefit directly from reductions in air pollution generated by the introduction of lower emissions vehicles, market failures exist that reduce the incentive to introduce such vehicles. Beyond these economic rationales, R&D for environmental technologies may also be pursued in order accomplish important public goals articulated by the electorate. Indeed, Presidents Nixon, Ford, Carter injected billions of dollars into an expanse of energy technology research in order to respond to the energy crisis in the 1970s. Investment in space technology represents another situation in which the desire to pursue particular public goals outweighed other more economically oriented rationales for R&D spending.

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[24] Linda R. Cohen and Roger G. Noll, p. 2.
[25] Ibid.
[26] F.M. Scherer, *New Perspectives on Economic Growth and Technological Innovation* (Brookings 1999), p. 54.

Government R&D initiatives can generally be separated into two broad categories. The first is typically termed basic research or fundamental R&D, and represents research with no particular commercial objective. [27] Researchers are provided funding in order to add to a generalized base of knowledge about science and technology, which may or may not have specific applications in later stages. The second category of activities, usually referred to as commercial R&D, is intended to address a particular set of problems affecting a commercial technology. [28] Such research differs from basic research in that is relates to a specific to a commercial application, but has similar characteristics in that the company researching the topic cannot patent the information it generates.

Demonstration projects fall into the "development" portion of broader commercial R&D initiatives. The intention of commercial R&D initiatives is that 1) research will lead to 2) development of prototypes that can be 3) tested in operation through demonstration projects. The main objective of this process is to narrow down the potential technological alternatives into a few options that are seen as most suitable for commercialization. In the early research stages of the program, the number of these alternatives is almost infinite, but, as work progresses, scientists develop greater consensus about which alternatives will progress to later stages. The photovoltaic cell development program, which represented one of the largest commercial R&D programs during the late 1970s, for example, was intended to explore various alternate technologies and push for the commercialization of the best option that emerged. The development process is therefore characterized by a high degree of uncertainty, but the resultant demonstration programs are intended to push for the commercialization of the most feasible options carried over from previous research.

Although the research portion of commercial R&D initiatives are certainly open to congressional influence, the demonstration phase represents the most political portion of the process.[29] The larger overall expense of this phase of the process largely explains its heightened political importance. In general, the activities of the commercialization process – building prototypes and new production processes for them – are much more expensive than the laboratory research that goes into exploring which options should be built and tested.[30] Because of the increased expense of commercial demonstrations and the greater visibility these projects generate, demonstration projects are typically seen as distributive benefits in the eyes of Congress. [31] As shown later in this chapter, the result is greater congressional intervention in the planning and management of the demonstration phase, and conversely, decreased discretion on behalf of the public managers who oversee the projects. Such micromanagement means that funding decisions are often made based on electoral rather than scientific considerations.

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[27] Linda R. Cohen and Roger G. Noll, p. 379.
[28] Ibid.
[29] Ibid., p. 72.
[30] Ibid., p. 41.
[31] Ibid., p. 72.

This micromanagement problem is exacerbated by the risk-adverse nature of most politicians. Because demonstration projects provide local benefits to constituents that are more predicable and visible than their broader societal benefits, politicians are careful to avoid risky projects that could fail and be cancelled midstream. This risk adversity is largely explained by the fact that members of Congress are highly uncertain about which issues might become controversial during their campaign. Because of the high importance placed upon financial accountability both from the American public and media, even the failure of a demonstration project with a relatively small budget might be seen as a waste of taxpayer resources. New reports of such government wastefulness are extremely prevalent within the American media, and members of Congress are extremely paranoid about their potential involvement in any such publicity.

These limits on the flexibility of demonstration projects are reflected in the goals of these programs. As demonstrated in the next section, these programs are not designed to continually respond to problems that emerge throughout development and the process of commercialization. Instead, demonstration projects generate important information about the production and use of new technologies with the intention that the private sector will incorporate this information into their development process and commercialize the technology. As such, the programs maintain a distinction between the public and private sectors, and are not directly involved in managing the transition from demonstration to commercialization.

In actuality, however, the transition between developing prototypes and commercializing the technology is difficult to surmount by only generating information about the production and use of the product. In general, two main sets of barriers exist that any new technology must overcome in order to reach the marketplace, neither of which is easily surmountable without sustained effort and organizational flexibility. The first of these barriers is the internal technological inertia that develops around traditional methods of practice and production within the company. Such inertia typically emerges because managers within the company develop shared beliefs about engineering parameters and market demand for new products.[32] Organizations that develop around particular technologies understandingly have trouble adjusting to new information and require more robust efforts at problem solving to produce immediate innovation. Automobile manufacturers with decades of experience with combustion engines are unlikely to begin immediate production of fuel cell vehicles, for example.

The second set of these barriers to commercializing new technologies relates to external market conditions. Many new technologies challenge modes of practice to the services necessary to operate these products. Maintenance provides an example in this instance. A demonstration project may show that the new technology will require news forms of maintenance and outline what these activities will entail. It would not, however, contribute to actually training new mechanics and implementing these new maintenance systems. Demonstration projects generate information, but they are not designed to build

[32] Rene Kemp, Johan Schot, and Remco Hoogma, "Regime Shifts to Sustainability Through Processes of Niche Formation: The Approach of Strategic Niche Management," *Technology Analysis and Strategic Management*, Vol. 10, No. 2, p. 177.

the institutional capacity to use this information and bring the technologies into actual use.

Managing Demonstration Projects

In order to better understand the day-to-day process of managing demonstration projects, two federal demonstration programs were investigated through interviews and reviews of project materials. The first, the Federal Transit Administration Research & Technology Program, is intended to advance the commercialization of fuel cells, alternative fuels, and electric vehicle technology. Initiated in early 2000, the program currently provides $20 million in funding to twelve demonstration projects throughout the country. The second initiative, the Department of Energy Hydrogen Program, is a broader research and development program with a demonstration component called the Technology Validation Plan. The plan currently spends about $12 million on fourteen hydrogen infrastructure and renewable hydrogen systems projects.

The overall structure and goals of the two programs are extremely different, highlighting the diversity of government demonstration projects. In general, the FTA demonstration programs are designed more as short-term information gathering exercises while the DOE initiatives are longer-term and provide for more interaction with the private sector. Focusing solely on one to two year projects, the FTA program deploys new technologies and monitors their operations throughout that period. One representative FTA project (the Advanced Electric Transit Bus Demonstration) provides two prototype electric buses for use by the Massachusetts Bay Transportation Authority (MBTA). Underscoring the passive nature of the program, it aims to "provide a better understanding of the battery management process and battery performance, including battery life, reliability, and energy efficiency"[33] rather than produce a marketable product.

The DOE program represents a more robust effort to commercialize new technologies. These projects not only call for the development of new technologies, but may fund several rounds of development in order add new levels of refinement to previous prototypes. One project, for example, calls for the staged development of integrated hydrogen power systems, and establishes specific cost goals that must be met before additional rounds of funding will be dispersed. This staged development scheme allows the most successful projects to extend as much as a decade, and requires that public managers become more active in evaluating the performance of the projects. The DOE project also differs from the FTA initiative in its focus on partnering with companies. All of the DOE projects require a consortium of private sector companies to work together in building the prototypes, and mandate that these companies provide fifty percent of the funding to the demonstration. The projects therefore assist in creating a network of expertise around a particular product, which may result in new insights via the interaction of these various parties.

The following discussion outlines how current managers of these demonstration programs currently tackle two major tasks in the transition process: *choosing projects and managing the development process.* The discussion underscores that, although the

[33] <www.fta.dot.gov/research/info/pubprojreps/fy2000/eib.htm>

programs provide a means for public officials to collaborate with the private sector over the development of new technologies, these programs are not designed to promote continual engagement in the development process. Such engagement would be necessary to assist more directly in transitioning the technologies from demonstration to commercialization.

1. Choosing Projects

Although the selection of projects represents the first task of public managers of demonstration programs, the political process that precedes these decisions influences their direction. Indeed, before funding can be allocated to specific projects, the Congress must first approve the entire demonstration program, requiring authorization from subcommittees, committees, the floors of both houses, and a conference committee. This process not only shapes the overall direction of the demonstration programs, but also results in interference in the choice of specific projects. As mentioned previously, the fact that the projects are geographically situated makes them important pieces of political pork for members of Congress. The process leads to the substantial earmarking of specific demonstration programs, decreasing the discretion of public managers to select projects. In fact, nine of the twelve FTA demonstration projects are congressionally mandated, in comparison to five of the fourteen DOE projects. Although the managers of these programs are careful not to criticize Congress, they view the intrusion in these funding decisions as directing funding away from the more promising projects. Asked about whether these projects are seen as less than ideal, one manager of the DOE program explained, "You know I can't say that, but I think you can draw your own conclusions." This process of earmarking therefore creates more predictable funding outcomes for members of congress, but undermines the ability of public managers to support more favorable projects.

The process of allocating funds left after the earmarking process is more discretionary but also still bears considerable congressional oversight. Rather than allow the bureaucrats to invest in any technology that may address a specific public goal – such as reduced vehicle emissions – the programs are based around several research areas specified by Congress. In the case of the DOE Hydrogen Program, for example, the program managers may only allocate money to renewable hydrogen systems, hydrogen infrastructure, or small-scale residential fuel cells. The choice of these program areas occurs via negotiation between the agency and Congress at the beginning of the project, wherein the public managers develop a "win-set" of proposals that they believe will be most politically feasible. Although the public managers may view these program areas as technologically significant, the win-set may not include all of such areas.[34] The process therefore immediately limits the ability of officials to change the overall goals of the demonstration program and react to new information as it becomes available. Officials may have considerable choice among projects that fit within the technological criteria, but funding technologies outside these program areas would require congressional approval.

[34] Linda R. Cohen and Roger G. Noll, pp. 66-67.

Choosing projects within each of these program areas begins with the agency staff analyzing which technologies seem most feasible for commercialization. The staff will develop a "business case," as one manger at the DOE Hydrogen Program described, "to indicate what happens if you build 1,000 or 2,000 or 10,000 units." Such plans largely focus on what would happen to the costs of particular technologies if produced at a demonstration level, and whether these costs would enable them to capture a niche marketplace for the product. Once the team determines which technologies they view as most feasible, the program issues a solicitation to private companies that describe the cost goals and other project criteria. After being briefly reviewed by the agency for general congruence with the criteria, these solicitations are sent to a merit review committee comprised of academics, government officials, and private sector managers with experience in the particular field. This committee gives each proposal a numerical score based on their technical merit and sends the proposals back to the agency for funding.

The public managers at the DOE cannot, however, only choose the projects with the highest technical merit as established by this review committee. Instead, the agency must review the responses with certain programmatic criteria that were established by Congress at the outset of the program. Highlighting the importance of these projects as distributional resources, these programmatic criteria are largely intended to insure geographic and technological diversity among the projects. The criteria first state that the projects must first be allocated to a variety of states, insuring that their economic benefits are spread among constituencies. Second, despite their relative technical merits, the projects must pursue different strategies to solving the particular technological problem. The best scoring projects that fit these additional criteria are granted funding by the program. Therefore, although this process draws heavily on both internal and external sources of expertise in choosing projects, public managers cannot act on this information in an unbiased manner.

The ability of the public managers to engage the most technologically promising projects is also somewhat limited by their distance from the private sector. Rather than respond to entrepreneurial initiatives from the private sector, the programs first specify what technology appears most promising and issues a solicitation. Such a process ignores other potentially more effective solutions to particular environmental problems, and establishes at the outset which technologies the government will and will not consider for funding. Many programs including the DOE initiative have an "unsolicited proposal" approach, which allows private companies to put forward ideas that these public managers may have not considered, but such proposals are fairly uncommon. Moreover, according to a DOE manager, "the bar is put at a higher level" when reviewing such proposals. The overall process of choosing projects therefore promotes somewhat predictable outcomes at the expense of acknowledging the diversity of innovative ideas in the private sector.

2. Managing the Development Process

The second major task of the public managers who oversee demonstration projects is to manage their development and assess progress. This management role differs dramatically from demonstration program to demonstration program depending on their

overall goals. In the case of the FTA program, the short-term information-gathering role of the program means that the public manager has little role in managing the development of the technology. Fuel cell buses will be purchased and deployed for two years, while during such time information will be gathered about their operation. Unless the project faces a catastrophic problem – such as the non-functioning of the technology – the project will typically expire in two years and be deemed a "success." The central role of the project manager is to solve administrative problems that could suspend the project; because the technology deployment is not seen as an ongoing process, little in the way of technical assistance is needed.

Longer-term demonstration projects such as those administered under the DOE Hydrogen Program have much different goals, however. Because of their extended timeframe, public managers have a much more pronounced role in their development. Rather than simply insuring that the administrative aspects of the projects are met, the managers are involved in technical design and management decisions, as well as in evaluating whether the project deserves additional rounds of funding. This management structure is effective in insuring that demonstration projects accomplish their goals of building and testing new technologies. Furthermore, the staging of funding provides for flexibility in adjusting the overall endeavor to new market information about the products under development.

Even these long-term demonstration projects, however, are not designed to promote the level of collaboration necessary to addressing the barriers to commercialization. Public managers may have a strong role in guiding the overall development goals for the program, but are removed from the day-to-day process of developing the technologies. In fact, after funding has been dispersed, these officials typically speak to the local project managers at most less than once a month. A manger at the DOE hydrogen project explained, "it really depends – it could be seven or eight times [per year], or one or two times." The intermittency of these discussions underscores the government's lack of continuing engagement in the development process, which some argue allows the local project managers to conceal negative information that may arise.[35] Rather than disclose such information and risk project cancellation, local project leaders may attempt to hide "bad news" by taking advantage of the information asymmetries between themselves and their government sponsors. These asymmetries are compounded by the fact that the public managers often know less about the technologies than their private sector counterparts who work with them on a day -to-day basis. In order for the government to attempt to solve problems that may emerge throughout the development process, accurate inter-organizational transfer of information must take place.

The organizational structure for reviewing the progress of demonstration projects also underscores that the programs are not designed to continually address barriers to commercialization. Major assessments of the progress of the projects typically only occur once per year, at an annual meeting attended by the DOE officials, the private sector companies involved in the projects, and academics. Before the meeting, a panel comprised of these experts will assess the progress of each of the project and issue recommendations about the future strategy of the project. These assessments are

[35] Ibid., pp. 72-73.

typically based on comparisons of the actual performance of the project with performance benchmarks set in the original project proposal. Due to the high degree of uncertainty that surrounds the development of new technologies, however, the panel may allow for some divergence from the original plan due to unexpected circumstances that challenge its original market or technological assumptions. Based on this review, the committee will recommend either that the project proceed as planned, be terminated, or revised, in which case they will recommend how the project should proceed.

Although this review process allows for some flexibility in demonstration projects to react to new information, the intermittency of such reviews ultimately limits their effectiveness reacting to the volatility of the development process. In order to respond to the unexpected problems that emerge constantly to challenge development, the organizational structure designed to manage it must be able to respond to new information on a more ongoing basis. The inability of public manager to do so often contributes to demonstration projects taking one of two negative trajectories. First, without the ability to respond to unexpected barriers in a timely manner, problems can mount for the projects and result in their cancellation. Although it may be difficult to tell whether the project was inherently bad or represented a good project that went bad due to inadequate attention, the lack of ability to deal with unexpected problems precludes public managers from attempting to identify and save the latter group.

The second negative trajectory taken by many demonstration projects occurs when a technology develops a strong constituency with either members of Congress or a particular scientific group. In this case, public managers have an even more difficult time reacting to new information due to the importance of the technology to one of these constituencies. This problem emerges most often when Congress views certain projects as important to their constituency, and feels secure that the technology does not pose any significant political risks. The scientific community, on the other hand, may either stand to benefit financially from the continued development of certain types of technologies, or may have an important intellectual interest the product. In either case, the ability of the project manager to react to unexpected events is impeded.

Looking to Venture Capital

The current management of demonstration project reflects an interesting conundrum often witnessed in bureaucracies. As James Q. Wilson describes, governments hire professionals for their "esoteric knowledge" because "they know how to do things that must be done." But rather than provide them with the discretion to use such knowledge, concerns about accountability result in congressional micromanagement of these agencies. These managers are constrained because "no one wholly can be trusted to make important choices free of legal and administrative constraints." We therefore resolve this conundrum between expertise and accountability by "hiring professionals for their expert knowledge but denying them the right to use that knowledge as they see fit."[36]

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[36] James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It* (Basic Books, 1989), p. 149. Also quoted in Behn, *Rethinking Democratic Accountability*, pp. 101-102.

Although many argue that the rigidity of public administration negatively affects the performance of the executive branch in general, such inflexibility seems especially damaging to the effectiveness of demonstration projects. As shown in the next chapter, the process of nurturing new technologies relies heavily on the ability to respond to unexpected information that arises throughout the development process. Because these technologies are characterized by a significant amount of uncertainty, the venture capital process has succeeded because of its ability to flexibly overcome unforeseen barriers to development. Better understanding both the skills necessary to managing such uncertainty and the accountability mechanisms used these ventures might in help constructing more problem-oriented demonstration projects.

CHAPTER 4: THE PRACTICE OF PRIVATE SECTOR VENTURE CAPITAL

Over the last two decades, venture capital has represented an important mechanism for funding the development of new ventures. The industry has witnessed rapid growth since its inception in the mid-1970s, attracting an annual inflow of $17.2 billion in 1998, and has produced many of the most successful companies of the past two decades.[37] Companies such as Apple Computer, Intel, Lotus, and Microsoft all received backing from venture capital firms.[38]

The broad structural characteristics of the process of venture capital are similar to those of demonstration projects, in that venture capitalists provide funding to new technologies and assist in developing them. Venture capital, however, is differentiated from the management of demonstration projects by the flexibility and active nature of its investment process. In contrast to the oversight role generally played by public managers, most venture capitalists remain deeply involved in the development of the venture even after funding has been dispersed to the company. Because venture capitalists are typically experienced entrepreneurs from the same technology sector, this engagement allows them to provide a host of non-monetary resources to assist in developing the company. As problems emerge throughout the development process, the venture capitalist may act as a mentor to the company and advise its managers about shifts in strategy. In addition, they may draw on their network of contacts to provide specialized expertise in addressing emergent problems. This involvement somewhat reduces the risk posed by investing in new companies by providing the venture capitalist with some degree of control over the direction of their investment. As unforeseen circumstances emerge and the underlying assumptions of the company changes, the venture capitalist is able to provide expertise in reframing the direction of the company to address the situation.

The goals of the venture capital process are reflected in this flexible, problem-oriented organizational structure. In contrast to demonstration projects, which generate prototypes of technologies with the intention that the private sector will commercialize the product, venture capital is designed to manage the transition between development and the marketplace. The venture investment cycle typically begins before companies have built prototypes for their proposed products, and ideally terminates when these technologies are successful enough to warrant issuing publicly traded stock for the company. Venture capitalists manage the wealth unexpected problems that emerge between development and commercialization by remaining actively engaged in the development process and drawing on their network of resources for assistance.

This chapter explores the practice of venture capital to shed light on the managerial skills that might be necessary for public managers of problem-centered demonstration projects. In addition, it examines the mechanisms for accountability that venture capitalists use both within new companies and within venture capital firms. In order to understand these practices, interviews were conducted with seven current venture capitalists and angel

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[37] Paul A. Gompers and Josh Lerner, *The Venture Capital Cycle* (The MIT Press, 2000), p. 1.
[38] Ibid.

investors.[39] In addition, three meetings among angel investors were observed where they discussed the relative merits of several companies in consideration for funding. In order to encourage their candid reflection on their practices, these interviews were conducted on the condition of anonymity. The chapter first provides a brief overview of the mechanics of venture capital. Second, it explores the three major tasks of the practice of venture capital: choosing investments, guiding the development process, and assessing progress.

Overview of the Venture Capital Process

The basic impetus of venture capital is to provide funding and other resources to support entrepreneurs who cannot qualify for more traditional sources of debt financing.[40] Because these companies are characterized by a lack of tangible assets and face uncertain prospects, lenders are unable to determine whether particular entrepreneurs will eventually produce a marketable product. As discussed above, venture capital funds attempt to address these information asymmetries by remaining engaged in the companies throughout their development. This involvement typically takes place through a seat on the company's board of management, where the venture capitalist can provide both formal and informal influence on the direction of the venture.

In addition to this high uncertainty, venture capitalists involve themselves in nurturing the ventures due to the illiquid nature of the investments. Although investors in more established companies exert substantial control over their investments via stock trading, venture capitalists have no ability to pull out their investment after it has been made. Such funding rounds typically last about three years, during which the company will most likely face a number of challenging situations. Rather than exit the company as unforeseen problems emerge, however, the illiquid nature of the investment provides an incentive for the venture capitalist to engage and solve these problems.

The venture capitalist may make the decision whether or not to reinvest in the company at the completion of each funding period, however. New companies typically require several stages of funding until they reach the IPO stage, and the episodic nature of this funding allows the venture capitalist to periodically act on opinions he or she has generated about the company. Because they represent specific important milestones in the maturation of a product, these funding stages highlight the developmental nature of the venture capital process. For example, the first or "series A" round of funding typically focuses on building a viable prototype of the product, while the second or "series B" round usually centers on establishing a core set of customers for the beta version of the product. At each of these transition points, risk is removed from the venture, which increases the overall valuation of the company. Because each of these milestones represents specific events, such as the production of a functioning prototype,

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[39] Venture capitalists are traditionally defined as those investors that work for venture capital funds. In contrast, angel investors are wealthy independent investors who provide funding from their on resources. Although differences exist in the practices of these institutional and independent investors, the term "venture capitalist" will be used to describe both types of investors throughout this study. Collapsing the distinction between the two groups seems reasonable in discussing the fundamental practices of early-stage investing.

[40] Paul A. Gompers and Josh Lerner. p. 5.

these increases in valuation are slightly lumpy. Even if the company is close to building a strong product, the company's overall risk level has remained unchanged until it finishes the prototype.

Although specific ventures may have different amounts of risk based on their position in this development process, venture capital in general represents an extremely risky endeavor. In fact, only between one-fifth to one-third of new ventures succeed. This high amount of risk mandates that venture capitalists are comfortable making high-stakes business decisions based on little tangible information. Such uncertainty also increases the difficulty of knowing whether the venture capitalist represents a "good" investor, especially over the short term. With most of their investments going bankrupt and producing zero return, the venture capitalist must wait several years to generate successful companies and balance these losses.

Exploring the Practice of Venture Capital

In addition to these organizational traits of the process of venture capital, the high uncertainty that characterizes new ventures also greatly informs the day-to-day practice of venture investing. As with the management of demonstration projects, this practice is generally characterized by three major tasks -- *choosing investments, managing the development process, and creating accountability for performance.* Although venture capitalists must become comfortable with uncertainty, qualifying and minimizing risk represents a central goal in all three of these tasks. This section explores each of these three main tasks of the practice of venture capital, from which two major themes emerge.

First, because the decisions made by venture capitalists are largely based on intangible calculations, those interviewed suggested that the practice of venture capital is largely based on *intuition or "gut feelings"* about risk. Faced with high uncertainty about the consequences of their decisions, venture capitalists suggest that they must rely on this intuition in order to proceed in developing the company. The venture capitalists interviewed proposed that such intuition is largely developed through first-hand experience with ventures in a particular technological sector. Because most venture capitalists have previous experience as entrepreneurs and managers, their familiarity with new companies guides their intuition about risk.

Second, although venture capitalists certainly make decisions based on this personal intuition, embedding their decisions in a network of contacts represents the primary way in which venture capitalists attempt to minimize risk. Throughout the development process, venture capitalists rely on the advice of this network of both social and professional contacts in order to provide a context for evaluating their decisions. Rather than only follow their individual intuition, they seek the advice and reaction of their peers in order to bolster or erode these personal assessments. Reliance on this network of peers undermines the traditional notion of venture capitalists as lone investors and underscores the importance of the interconnectedness of the venture capital industry.

1. Choosing Investments

As with the management of demonstration projects, selecting investments is the first task in the practice of venture capital. Because venture investments are illiquid for several years, decisions about what people and technologies to invest in represent a substantial commitment on behalf of the venture capitalist. Despite the seriousness of the exercise, however, the high degree of uncertainty about the prospects of companies requires that investment decisions be made largely on the basis on intangible calculations. Moreover, unlike the management of demonstration projects, where public managers simplify the decision-making process by selecting the best projects from a set of submitted proposals, venture capitalists must continually evaluate potential investments on their own merits. The situation not only requires venture capitalists to be comfortable with uncertainty – one noted, "[if] you wait for everything to be positive you wouldn't do any deal" -- but to minimize such uncertainty by quantifying and qualifying risk as much as possible. This process of conceptualizing risk largely occurs in a networked environment, in which venture investors use feedback from their peers in order to develop consensus about investments. As discussed below, venture investors first develop their own intuition about individual entrepreneurs and their products, and then seek to validate their opinions through the advice of trusted contacts.

Financial Due Diligence

Investing begins with collecting financial due diligence, which represents the most objective and least intuitive part of the decision-making process. Usually conducted by associates at venture capital firms, due diligence provides a base of information about the company and the market in which it intends to position itself. The process of collecting such information also represents the initial "training" for these younger initiates into the practice. Described by one investor as a "laundry list" of information, the venture capitalist collects such information as current sales data, names of current customers and competitors, and revenue projections. Some of the information is quantitative, such as revenue projections, but many other aspects of due diligence relate to understanding how the company intends to position and market itself. In addition to the company's current cash burn rate, the investor may want to catalogue the entrepreneur's "elevator sales pitch," for example. Investors use this base of information to reflect on the company as they move through the decision-making process and are increasingly exposed to more intangible considerations.

Besides providing a preliminary picture of the company, however, financial due diligence is primarily used to test the key market assumptions that will guide the development of the product. Much of this research relates to demonstrating that the product has a large market with a recognizable need. Although retrospective data may provide some indication of a product's future success, the task of producing credible future projections about the company's growth is a much more difficult proposition. Venture capitalists understand that quantitative information provided in such plans is probably as intangible as other aspects of the deal (such as the management capability of the CEO). As one angel investor quipped, "the [plans] looking out two to five years are a joke." Financial due diligence provides some retrospective data on which to base such projections, and creates a kind of objective test that the product must satisfy, but the high uncertainty

associated with the future prospects of the company quickly outweigh its usefulness as investors move onto the next phases of the process. In attempting to value the financial projections made by a particular entrepreneur, the intuitive aspects of venture capital become much more important than any quantitative information they may provide.

Intuition or "Gut Feelings" about the Entrepreneur

Beyond the information collected via due diligence, much of the decision to invest in a particular company is based on highly intangible factors uncovered via interaction with the entrepreneur. This intuitive process is largely based on the investor's reaction to the personal characteristics of the entrepreneur. In seeking some means to better judge the future prospects of the company, the investors use these personal assessments to achieve two goals. First and most importantly, they seek to predict whether or not the entrepreneur can deliver on their business plan and dramatically grow the company. In some sense, the venture capitalist's *belief* in the entrepreneur's ability substitutes for the lack of objective data about the future prospects of the company. Second, because venture capital represents an interactive process between the investor and the entrepreneur, the investment intuition relates to the potential of building a successful personal relationship. As one investor asserted, "What are the intuitive pieces? Well, the intuition relates a lot to who the people are." Throughout the interviews, four characteristics emerged as important to judging "who the people are."

Trustworthiness represents the first and most important characteristic that venture capitalists look for in entrepreneurs. One investor stated, "There's no question that character is key to me. Anybody who isn't completely and totally straight, I just simply . . . there's no way you can do business with those people and I don't do business with them." The reasoning is simple: the process of venture capital cannot operate effectively without knowing what is actually happening within the company. As mentioned previously, the way that venture investors add value to their investments is by contributing non-financial resources such as expertise and contacts within an industry network. This nurturing process occurs via the constant gathering of information from the entrepreneur, which breaks down the huge information asymmetries that exist around new ventures. Without reliable information, therefore, the venture capitalists cannot provide the guidance they see as necessary to grow the company.

The second personal factor that contributes to venture investors' evaluation of the entrepreneur is pragmatism. In attempting to understand whether or not the entrepreneur has developed a truly viable product and are capable of managing its growth, the investors assess whether they has a grounded perspective of their product. Although the ideal entrepreneur must have the vision to produce a pioneering product, the investor must also develop a sense that the inventor understands the realities of the business world. One venture investor commented:

> There's . . . a combination of the person knowing both the big picture and the close up picture. So I have a goal, I have a vision, I know what I want it to look like, I know where I want to get, but I realize also that this is the next step that I have to take. One of the people that I don't invest in are those that have this

> grandiose version that haven't a clue about how to get there. They can describe it in glowing terms, they can describe the perfect world, they can describe exactly how it's going to look in the perfect world, but can't tell you what the first step is.

In addition to assessing whether the entrepreneur has a grounded understanding of the market, venture capitalists also use this intuition about pragmatism to judge the inventors dedication to the new technology. "Dreamers," as one investor calls them, "[spend] 90 or 180 days tweaking a piece of software in their basement all by themselves and [think] it's going to change the world." The entrepreneur's failure to understand the market is therefore taken as a lack of seriousness about the product they have been developing. Those that really care about what they are developing will therefore develop a more grounded perspective of their situation.

Personality is the third factor that contributes to venture capitalists' personal intuition about an entrepreneur. Although one investor who was interviewed objected to the notion that personality plays a role in his decision making process, he suggested that he might be "full of shit about my own behavior." Indeed, especially at the company screening meetings, comments about the personal characteristics of the entrepreneurs presenting dominated the conversation. Although making business judgments based on the entrepreneur's personality may seem somewhat shortsighted, one venture capitalist explained the importance of personal chemistry:

> [We ask the question] do they see things in a like-minded manner? – because if you have an extreme variation of expectations on the board or within the investor group about the direction a company should take, the kinds of exit opportunities it should be prepared to avail itself of, etc., that can lead to a dissatisfying dynamic that you don't want to put yourself into that position at the outset. And sometimes you know it's a chemistry issue between you and the team, because if we can't deploy more than our capital, we shouldn't be involved. So it has to be a team . . . where you are going to really see yourself on the same side of the table after the term sheet discussions have ended and the documents are signed.

In this sense, the personality of the entrepreneur may affect whether the investor believes they can develop an ongoing relationship with the person. Due to the close personal relationships that often develop via continual contact with the entrepreneur, the investor seeks someone who they believe they could develop a personal connection. Another venture investor explained the situation this way:

> Personally I feel more comfortable with entrepreneurs who have come from entrepreneurial families or have entrepreneurial backgrounds. And maybe that's simply because they're more capable of discussing things – I don't know. One of the things I guess that comes out of these interviews with the prospective entrepreneurs is how comfortable we are . . . I tend to look for people who can discuss the whole business building process without fear and there's some knowledge – intuitive knowledge – about how it happens.

Although these comments indicate that there may be specific personality traits that are more attractive to venture capitalists, these specific characteristics are unclear. Despite some venture capitalists insistence to the contrary, however, it appears that personality does represent one portion of the intuitive judgment made about entrepreneurs.

Reference Checks

Due to the intangibility of the personal intuition in making judgments about entrepreneurs, venture investors seek to qualify these impressions by relying heavily on reference checks. Indeed, reference checking represents one of the major mechanisms of the investment decision-making process. Venture capitalists' emphasis on outside references underscores the importance of embedding their decisions in a network of contacts within the entrepreneurship community. Not only do the investors call the references that entrepreneurs provide with their business plans, but they independently search for others who have dealt with the entrepreneurs sometime throughout their careers. As their intuition builds about the capabilities of a particular entrepreneur, the venture capitalists use references to hone and verify their own perceptions. One investor commented:

> There is an intuitive element that sort of occurs in aggregation. . . I tend to be very, very big on references – references drives a lot of what I do on the people, on the customers, on the industry experts, on the competitors, on the suppliers, the whole bit. And I do a lot of that work, and I aggregate that."

Just as the references may confirm the observations made by the venture capitalist, they can also break the momentum of the process. Although different investors expressed varying levels of emphasis they place on the references, one mentioned that most venture capitalists require "glowing references" in order to proceed with a company. Rather than allowing for a mixture of mainly good and some mediocre references, the investor asserted "If one person tells you something bad, the whole process can fall apart." Venture capitalists, he explained, "want to back rock stars – you need more than hard working people." In order to test whether the entrepreneur represented such a "rock star," this investor suggested that ten out of ten references should be of the highest quality in order to pursue the project.

Such attention to references underscores the notion that, due to the high degree uncertainty posed by these nascent companies, venture capitalists look to any means possible to qualify potential risks when choosing companies to fund.[41] The reference checking process therefore serves to qualify the intuition they develop about a particular entrepreneur by embedding these decisions within their network of contacts. Venture capitalists may develop their own intuition about a particular entrepreneur, but these

[41] Due to the illiquid nature of venture investments, venture capitalists seek to minimize as much risk as possible before providing funding to company. Understanding that the development process will necessarily entail a high level of uncertainty, they seek as low initial risk as possible. After funding has been dispersed to the company, however, the objective of venture capitalist shifts away from minimizing risk to engaging problems and nurturing the company.

judgments are reevaluated and reframed based on their interactions with others within the entrepreneurship community.

Expertise

Another important factor that often contributes to the investment decisions of venture capitalists is their expertise in a particular field of technology. Again, because they hope to contribute more than monetary resources to the development of new companies, most venture capitalists will only invest in technologies in which they have expertise. Such expertise not only provides them with a better understanding of the unique characteristics of the technology and its market, but also allows them to draw on their network of contacts to nurture the company. Being part of this "community of practice" also allows the venture capitalists to qualify their personal intuition about decisions facing the company. Because of the importance of this outside network of contacts, for many venture capital firms, in particular, such specialization is the first criteria used in choosing investments. One venture capitalist at such a firm explained:

> The reason we've chosen those sectors is because each of the partners at [our company] have had substantial prior industry experience either working directly for companies in those industries or working with companies in those industries. There is a great deal of technical expertise, industry contacts, and general corporate experience in those environments. So our first rule is we invest in what we know. If we encounter a project that isn't close enough to our comfort zone, we usually decline right at the outset. One of the important premises that we operate under is that if we're contributing only our money it's a bad investment. Right – it has to be something where we have the opportunity of enhancing the potential return because we're bringing more than our capital, we're bringing our expertise, our experience, our contacts, our recruiting capabilities, our partnering capabilities, etc."

Venture capitalists' understanding of "expertise" therefore not only represents their personal experience with the technical and market characteristics of a particular technology. In addition, this notion of expertise reflects the accumulated experience that their network of resources provides to the new venture. As underscored in the quote above, this network of contacts provides a flexible pool of resources that provide the value that venture capitalists bring the company. As unexpected complications emerge throughout the development process, the venture capitalist draws on these resources to solve problems that they might not otherwise have experience in addressing. Furthermore, they may seek to qualify their opinions about a specific problem by consulting with a trusted colleague who has experienced similar situations. As such, the exchange of information within this network provides a source of insight and innovation. This community of interaction provides an interesting counterpoint to the management of demonstration projects, which largely relies on the relationship between a fixed group of managers and companies.

Although venture investors rely on this network for assistance, they must also develop their own personal judgments about the company's direction. Expertise in a certain field allows them to develop these judgments by yielding a specific intuition about the particular market for that product. During the next phase of the investment, when the venture capitalist begins to offer suggestions to the company, such intuition is vital in making good recommendations. He explained, "Instinct is where you know that's a good idea, you know it's a bad idea – you have the tools to judge it." Because of the importance of their continual monitoring of the entrepreneur, therefore, expertise plays a vital function in choosing which companies to fund.

Momentum

Each of the factors above contributes to the personal intuition behind the funding process for venture capitalists. Due to the uncertainty of the investment process, however, such intuition about particular entrepreneurs emerges slowly and may be extremely fragile to disruption. Although not all the information gathered about a particular company need be positive, any negative news that emerges risks destroying the fragile positive intuition that may have developed. One investor explained this "momentum" as he called it, that particular investments gain:

> There's sort of a maturing process in the way you think about it, you sort of start becoming more comfortable with the idea of putting money into this deal. You go in and see a deal and say fine, you kind of like it, you're intrigued by it. You talk to the guy, you get a little more positive. The positive feeling starts to build, and at some point you reach some sort of threshold, which I don't understand how that happens. But then I go to somebody and I've got a very interesting deal, and I say hey, I'm going to do this deal.

Because each venture capitalist bases their judgments on different personal preferences and intuitive "recipes," they may gather momentum on entirely different projects. Even two venture capitalists in the same field might reach exactly opposing opinions about particular company because of their personal intuition. In some cases, venture capitalists follow these personal judgments regardless of how their colleagues feel about the company and invest in the venture. In most cases, however, the networked nature of this process provides an important context for individual investment decisions. Understanding that these personal judgments are susceptible to biases and oversight of important considerations outside their perspective, venture capitalists spend a considerable amount of time talking with other investors about potential new investments. In each case, the intuition that emerges is subject to reinterpretation given the opinions of their peers about the entrepreneur. One investor explained:

> Another way to describe it is that everyone's got a little bit of a sheep in them. Me included, I mean, if I find another twenty people who didn't want to do the deal, I would have to be a pretty strong-willed individual and pretty self-confident to go and do the deal anyway.

Although some investors may make investments based solely on their personal perspective, most attempt to capitalize on the advice of their peers in order to check their intuition before investing. Venture capital firms in particular operationalize such a system of "checks and balances," as one venture capitalist called it, by requiring the others partners in the firm to approve of new investments. Individual investors, on the other hand, operate within more informal networks, wherein their personal acquaintances provide tips about promising new investments. These lone investors also form informal investment groups, which serve as forums in which to introduce potential new investments to trusted colleagues and share their personal judgments of these ventures. In either case, however, the networked nature of the investment environment represents another means of qualifying the high degree of risk entailed by venture investment decisions.

2. Managing the Development Process

After an investment has been made with a particular company, venture capitalists enter the second stage of their relationship with the entrepreneur, which represents the process of helping to nurture the start-up. Again, in contrast to the management of demonstration projects, venture capital is an ongoing process that seeks to tailor both monetary and non-monetary resources to solve problems that emerge throughout the development of the company. Most venture capitalists assist in identifying and solving problems as they emerge, and draw on their network of contacts to find innovative solutions to barriers that face the company. As discussed above, venture capitalists organize the task of selecting companies to facilitate this development process. Selecting only companies in sectors in which they have substantial expertise and experience, for example, allows them to draw on their network of contacts to nurture the company.

In participating in this development process, venture capitalists engage in three primary activities. First, venture investors continually generate and analyze information about the companies in order to monitor their development. Second, they act on this information by providing a host of non-monetary resources from their network of contacts in order to solve problems that emerge. Third, they assess the progress of the company in order to determine whether to continue funding the entrepreneur in subsequent stages of development. Because making a profit represents the ultimate goal of the venture capital process, the venture investor must balance their commitment to the company with these judgments about whether to continue funding.

Monitoring Development

Venture capitalists continually generate information about their investments in order to surmount the large information asymmetries that characterize start-up companies. Because of the high degree of uncertainty that surrounds entrepreneurial ventures, venture capitalists rely on this information to assess the status of their investments. Some investors describe such monitoring in somewhat adversarial terms, while others view it as an ongoing component of the their relationship with the entrepreneur. One discussed the danger of failing to remain involved by suggesting, "people lie all the time about themselves and their companies."

For most venture capitalists, such monitoring occurs both through formal and informal contact with company management, providing multiple avenues for interaction. Formally, many venture capital firms require a seat on the company's board of directors, from which they can actively participate in the management process. Because there may be several venture firms investing in a particular start-up, however, such formal involvement is tied to the size of the investment. The lead investor usually takes the seat on the board, and typically informally represents the other venture firms. Even a group of four venture firms may designate a lead investor due to practical considerations relating to the size of the board.

The relative frequency of board meetings for early stage companies increases the effectiveness of gathering information via board membership. Although board meetings for most established companies only occur every quarter, new companies must rely on these gatherings much more often. As one investor explained, "it might be every two months, maybe every month, maybe they'll be board calls or conference calls quite often, and there's a lot of interaction that goes on between the board and the CEO and the management team."

As indicated by the relative frequency of impromptu conference calls, informal relationships with the company management also play an important role in gathering information. As mentioned above, many venture capitalists choose projects on the basis of whether they feel a personal connection to the entrepreneur, and draw on this connection to build understanding about the company's evolving situation. One investor explained the importance of these informal discussions:

> You're in weekly contact with these companies, and in some instances daily when you're going through major decision points. It's not like you're aloof and there's a scheduled monthly or every six week board meeting and your waiting until then to figure out where you are relative to where you were six weeks ago.

The ongoing nature of this process therefore stands in great contrast to the periodic monitoring that occurs in demonstration projects. Public managers engage in such episodic reporting primarily to document the progress of the endeavor, rather than to actively engage its day-to-day challenges. Venture capitalists view this constant engagement as vital to providing the support necessary to developing the company.

Nurturing Development

Venture capitalists use the information gathered via interaction with entrepreneurs to frame and respond to problems that emerge in the company's development. This process of problem solving is where the non-monetary resources provided by venture capitalists become important. Drawing on their network of business and social acquaintances familiar with different aspects of the business and technology development, the venture capitalists can provide both informal advice and formal guidance via board management positions. Their experience as successful investors and managers therefore proves of vital importance in this process of nurturing development. One venture capitalist explained firm's role as follows:

> We are an accessible sounding board so they know that when an issue comes up there's a good chance that [we have] seen it, either in another portfolio company or in another aspect of a partner's career, and can be a valuable resource in thinking through it.

This role as "sounding board" or mentor was echoed in another investor's statements. He explained:

> You know yesterday I got a call from one of my CEOs, he says can we meet for breakfast. We met at 7:30 to nine o'clock and we had two basic topics, he's got a big meeting coming up with a customer he want to strategize about, turns out it's a very important customer, . . . and he also had a personnel issue he wanted to talk about.

By serving in such an advisory role, the venture capitalist acts in a proactive way to recognize and solve problems that could hinder the company's progress. These investors provide more than individual advice to the entrepreneur, however, by drawing on a host of other non-monetary resources. The venture capitalist may assist in writing capital budget and business plans, recommend and hire consultants to assist with a specific problem, or recruit management team members to fill in critical gaps in the company's expertise. The key characteristic of these resources is that they are deployed in *problem-oriented* manner. Rather than simply funding the company and disengaging like the managers' of demonstration projects, the venture capitalist draws on this network of resources to specifically suit the particular characteristics of the company at hand. Thus, the investor assists in nurturing the company via his or her expertise and contacts.

By engaging in this process of problem solving, venture capitalists not only hope to overcome barriers as they emerge, but also build the capacity within the company to learn from these setbacks. As one investor asserted, "Getting experience often times requires making mistakes. And you see this a hundred times where the company gets smarter as it goes along." By interacting with entrepreneurs and surmounting mistakes with them, the investors therefore act as teachers. The networks that venture capitalists build with new companies may also help in developing this organizational capacity for learning and problem solving. As new relationships form with consultants or other companies via interaction over a specific problem, these interconnections may lead to further insight or innovation. One venture capitalist suggested that setting up conversations with other companies for product testing, for example "may result in additional relationships or other sorts of corporate partnering initiative downstream as the case may be."

Monetary resources are also deployed in a problem-centered manner. Although venture capitalists, like the managers of demonstration projects, typically provide full the amount of funding at the beginning of the investment cycle, their position on the board of directors provides them with some control over the use of that money. Demonstration projects differ in that they provide little direction to funding recipients after resources have been allocated. Rather than allow the entrepreneurs to spend the funding as they wish, the venture capitalist will often make specific recommendations about how the

money should be used given the stage of the company in the development process. When problems emerge, capital budgets and other funding decisions may be adjusted to address these barriers. An investor provided the following example of shifting capital funding to address unforeseen circumstances:

> So in those where we're actually on the board, hopefully you're going to see some of these problems coming. So you're slipping on your engineering deliverables. All right, well maybe we ought to be thinking about delaying when we bring in our marketing and sales resources to save the dollars so that we can get to those deliverables before we have to go out and raise more money. Maybe we need to add to engineering resources, spend more money to get back on track, and either take it from elsewhere in the budget or recognize that that's going to lead us to need external cash sooner but we're making an explicit judgment that that's necessary in order to increase the probability that we'll be successful in raising those funds.

In addition to providing advise about these capital management decisions, venture capitalists leverage control over their resources by staging investment in companies. Although the investor may not pull out their funding after it has been committed to a specific company, they may decide whether or not to pursue an additional round of financing after existing resources have been exhausted. Staging therefore provides points at which the investors and the company management must assess the overall progress of the venture, which represents the next major task of venture capitalists during the company development phase.

Assessing Progress

As venture proceeds, the investor must assess the overall progress of the company in order to determine whether he or she will contribute to the next round of funding. This task is greatly complicated by the fact that the underlying market assumptions that provide the justification for new companies often change dramatically after the investment has been made. Due to the high degree of uncertainty that characterizes new ventures, these assumptions are often undermined by new information or invalidated as development progresses. One investor discussed the frequency and severity of such changes in these underlying assumptions:

> For every single investment there are actually three companies: the company you thought you were investing in, the company you actually invested in, and the company you wish you had invested in. They're rarely the same. So you make your first investment, and almost before the check is cashed, everything changes. So you make the investment and literally overnight something happens – you know the old saying about shit happens. It could be good, it could be disaster, it could be – but things change.

Often times these changes in the underlying assumptions about a given product will serve to alter the overall goals of the venture. Given that most of early stage companies rely on one main product, challenges to the feasibility of this product represent a significant problem for the entire organization. However, both because of the fixed nature of their investment and their orientation towards problem solving, such changes to the overall direction of the company do not necessarily break the venture capitalist's commitment to the company. Unlike public demonstration projects, where deviation from project goals will typically be seen as justification for canceling the program, venture capitalists realize that overcoming such problems represents a significant learning experience, and that the new product and goals that emerge may eventually be more successful than the original strategy.

> You know, there's an old saying, and it's really true. There's the famous story that supposedly came from IBM, where the guy in charge of a major project had just completely blown it and had been an absolute failure, and he came into Todd Watson and offered his resignation, and Watson's response was, "you've got to be kidding, I've just spent 10 million dollars educating you – I'm not letting you go now." You know getting experience often times requires making mistakes.

Given the frequency of such "mistakes" in setting the initial direction of the company, most venture capitalists have stories of investments that dramatically altered their course and ultimately succeeded. Much of the time, these shifts in direction required reconfiguring the basic technology that has been developed to address different needs. In one instance, for example, a company that built information technology designed to maintain the security of business transactions faced a total collapse in market interest for such products. Rather than folding the company, however, the entrepreneurs and venture capitalists worked together to develop a new product using the same technology for digital signature applications. This willingness to participate in reframing the overall goals of the company underscores the problem solving orientation of venture capitalists.

Venture capitalists use the company business plan as their main tool in tracking the process of the start-up in attaining its goals. Drafted by the management team before initial investment in the company, the business plan sets out an extremely detailed set of market assumptions and performance benchmarks that the company hopes to achieve by particular dates. These benchmarks are of crucial importance, because the venture capitalists use comparisons between them and the company's actual progress as their central means to evaluating the overall performance of the venture. These evaluations in turn influence whether the venture capitalist will participate in the next round of funding. As one investor clarified, "that document then becomes the foundation by which the funding is made and the company begins to execute." The management team at the company therefore attempts to meet these benchmarks because their performance impacts the ability of the company to attract more equity. The same venture capitalist explained that a "tacit understanding" develops that suggests that "if you have made your milestones [we will] go hand and hand with you to the marketplace."

When these milestones change due to unforeseen circumstances, however, the venture capitalist faces a much more difficult time determining whether to provide additional investment. On one hand, the company could thrive once it has reframed its goals and its product to address the new market conditions. On the other, the change in milestones could foreshadow the eventual decline of the venture. Given the uncertainty of the situation, deciding whether to fund a company that has dramatically reframed its goals represents one of the most difficult decisions of a venture capitalist. Venture investors contend that this assessment often comes from intuition about the location of the company on its lifecycle. As on investor explained, "every enterprise has a lifecycle from the beginning into growth and then eventually into maturity and decline." The key to success in venture capital is developing a strong intuition about the company's position in this lifecycle, and exiting before it reaches maturity.

Although many venture capitalists had a difficult time attempting to describe the intuition that does into deciding whether or not to remain committed a company that has changed its strategy, two themes emerged throughout the interviews. First, the investor is more likely to participate in another round of funding if they believe the new assumptions and goals that will guide the company. Although venture capitalists are willing to make risks given the inherent uncertainty of early stage companies, they must have as much faith in the revised business plans as they did in the original assumptions that spurred their initial investment. Second, a venture capitalist's level of belief in the entrepreneurs who manage the company will dramatically color his or her faith in the new business plan. If the investor maintains personal faith that the manger can execute the new plan and produce a successful company, he or she is much more likely to enter another round. One investor explained the situation this way:

> It is not impossible that two companies that are very analogous to each other could both change strategy and [the one with] a CEO who's a pretty bad sales guy and who doesn't know how to pitch his ideas very well might have a brilliant second strategy and might finish giving the strategy and the next day the board members will be on the phone talking about maybe shutting the company down or scaling it back and firing the CEO, and a CEO . . . who's extremely confident, who articulates well, who knows how to pitch his ideas comes out with a change of strategy which makes everybody come away feeling confident. And to some degree, actually, that's not bogus either because as a CEO your job is to get the entire world to believe your dream and to put their resources into it – employees, suppliers, investors, landlords, you name it.

Venture capitalists may also rely on their network to test whether the CEO is effective in inspiring others to believe in his or her "dream." Because investments in early stage companies are often diversified among several venture capital firms or individual investors, the management team must secure the continued participation of not one but many investors. Although these investors may or may not discuss their investment decisions amongst each other, the fact that several firms must commit to the company acts as a check against questionable business plans. In other instances, the next round of funding may call for additional investors to increase the overall amount of equity in the

company, and as one investor described, "the plug gets pulled, because the next round of money – it's not even so much that you don't fund them – but they need a new investor as well and that doesn't happen."

3. Creating Accountability for Performance

In order to explore the administrative questions posed by entrepreneurial bureaucracy, we now turn to the third and final major task in private venture capital: creating accountability for performance. Despite the high degree of uncertainty that characterizes new ventures, both entrepreneurs and venture capitalists need to be held accountable for their performance. Similar to the relationship between Congress and the public managers who oversee demonstration projects, the mangers of a venture firm must evaluate whether their partners have performed adequately. Likewise, the venture capitalist and the board of directors need to determine whether the management team has met its expectations, mirroring the relationship between the public manager and local project leader.

In contrast to the procedural accountability of the public sector, however, venture capital relies on retrospective assessments of performance. Public managers are largely evaluated on whether they have followed the rules for finance and fairness that guide public administration, while venture capitalists are held accountable for developing successful ventures. The high uncertainty that characterizes early stage companies, however, greatly complicates this task of assessing performance. Because the practice of venture capital requires the flexibility to adapt to unforeseen circumstances and revise the overall goals of an endeavor in response to new information, the task of evaluating whether anyone involved in doing a "good" job is problematic.

Evaluating the performance of venture capitalists is easier than that of entrepreneurs. Although the goals of the early stage companies may shift throughout their development, making a return on their investment always represents the ultimate goal of venture capitalists. "Good" venture capitalists are those that create value for the investors in the venture fund. As one early stage investor explained this bluntly:

> The answer is: did you make a very good return on your money. How many winners did you have and how many losers did you have . . . how much did you put in over what time and how much did you get back . . . any other criteria is full of shit criteria.

Evaluating whether the venture capitalist has made such a return over several investments may require half a decade to determine, but such an evaluation can eventually be made easily. Within a shorter timeframe, however, it may be extremely difficult to determine the contribution a venture capitalist has made to the success – or failure -- of their investments. With the majority of their investments going bankrupt, the amount risk inherent in venture capital obscures the relative performance of the investors without a longer-term perspective.

The instability of the short-term goals that guide early stage companies complicates the task of creating accountability for performance for entrepreneurs. Indeed, in order to hold someone accountable for their performance, organizations must set up clear expectations based on the achievement of certain goals. Without such expectations, the organization has no ability to measure whether the person has performed adequately. Within the context of early stage companies, however, the goals of management may change on a regular basis. New information may undermine the underlying market assumptions for the company and it products, requiring the management team and the board of directors to reframe the direction of the company. The ultimate goal of the venture capital process may be to take the company public or sell it a valuation ten times its present value, but the steps required to reach these goals are unclear. One early stage investor described the process of goal setting as one in which "there's an infinite number of permutations [of] timeframe [and] performance."

The business plan and its series of benchmarks ultimately represent the basis for creating expectations for the performance of the company management. Despite the fact that these benchmarks will most likely shift throughout the company's development, they nevertheless remain the most important means of measuring performance. One investor explained that, although the business plans do not specifically lay out penalties for lack of performance, many companies operate under the implicit rule that "if the company doesn't make plan, the CEO is out. Just like that." The business plan therefore allows the board to explicitly measure the performance of the management, and provides a means for them to intervene if the company begins to diverge from its stated objectives. In meeting with a CEO that has failed to meet the specified benchmarks, the board could point to the business plan as justification for their dismissal.

But how does the management team maintain such accountability when it's unclear whether company's departure from the business plan represents a negative development? Given the uncertainty of the venture process, altering the direction of the company may represent a more intelligent decision that following the goals outlined in the business plan. Ultimately, however, the board of directors will only accept such divergence from the business plan if they have developed a consensus that the underlying market assumptions guiding the plan are now inaccurate. Faced with management that has failed to meet its benchmarks, one investor suggest that the board would say:

> You could say, well we know the plan isn't working, [but] you haven't demonstrated to us that any of the original assumptions are incorrect, so our expectation is that you will make the plan and we'll give you a quarter to get that on track or we'll give you six months to get back on track, or by next month you will have closed that big order, or some direction of the board.

In other cases, the board may be willing to accept management's failure to meets its benchmarks if its members develop a consensus that the ideas grounding the plan have been invalidated. Typically, such consensus must emerge out of discussions between the board and management, where the management must develop trust with the board in order for their revisions to be adopted. The situation underscores the reasons that venture

capitalists look for entrepreneurs who are both trustworthy and capable of making others believe their ideas. Hiring management without these characteristics would result in a much more one-sided process for setting and managing the goals of the company, because the board would never engage in a real dialogue with the management. One early stage investor explained the process of building consensus between the board and the management as follows:

> [The board] may say, the plan's not working, you've shown us why it's not working, you've made a proposal to do the following, OK – we'll give you a chance, we'll give you a shot at it. Or not only will we give you a shot at it, we're going to support you, we're going to assist you in raising new capital, or we're going to do whatever. And it ends of being a bargain, an agreement that comes out of that little mini-negotiation. Because every conversation is a bit of a negotiation, even if the board is really supportive of the CEO, there's always expectation setting going on an ongoing basis. It's a continuous process.

The willingness of the board to accept diversions from the business plan may also reflect the overall uncertainty of the company's position in the market. If the company has an extremely innovative product that has no real competitors, the board will recognize the uncertainty of the benchmarks and provide more discretion for the management. As one venture capitalist suggested, in such circumstances, the board lacks the expertise to really determine whether or not the original benchmarks represent fair performance measures:

> The company in several cases did not make plan, but it was as much naiveté, the ignorance of the board – it was a brand new area that nobody knew anything about, so it was virgin territory. So in that case, judgment, it wasn't the CEOs fault, we all bought the plan, we all said this plan is not without risk, we acknowledge up front that this may not be achievable, so the CEO got to keep his job.

Overall, then, the process of accountability for entrepreneurs receiving venture capital is based on negotiated expectations between the board of directors and the company management. These negotiations may result in revised benchmarks, allowing the management to remain even if they fail to meet these performance guidelines. However, such revisions must result from a new consensus among the board of directors that the underlying assumptions of the business plan have changed. If such a consensus fails to emerge, the entrepreneur is seen as failed at managing the company and excused from the venture.

Looking to the Public Sector

This chapter underscores how the organizational structure of venture capital serves its goals of promoting technological innovation and managing the transition from prototype development to the marketplace. Unlike demonstration projects, which are not designed to actively address this transition process, venture capital provides the organizational flexibility commensurate with the volatility and uncertainty of the development process. Although this discussion provides insight into the question of what the public sector

might learn from the practice of venture capital remains, this question is addressed more directly in the next chapter. Many of the barriers to building problem-centered demonstration projects result from our current system of democratic accountability, which, as demonstrated next, promotes a false dichotomy between discretion and accountability. Understanding the practice of venture capital suggests new institutional mechanisms that might allow the government to surmount this false dichotomy.

CHAPTER 5: LEARNING FROM THE PRACTICE OF VENTURE CAPITAL

A comparison of the practice of private sector venture capital with the management of demonstration projects underscores the difference of these processes in nurturing new technologies. The main difference between these processes is in the ability not only to collect but also to respond to new information that arises unexpectedly throughout development. With its lean, decentralized decision-making process, the venture capital process provides the flexibility needed to engage problems and reframe the goals of the company. Although the longer-term demonstration projects such as those administered by the DOE share some of the characteristics of venture capital (such as performance benchmarks linked to distinct stages) the overall process lacks the flexibility required to successfully manage the transition from development to commercialization. Public managers face both congressional intervention as well as agency hierarchy in managing and evaluating their programs. Both limit their discretion to react to emergent information in a timely manner, and provide a disincentive engaging in the network of activity that develops around the project.

Because of the importance of organizational flexibility in promoting innovation, providing more discretion to public managers through institutional changes represents the first necessary step in producing more problem oriented demonstration projects. But these organizational changes will not be sufficient to produce more effective efforts at commercialization. As discussed previously, the notion of more flexible public mangers raises significant managerial and administrative concerns that will need to be addressed. The public managers faced with these new roles will need the managerial abilities to gather new information, and, more importantly, possess the intuitive skills necessary to making risky decisions with little concrete information. Perhaps more significantly, providing such discretion to public managers would require a new conception of public administration based around the performance of these agencies rather than their adherence to procedures.

In order to explore how the practice of private venture capital might help to answer these questions, this chapter first explores the organizational changes that would be necessary to provide more discretion to public mangers; second, discusses the managerial skills that bureaucrats might learn from venture capitalists in nurturing new technologies; and third, outlines how accountability within the venture capital process might inform a new conception of public administration.

The Organization of Problem-Centered Demonstration Projects

Although providing more flexibility to the public managers overseeing demonstration projects represents the first necessary step to making them more problem-centered, the specifics of what such flexibility would entail are unclear. Indeed, what do we mean when we say flexibility? Within the context of demonstration projects, such flexibility would at least theoretically entail two major changes to current modes of practice.

First, the congressional budgeting process would need to be altered to provide more discretion and different mechanisms for accountability over funding for demonstration projects. The current budgeting process not only earmarks a substantial portion of project funding before it reaches the bureaucracy, but also further delineates how such funding should be spent through programmatic guidelines. Although private venture capitalists have some restrictions placed on their funding decisions based on the limits of their expertise within the market, the partners retain complete control over the exercise of funds. Ideally, funding for problem-centered demonstration projects could work similarly, with Congress granting a sum of money to the agency to disperse as it pleases within certain broad technological limits. The Department of Energy for example, might only spend such funding on alternative energy technology, but such specialization might be limited by the agency's expertise and goals as much by any congressional mandate delineating their spending priorities.

Second, problem-centered demonstration projects would require public managers who can make day-to-day decisions about the operation of the projects without the need to gain extensive approval from superiors. Much like the work of venture capitalists on boards of directors, reframing the goals of the project would necessarily be worked out in consultation with the project management team. In contrast to current practices, such activities could not involve lengthy approval processes within the agency or from outside consultants such as academics and industry leaders. The public manger could rely on these contacts to form opinions and develop expertise about particular problems, but formalized review processes would remove the discretion needed to engage the projects in a timely manner. The agencies would need to develop the internal trust necessary to let their managers act on information as the projects proceed.

Managing Problem-Centered Demonstration Projects

Providing new discretion to disperse and manage funding, however, fails to answer the question of whether these managers possess the skills necessary for effective management. What are the skills necessary to nurture new technologies and could public managers develop them? Understanding the practice of venture capital underscores that two skills are essential in successfully managing new ventures. First, public managers must develop an intuitive sense of risk learned through extensive business experience. Learning to make decisions – preferably good decisions – within an environment characterized by risk occurs through trial and error and develops along with expertise in a technology sector through experience. Second, the public manager would require the ability to create and recreate social networks that help to inform, test, and revise these personal judgments. Embedding their decisions in these informal networks not only provides a mechanism for building new insights, but also provides a means to check their intuition against others in the field. The interplay between personal intuition and this network of trusted contacts is crucially important in all three stages of the development process: choosing companies, managing the development process, and creating accountability for performance.

1. Choosing Projects

Without the direction provided by earmarking or other programmatic criteria, public mangers would need to rely more on personal expertise and intuition when making funding decisions. To some extent, the current process of proposal solicitation is structured to reduce the need and opportunity for personal judgment in funding decisions. Bureaucrats choose which areas of technology they would like to fund ahead of time and develop a "contest" of sorts in which projects compete on their merits related to pre-established criteria. Public managers avoid the demands of evaluating each project on its own merits, and simplify their decision making process by choosing among the projects in a group based on set criteria. If such a system of solicitation was relaxed so as to allow for more diversity in the types of projects the agency would entertain, public managers might face a more difficult problem in choosing projects. Indeed, the uncertainty surrounding the financial and market projections for these projects might push public managers to fall back on personal judgments about the project and its management team when making funding decisions. The bureaucrat might assess whether they believe the local project manager could successfully develop the technology, for example. Beyond these personal assessments, however, the public manager would require the expertise to develop an intuition about the technical prospects and market potential of the new product.

Despite the increased importance of such intuition in choosing projects, however, the public manager would not necessarily rely solely on these personal judgments in the decision-making process. Although managers would need to be able to make these decisions without lengthy approval processes, more informal review processes would be important to qualifying the personal judgments of individual public managers. Venture capitalists test such intuition through their interaction with a network of contacts, relying especially on the feedback of the other partners in their firm before making funding decisions. The consensus that develops among these partners about individual projects guides the final funding decision. Public agencies could also seek to develop a middle ground between hierarchical review processes and completely autonomous decision-making by generating such horizontal evaluation processes. Even mandating that these public managers build agreement about which projects to fund would represent a more fluid and flexible decision-making structure than the hierarchical processes now in place.

2. Managing the Development Process

Expertise about the market and technology of a particular product would also be crucial to building the intuition necessary to contributing to the development process. Venture capitalists add to this process because they have developed a unique expertise in the particular technological field through years of experience. Rather than simply contributing funding, therefore, such expertise allows them to provide a host of non-monetary resources by acting as a mentor to company management. Likewise, problem-centered demonstration projects would require that public managers possess such experience in order to contribute something meaningful to the project. Indeed, public managers would need at least as much expertise as their private sector counterparts in order to help to nurture the technology, and preferably more if they hope to provide the mentoring role that venture capitalists supply. In order to build this mentoring

relationship, the local project leaders steeped in the day-to-day challenges of developing the technology should feel as if the public managers had the ability to provide meaningful advice developed through personal experience with the problem.

In addition to acting in this mentoring role by offering their personal expertise, public managers might also provide important resources via their network of contacts in the field. Although venture capitalists typically have experience with the plethora of problems that face new ventures, they understandably do not possess answers to all of these questions. When difficult situations arise, therefore, the venture capitalist draws on someone in this field of contacts who has expertise in that particular problem. They may also seek to verify their own personal judgment about a situation via this network. In the public sector, developing a network of contacts outside the agency would therefore provide an invaluable source of expertise in addressing the problems that face demonstration projects. The local project managers involved in the developing the technology might expect that the public manager could provide access to a pool of resources previously unavailable to them.

Streamlining and organizing access to other public resources might represent one unique non-monetary resource that public mangers might provide to demonstration projects. In addition to the expertise that these officials could provide to local project managers about their specific technology sector, public managers might coordinate access to public resources that might helpful to developing and deploying the product. These resources could be monetary if the project overlaps with the goals of other demonstration projects, but might also represent assistance in dealing with specific regulations that might impede development. Such assistance with rules might be especially helpful with demonstration projects that use local government agencies as test-beds for the new products. Dealing with the myriad of accounting and fairness rules across multiple jurisdictions often represents a significant barrier to the success of demonstration programs. Providing coordination across these jurisdictional and institutional divides would therefore allow managers of problem-centered demonstration projects to provide assistance via their network of public sector contacts.

3. Creating Accountability for Performance

Personal experience and an intuitive sense of risk would also be vital to assessing the progress of the project. As the project proceeds, the manager will need to determine whether it should receive additional rounds of funding or whether public investment in the technology should end. Due to the uncertainty that characterizes the development of new technologies, unforeseen circumstances will often require that the project reframe its goals in reaction to the new information. Venture capitalists navigate such situations – determining whether the reframed company still represents a good investment – based on the intuition that they have developed with business experience and ongoing consultations over the project and the industry. Rather than defer to a committee of academics, industry leaders, and scientists, the public manager would require expertise to make these adjustments to project goals largely during consultations with project management. Consultation with peers in their agency might provide a means to qualify these judgments, but the manager alone would have the specific knowledge about the

particular circumstances of the project. Renegotiating the goals of the project would therefore occur primarily with the management team, and public managers would need to the ability to justify these decisions to their managers at the agency or members of Congress, "selling" them on the vision put forth by the reframed project.

Private Sector Expertise in the Public Sector

The importance of expertise and an industry network to the managers of new ventures presents an important question, however: would it be possible for the government to attract individuals with such a background? The partners of venture capital firms largely represent former entrepreneurs and institutional investors with experience in multiple successful companies that provides contacts, expertise, and a personal history in which to situate judgments about risk. This combination of experience is rare, and provides the value that the venture capital firms bring to new companies. In return for providing expertise and access to capital in spite of the high risk of failure, venture capitalists are highly compensated for their services. The probable huge discrepancy in compensation between the public and private sectors may inhibit former business leaders with the necessary expertise from participating in such projects

Surveying other government agencies that successfully attract employees that face similar discrepancies in pay suggests that this barrier can be overcome, however. Government agencies such as the Department of Justice and the Department of Commerce routinely hire both attorneys and business leaders that could make substantially higher salaries in the private sector. In many cases, these employees are attracted to the agencies because the experience adds to their expertise about the public sector, which later increases their value to private sector companies. In other instances, the positions (such as federal prosecutor) hold substantial prestige that offsets their lower salary. The common thread that unites these positions, however, is that the public official has substantial discretion in decision-making, and therefore may apply their expertise in a particular field to solving public goals. Without such discretion, the expertise provided by these individuals would be mismatched with the responsibilities of the position. Likewise, providing such discretion would be vital to attracting public managers with substantial private sector experience to demonstration projects.

Overall, then, proactive demonstration projects would not only require more flexible management but also managers that had expertise in a particular technology sector. The success of these programs would also require that the managers have a certain entrepreneurial energy in thinking creatively about problems and working around rules that may impede their success. However, the discussion so far has assumed that allowing public managers to assume such proactive roles in managing public resources would be acceptable to the public and the media. This creates an unusual problem in that the aggressiveness demanded of public managers in order to create more effective programs conflicts with our notion of appropriate behavior in the public sector. James Silver underscores this conflict by noting:

> The entrepreneurial model can never legitimate public sector administration in the eyes of a skeptical public. The public may envy, even admire the entrepreneur, but the actions of the entrepreneur are illegitimate in that the entrepreneur cannot be expected to function as a guardian of the broader public interest.[42]

Problem centered demonstration projects and the changes they suggest to the practices of our public managers therefore pose an enormous challenge to our notion of democratic accountability. With the discretion to make funding decisions as they choose (even basing them on such intangible criteria as personal intuition), public mangers might be severed from democratic mechanisms that currently authorize them to make such decisions. How can the needs both for increased discretion and accountability to the electorate be met?

Public Administration and Democratic Accountability

Answering this question begins with the understanding that public managers already exhibit discretion in their everyday activities. As Michael Lipsky pointed out more than two decades ago, bureaucratic superiors and legislatures cannot pass rules that will deal with every situation that public managers face on a day-to-day basis. Bureaucrats must exercise discretion in making choices due to the lack of definitive policy guidance provided to them. Moreover, depending on their specific goals, certain public managers are allowed greater discretion if such flexibility is viewed as important to their effectiveness. Gerald Caiden provides the example of government prosecutors, who, "every day . . . have to decide whether individuals should be indicted" based on their own personal intuition. Echoing the gut feelings that venture capitalists use to make their decisions, he continues, "sometimes these questions cannot be answered with certitude, and prosecutors have to make their decisions according to unspoken judgments, hunches, and predispositions."[43] Accepting that bureaucrats often make decisions based on such intangible criteria represents the first step in fashioning accountability process that allow for more innovative public managers.

After understanding the discretion that public managers already exhibit, Congress and the public secondly need to develop more trust – or new arrangements in which trust is possible -- with the public managers in order to build a more entrepreneurial bureaucracy. Indeed, such distrust largely helps to explain why Congress imposes so many rules governing the actions of the bureaucracy. Due to the risk adverse nature of the Congress, it members fear that providing too much discretion to public managers will result in political controversy. It micromanages the bureaucracy because it feels these rules will result in increased accountability.

Building such trust, however, will require resolving the apparent trade-off between discretion and accountability. Members of Congress believe that providing too much discretion to public managers will provide little basis for accountability, and that the bureaucracy will ultimately make mistakes. But does this tradeoff really exist? Robert Behn suggests that creating a system of retrospective accountability for performance

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[42] Robert Behn, *Rethinking Democratic Accountability*, pp. 99-100.
[43] Ibid., p. 95.

represents one alternative strategy to establishing accountability without micromanagement. Put simply, such performance-based accountability would allow public managers to exhibit discretion over their decisions and then elected officials would determine if such discretion has been used appropriately.[44] Congress and the agencies would agree on specific performance goals for the agencies that would have to be achieved within a particular timeframe. Agencies that fail to violate the trust given to them would continue to receive discretion over their activities, whereas those that develop a pattern of failure might revert back to traditional forms of accountability.

The process of setting and evaluating agency goals via negotiations with Congress would help to insure that the bureaucracy still pursued democratically established goals. Within this system, the legislature would have to take on two important tasks. First, they would review the choice of goals established by each agency by holding public hearings and conducting external analyses. Once the Congress was satisfied that the goals were acceptable to the public, the agency would have considerable discretion about how to achieve them. Second, the Congress would evaluate the achievement of these goals, and assess whether the agency warrants their continued trust. Although some might argue that this process of broad goal setting would blur the link between public agencies and the electorate, the lack of specificity of these goals might actually better reflect public opinion. Beyond specific stakeholder groups, the public goals articulated by the electorate via Congress are often more general priorities (such as reduce air pollution) rather then specific programmatic goals (such as fund only a particular type of technology).

Behn suggests that perhaps the biggest problem facing retrospective accountability is the difficulty of measuring whether or not the agencies have achieved their performance goals. If the bureaucracy can show that they have performed adequately, the legislature will be more likely to trust them in the future. But how do public managers and legislators know if the agencies have done a good job? Retrospectively analyzing the benefit of certain program requires both an analysis of the outcomes of the project and the impact that these outcomes engendered. Such measurements can be especially tricky in public programs, because their goals often relate to correcting market failures that are incredibly difficult to measure. Moreover, due to the complexity of the problems being addressed, public managers may have difficulty determining how much the policy actually contributed to the objective. If a program is designed to reduce certain types of automobile emissions, for example, how can one determine whether or not the program engendered certain results or if some other factor explains the trend? Although building consensus on which measurements to use seems plausible, the process might be extremely difficult due to political differences in framing particular problems.

Accountability and Problem-Centered Demonstration Projects

The discussion thus far has focused on the generic challenges posed by creating a performance-based system of accountability for public managers. Developing such accountability in the context of problem-centered demonstration projects poses additional problems, however. These additional challenges stem from the uncertainty that

[44] Ibid., p. 104.

characterizes the development process of new technologies. As development proceeds in the venture capital process, considerable confusion exists about the proper goals of the company and the best strategy to reach these outcomes. Due to this uncertainty, these goals often change in response to new market information. The process works precisely because it is able to react to such information and reframe its technological goals. But this flexibility also greatly complicates the task of measuring whether or not the venture capitalists and the entrepreneurs are performing well. As the goals of the venture change, the indicators used to measure performance may also change, which would greatly complicate the ability of legislators to hold public managers accountable for their performance.

As with venture capital, the process of benchmarking could provide the basis for measuring performance in problem-centered demonstration programs. These benchmarks would allow the project managers to set goals for the local managers of the demonstration projects and track their progress. These benchmarks might additionally provide a means for the public manager to report to Congress or their superiors about the progress of the project. But if the goal of providing more discretion to these officials in managing demonstration projects is to allow for greater flexibility in responding to new information, public managers must also be able to revise the benchmarks. Although such revisions might occur through consultation with other officials in the agency, the flexibility demanded by the situation could not require lengthy congressional approval processes every time such benchmarks are called into question.

The necessarily mercurial nature of these benchmarks poses two major measurement problems for problem-centered demonstration projects under the current legislative framework. First, the task of reviewing changes in the benchmarks of every demonstration project would be too complicated for a legislature to tackle every year. Congress could evaluate whether the programs are "headed in the right direction" and selectively analyze whether decisions to revise project goals seemed reasonable, but such evaluations would be incredibly subjective. The overall uncertainty of whether these shifts in strategy will ultimately benefit the project means that little objective information is available to justify them. Because of this lack of concrete information, venture capitalists make such decisions with personal intuition developed through years of business experience. The public manager might be able to "sell" members of Congress on his or her reasoning for altering the benchmarks of a particular program, but it seems implausible that they would share a similar intuition about risk. The difficulty of measuring the short-term performance of these projects would therefore require a longer-term perspective on behalf of the legislature. Rather than evaluating the performance of these projects based on their adherence to short-term benchmarks, the legislature would need to determine whether these projects had succeeded using long-term measurements.

The need to measure the long-term performance of demonstration project leads to the second measurement problem. In contrast to the extremely defined long-term performance guidelines of venture capital, problem-centered demonstration projects lack easily measurable extended goals. Private venture capitalists can determine whether or not they have performed adequately by looking at their investments over the past five

years and seeing how many made an adequate return on investment. In contrast, the managers of problem oriented demonstration projects would face a much more difficult time determining whether or not they have performed adequately. If the long-term goals of these projects would be to commercialize new products, how would they measure whether or not these objectives have been met? Although it seems plausible that performance indicators could be developed to measure the whether the programs have met the goal of commercializing new products, it would be especially difficult to measure the marginal impact of the public sector in spurring production. The increased expense of conducting longer-term and more proactive demonstration projects might not outweigh the marginal benefits in time saved commercializing the product.

The inherent risky nature of the projects would further complicate the task of measuring their long-term benefit. In the venture capital process, a large majority of the projects are unsuccessful, but the high returns provided by the successful projects outweigh these failures. As such, the easily measurable nature of long-term success in venture capital (did you make a return?) provides a means to weighing failure and justifying risk. A venture capitalist faced with a substantial number of failed projects can say, "Yes, I've failed in these projects but overall I've been successful." Within the public sector, however, the lack of objective goals means that the balance between success and failure is much more opaque. Public managers who oversee a number of failed projects costing a substantial amount of taxpayer money might have difficulty pointing to their successes as justification for undertaking such risk. Even if some type of cost-benefit analysis could justify such expense economically (did the increase in air quality outweigh these five failed projects?), such tradeoffs might be incredibly difficult to communicate in a politically charged environment. Because such long-term tradeoffs between success and failure may be difficult to communicate, legislators and members of the media could point to the unsuccessful projects as an indication of the long-term failure of these endeavors. Creating acceptance for these projects among the public and politicians would therefore require a more long-term perspective on government expenditures than is typical.

Overcoming the Accountability Barrier: Building Trust with the Legislature

The discussion above poses an interesting dilemma: it appears that both the short-term and long-term measurements for performance for problem-centered demonstration projects would be difficult for Congress to manage. In the short term, it would be unreasonable to expect Congress to review changes to the benchmarks of the multitude of demonstration projects each year. In the long-term, the short attention span of the legislature might preclude the future oriented perspective necessary to judging the ultimate success of these programs. Without adopting either of these types of performance measures, however, Congress would most likely fail to grant the discretion necessary to promoting innovation.

Building new institutional mechanisms for trust between Congress and the agencies that oversee demonstration projects represents one way of breaking through this dilemma. Indeed, the dilemma is grounded in the notion that an adversarial relationship exists between Congress and these agencies (and that the we can only trust parties who are in an

adversarial relationship). Without a formalized process of insuring that each agency or demonstration project has met its performance goals, the legislature would assume that public managers would necessarily violate the public trust. Legal performance contracts are therefore necessary to insure that the agencies perform as they have promised. However, the formality of this accountability process largely creates the measurement problems posed above, because it greatly increases the inflexibility of these performance benchmarks. Assuming that the short-term performance benchmarks for these programs represent binding contracts between the legislature and agencies necessarily makes them inflexible.

Examining the venture capital process might provide insight into building organizational mechanisms for trust between Congress and these agencies. Venture capital in fact represents a practice based on trust-based performance measures. Rather than represent a binding contract, the business plans developed by entrepreneurs and mediated through discussions with the board of directors are based on trust rather than legal obligation. The informality of these plans creates several advantages over more strict accountability processes for practices focused on promoting innovation. First, because these benchmarks are informal, they can be altered easily without drawn out legal processes. Changing the benchmarks only requires agreement between the company management and the board of directors. Second, because these business plans represent an evolving consensus between the board and company management, the importance of specific benchmarks may change even without an official agreement between these two groups. As shown previously in Chapter 4, these benchmarks represent implicit expectations for performance based on a common understanding that develops between the board and the management. If an informal consensus emerges between these groups that the benchmarks represent tentative targets because of the high amount of uncertainty that characterizes the venture, neither party will expect them to represent strict obligations.

Trust between the company management and the board of directors provides the foundation for this informal system of accountability. Because agreements to reframe the business plan occur informally, and provide implicit rather than explicit expectations for performance, the system of accountability requires trust between the two groups. The CEO must trust that the board of directors will not remove him or her for failing to meet unreasonable expectations. The board, on the other hand, must trust that the entrepreneur will make a good faith effort to execute the business plan and provide a good return on their investment. This trust builds out of the consensus-based nature of the benchmarking process, which requires creating a common understanding between the management and board via interaction over the problems facing the company. This understanding imposes a responsibility on all parties involved to contribute to the development process. Not only must the entrepreneur seek to meet the company's performance objectives, but the venture capitalist must also contribute to nurturing the company. If either side feels that the other has failed to meet this common understanding, trust between the groups may break down, which might reduce the flexibility of the accountability system in responding to new information.

Trust also emerges out of learning about the behavior of the other parties involved in the development process. In the practice of venture capital, much of this learning results from the *monitoring* undertaken by the investor in order to break down the information asymmetries that characterize new companies. Gathering information about the progress of the venture provides a mechanism for the evolution of expectations about the venture and maintaining trust. As the venture capitalist determines that new market conditions or unforeseen circumstances may delay the development process, they reframe their performance expectations for the entrepreneur.

This discussion raises the important question of whether Congress and the agencies that oversee problem-centered demonstration projects would be able to develop trust-based relationships. Such a relationship based on a common understanding of the circumstances affecting demonstration projects might provide a solution to the measurement dilemma posed above. Rather than form a system of accountability grounded in formal benchmarks that require congressional approval, the legislature could adopt informal agreements with these agencies. These informal agreements would not only allow for the reframing of benchmarks without lengthy approval processes, but would represent the basis for a shared understanding of the development process. As new circumstances affect the performance of these projects, a shared consensus about the rigidity of these benchmarks would evolve and shape expectations for performance within the agencies. Even if the benchmarks had not been revised through agreement between this legislative body and the agency, they might informally evolve through this shared understanding.

As discussed above, it seems difficult to imagine our current legislative institutions adapting to a system of accountability based on shared understanding. Because of the uncertainty of the development process, evaluating whether short-term benchmarks seem reasonable requires deep understanding of the project and the changing market conditions that affect its development. However, the legislature would need to develop such an understanding in order to participate in shaping consensus about expectations for performance. The magnitude of this challenge would therefore require new institutional mechanisms for developing trust and interaction between Congress and the agencies overseeing demonstration projects.

This mechanism could represent a new form of congressional subcommittee that would oversee demonstration projects based on informal agreements. Characterized by *thicker, informal ties* with these agencies, this small body of legislators and their staff would seek to build a common understanding over the management of demonstration projects via monitoring such as that conducted by venture capitalists. The relationship of this subcommittee to the public managers overseeing demonstration projects might loosely resemble that of the board of directors in a venture to the company management. Similar to the entrepreneur, the agency would define the results for which they would expect to be held accountable, and detail the resources they would need to reach these goals. After reaching consensus about this system of expectations, the subcommittee would remain involved in monitoring the progress of the agencies. Such monitoring would not represent micromanagement, but information gathering in which to form judgments about the progress of the projects.

The informality of these performance agreements between the subcommittee and the public managers would help to break down the adversarial relationship that currently exists between these two groups. With expectations for performance derived from a common understanding about the circumstances of the project, both parties would have a responsibility contributing to the success of the project. Congress would be held accountable for imposing unreasonable expectations on the agencies, and the agencies would be expected to meet reasonable benchmarks. Moreover, the informality of the agreements would allow for the reframing of expectations in response to new circumstances. If the subcommittee changes its funding priorities, for example, then expectations about agency performance would shift as well. Negotiating performance benchmarks for these public managers would therefore necessarily result in a system of accountability for both parties.

Moving Forward

Building the foundation for trust-based systems of accountability will initially require experimentation and the suspension of cynicism about the potential success of these new forms of governance. Perhaps a good first step in experimenting with these types of arrangements would be to select a group of related programs and establish a community of like-minded legislators who would be interested in drafting informal agreements about their performance. Although this model of accountability might be applied to a host of governmental agencies and programs that might benefit from added discretion, demonstration projects seem to represent an especially strong candidate for such experimentation due to the importance of promoting innovation in the environmental technologies.

CONCLUSIONS

Allegiance to traditional forms of public administration limits the potential for government demonstration programs to promote technological innovation. The hierarchy and rigidity of the agencies that oversee these projects directly conflicts with organizational characteristics central to innovation. Rather than providing the discretion to public officials necessary to responding to unforeseen circumstances and solving problems that emerge throughout the development process, these agencies attempt to make the innovation process tractable. Increasing the predictability of the actions of public managers is intended to promote accountability for finance and fairness, and result in more equitable public outcomes, but also generates enormous tradeoffs in the effectiveness of our public programs.

The venture capital process, in contrast, provides an example of an alternative investment process that is designed to accommodate and learn from the uncertainty and unpredictability of the innovation process. Because venture capitalists have the discretion to gather and react to new information, they are much more effective at solving problems that emerge throughout development. Understanding this practice provides insights into solving the managerial and administrative problems posed by the notion of more flexible, entrepreneurial public managers. At first glance, the venture capital process appears to hinge on the personal judgments of individual investors, but examining the process more carefully underscores a more subtle system of decision-making and accountability grounded in informal networks. Throughout the process of choosing projects and managing the development process, venture capitalists constantly embed their decisions in an informal network of social and professional contacts in order to qualify their intuition about the venture. These networks are formalized within venture capital firms, which often require their partners to reach consensus about new investments before allowing the individual venture capitalist to proceed. This system provides for flexibility in decision-making while still guarding against the potential mistakes in individual judgment. In addition, it suggests a way in which the public sector might design less hierarchical decision-making process without greatly increasing the risk of corruption and personal favoritism in the making investments in demonstration projects.

Informal networks of trust also ground the broader system of accountability within the venture capital process, and provide suggestions for arranging new mechanisms for accountability for the public sector. Accountability in the venture capital process is based on a series of performance benchmarks that allow venture investors and the board of directors to measure whether or not the company management has performed as expected. Although this system appears to represent only a method of retrospective accountability for performance that is common throughout the private sector, on closer inspection the process is much more fine-grained. Rather than simply reviewing the performance of the company on a quarterly basis, the board of directors engages in an ongoing process of reframing these benchmarks via interaction and negotiation with management. The common understanding that develops via this interaction results in a set of implicit expectations for performance that are grounded in these benchmarks but

may diverge from the business plan when the company faces unexpected situations. This relationship between the board of directors and company management holds parallels to that of the public managers that oversee demonstration projects and congress, and suggests that building new institutional mechanisms for trust between these parties might provide a solution to the accountability problems posed by a more entrepreneurial public officials.

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