How to Maintain Innovation.gov in a Networked World?

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The potential for the diffusion of information regarding successful governmental (international, national or subnational) innovation has increased enormously in recent years. Information from geographically distant locales is often simply a click away, where networks of intergovernmental information exchange are spontaneously emerging. The intertwining of information technology and globalization – extends the pool of accessible innovations and lowers the barriers for their diffusion. (Bernstein & Cashore, 2000; Coleman & Grant, 1998; Coleman & Perl, 1999; Evans & Davies, 1999)

This diffusion process has enormous potential for increasing public welfare, by allowing location B to adopt the successful innovation in location A. There is, however, a potential dark side to the increased diffusion of information. First, as information diffuses more efficiently, it becomes more of a public good. As the publicness of information increases, so does the likelihood of free riding. There is an incentive for each government to allow another government to take the risks of innovation, and then to simply adopt the successful innovations. Second, in complex policy areas, the diffusion process may be too efficient: resulting in either premature convergence on a non-optimal policy, or eliminating policy alternatives that while not optimal in the present, might be in the future.

The governance implication is that in the networked world special attention must be given to increase governments’ incentives to experiment and innovate. (Moon & Bretschneider, 1997)

This paper will be organized as follows. First, it will briefly discuss some distinctive features of the diffusion process in the public sector. Second, it will analyze the “informational efficiency” of spatial versus non-spatial networks. Third, it will examine the potential for informational free riding in the networked world. Fourth, it will study the paradoxical possibility that the more efficient the system is at spreading information, the less information the system might contain. Finally, it will discuss the...
implication for governance: how does one design a system that is efficient at “spreading the word” while encouraging experimentation?

Inter-organizational diffusion of innovation


Similarly, there is a large literature on the diffusion of innovations through inter-organizational networks within and between corporations. (Atkinson & Bierling, 1998; Coleman & Grant, 1998; Dolowitz & Marsh, 2000; Dyer & Nobeoka, 2000; Evans & Davies, 1999; Gupta & Govindarajan, 1991; Kogut & Zander, 1992 & 1995; Liebeskind et al., 1996; Nooteboom, 1999; Radaelli, 2000; Robertson, Swan, & Newell, 1996; Rom, Peterson, & Scheve, 1998; Seeliger, 1996; Weale et al., 1996) This literature suggests that a tremendous amount of information flows through inter-organizational networks (typically measured through overlap of corporate boards).

Information diffusion through intergovernmental networks is quite different on certain dimensions from diffusion in the private sector. First, in the private sector, many innovations are proprietary, thus increasing both the cost of adopting an innovation, as well as the likelihood of the innovation in the first place, since the innovator may extract most of the benefits of that innovation. The profit motive also means that the innovator has an incentive to spread information about the innovation. Second, where innovations are not proprietary, a corporation has an incentive to keep information secret from competitors as long as possible. The public sector, in contrast, has no incentive to

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1 Although spillovers occur not just in the public sector but in the private as well, despite the protection of intellectual property law. Baumol (1999) for example, estimates that innovators retain only approximately 10% of the gains from their innovations.
suppress information about successful innovations. Third, with survival less of an issue, and relative performance more difficult to measure, bureaucratic inertia is likely a greater barrier to adopting successful innovations in the public sector than in the private. Fourth, many policy makers are likely “proselytizers”—moved to innovate and to spread the word in order to increase their impact on society.

There is therefore substantial potential for diffusion of successful policy innovations, both intra and internationally. The question asked here is what is the impact of the shift from local to global informational networks.

**Spatial and emergent informational networks**

First, a few definitions: An informational network is a set of dyadic connections among individuals, where information is exchanged over those connections. A “spatial” network is a network whose dyadic connections are spatially determined: each actor speaks exclusively to other actors in its neighborhood. For example, in figure 1, A communicates only with its four immediate neighbors to the north, south, east, and west.

![Figure 1: Example of a spatial network](image)

An emergent network is one in which spatial contiguity plays little or no role in determining who communicates with whom. The emergent network is determined by a “meeting and mating” process: a combination of chance collisions and the resulting choices of whether to pursue relationships.²

²Verbrugge 1977.
Following the “small world” findings of Watts (1999) and Watts and Strogatz (1998), the first proposition this paper will make is that neither spatial nor emergent networks are efficient at spreading information:

**Proposition 1**: Neither a purely spatial network nor (non-spatial) emergent network is very efficient at spreading information. However, overlaying a spatial and emergent network will be very effective at spreading information.

A simple illustration will demonstrate why a purely spatial network is not efficient at spreading information. Consider the network represented by figure 2, where each actor communicates with its immediate four neighbors.

Assume, now, that the actor in the middle of the chess board has a successful innovation, which is then adopted by its four neighbors, which is in turn adopted by each of their neighbors, and so on. It will take 10 rounds of communication before the whole system has adopted the innovation. By comparison, a “random” network, where actors randomly
“collide” with four other actors each round, will take just 4 rounds before the whole (99+% system has adopted the innovation.\(^3\)

A spatial network is inefficient at spreading information simply because the informed are spending most of their time communicating with other informed actors. Only at the periphery of the informed set of actors is information actually spreading.

One might imagine that emergent networks, the result of seemingly random collisions, and be far more efficient at spreading information. However, empirically, emergent networks suffer from the same problem as spatial networks. Emergent networks tend to break down into cliques within which there is a great deal of communication, and between which there is relatively little communication. If actor A is connected to actors B and C, the probability that B and C are connected are greatly increased. In a diffusion process, this means that the diffusion of information may break down between cliques. Bridges between cliques are therefore especially valuable, from a diffusion perspective (Burt 1992).

An overlay of an emergent network on a spatial network will be far more effective at spreading information than either one alone, for the simple reason that the spatial network will provide bridges between the cliques (or, alternatively, the emergent network will provide bridges between the regions), thus increasing the proportion of the uninformed in communication with the informed.

A minor elaboration of the above example will illustrate why. Imagine, now, that while all actors still communicate with all other actors, the actor in the middle of the chess board communicates also with an actor in the distant corner.\(^4\) What impact will adding just this one tie to the 242 that already exist have on the speed with which the innovation spreads? It will take \textit{40\% less time for innovation to spread}. Alternatively, what is the impact of simply accentuating the existing spatial network by doubling the neighborhood with which an actor communicates? Increasing the number of

\(^3\) Note that this is a different notion of a “random network” than Watts and Strogatz (1998) use.

\(^4\) In this scenario I am assuming that the chess board “wraps around”; i.e., the actors on the top communicate with the parallel actor on the bottom; actors on the left communicate with the parallel actor on the right.
neighborhood ties by 242 is only slightly more effective than adding one non-neighborhood tie— the time it would take for an innovation to spread drops by 50%.

Figure 3 presents the rate of diffusion for four diffusion models: random, spatial with 4 neighbors, spatial with 8 neighbors, and spatial with 4 neighbors + one non-spatial tie.

![Figure 3: Four modes of diffusion](image)

The above analysis highlights how the networked world, by increasing the number of non-spatial connections, can dramatically increase the rate of the diffusion of an innovation. From a systemic point of view this has an enormous upside: first, it will reduce the amount of re-inventing the wheel that occurs in government; second, it will increase the proportion of governments adopting the best means available to accomplish their policy objectives.

The dark side of the networked world: free riding and premature policy convergence

There is a potential downside to a more informationally efficient system, however. Specifically, governments may become more complacent with respect to innovating, in the hope that someone else will bear the costs of a successful innovation.
Proposition 2: As we move to a more informationally efficient system, there is an increased risk of free riding on other governments’ innovations. Free riding is ameliorated if there is a divergence in underlying policy values, and if policy entrepreneurs value the impact they have on the broader world.

Imagine a potential innovation that yields $1.10 worth of benefits and costs $1.00 to produce if a government produces the initial innovation, or is free if some other government produces the innovation. Assume, further, that there are 100 governments. In the absence of any information diffusion (call this the “island scenario”), every government will spend $1.00, and produce $1.10 worth of benefits, for a total of $110 of benefits for $100 of costs. In a world where there is rapid diffusion of information, assume that there is an initial innovator, that spends the initial $1.00, and reaps $.10 worth of net benefits. All other states then adopt the innovation, for $1.10 worth of net benefits. From the systemic point of view, that $1.00 of cost has yielded $109 of net benefits, as compared to just $10 in the previous scenario. From a systemic point of view, this is an enormous success. From 99 governments point of view, this is an enormous success. For the 100th government, this is, in absolute terms, exactly the same as the island scenario.

The networked world scenario is therefore pareto superior to the island scenario. However, it is not a stable scenario if you assume that the choice to innovate is endogenous. If you assume (1) that each government is choosing whether to innovate; and (2) that the innovation decision, over the long run, is itself modeled on the decisions of the governments that produce the highest net benefits, the equilibrium scenario is zero innovation by any government-- 0 net benefits.5

The impact of free riding is particularly acute because the benefits of an innovation would be so much greater in the networked scenario-- in fact, innovations that result in net absolute losses for an innovator could result in welfare gains for the system. If one assumes that the initial costs of an innovation are F, the costs of adoption for each
government after the initial innovator are c, the benefits for each government from that innovation are B, and N governments benefit from that innovation, then the innovation would result in net benefits if \( N(B - c) - F > 0 \). For example, if \( N = 100 \), \( c = 0 \), \( B = $1.10 \), that innovation would produce net systemic benefits even if \( F = $109 \). The innovator, however, would face net losses of $107.90.

The danger of free riding is determined, in part, by whether governments have different underlying preferences with respect to a potential innovation. Free riding is a great danger where “one size fits all”—governments have identical preferences. It is no danger if each government requires a unique solution (of course, in this latter scenario, there is no benefit to the networked world either).

The possibility of free riding may be reduced to the extent that policy makers are “proselytizers”, valuing the possibility that their innovation will spread. If one assumes that, rather than being egoists, policy makers are proselytizers, then the rate of innovation in the networked scenario will be greater than the rate of innovation in the island scenario.

A second danger in the highly networked world is that some diversity of policy solutions will be lost, to the detriment of the system. The decision to attempt an innovation will rely in part on a government’s assessment of the innovations adopted by other states, and whether there is a consensus in the system as to what best practice is. In a poorly networked world, a government will occasionally look at what a small number of other governments are doing— if none have a clearly superior alternative, that government may experiment. A successful innovation somewhere in the system will spread slowly, resulting in continued experimentation in the rest of the system during a slow “take off” period. If that innovation is the optimal solution this is clearly dysfunctional; however, if it is not, the continued experimentation may uncover a better solution.

Alternatively, even if the successful innovation is optimal, it may not be optimal in the future, and maintaining a diversity of approaches would therefore be healthy.

\[ ^5 \text{More technically, “no innovation” is an evolutionarily stable strategy-- see Axelrod} \]
Proposition 3: As we move to a more informationally efficient system, there is an increased risk of premature convergence on a particular policy solution. Premature policy convergence is exacerbated if there is a convergence in underlying policy values.

Heterogeneity is a systemic property that may yield benefits to all within a system. Adherence to unconventional and suboptimal policies today may provide diversity in the system for all to benefit from tomorrow. It also serves as a platform to experiment from. Excellent policy solutions may only differ from policy disasters on a few dimensions. A world where everyone rapidly converges to “best practice” will likely have better policy outcomes in the short run than a world where everyone experiments in different “neighborhoods” of the policy space and then only slowly converge to best practice. However, the latter world will have more experimentation and may be more likely to produce better policy outcomes in the long run.6

A classic example of premature convergence is the convergence on the QWERTY layout of keyboards. Early in the typewriter industry, there was substantial diversity of key layout. The QWERTY layout was originally designed to slow typing to prevent the mechanical jamming of the typewriter, and, over time, through a diffusion process, the QWERTY layout became standard. While the mechanical jamming of typewriters is no longer a problem, the QWERTY standard remains.7 One might hypothesize that QWERTY-type of outcomes are more likely in an informationally efficient system.

The likelihood of A adopting B’s innovation should drop as the similarity of A and B’s policy objectives drops, since B’s innovation would presumably be tailored to its policy objectives. Heterogeneity in underlying policy objectives should therefore help maintain a diversity of policy approaches.

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6 See March (1991) more generally on the trade off between exploration and exploitation.
7 See David 1986. Also see Liebowitz and Margolis (1999) for a critique of David’s analysis.
Conclusion: how to maintain innovation.gov?

Globalization should have an enormously positive effect on the spread of innovations. The shift from relatively geographically bound networks to global networks should greatly increase the informational efficiency of international policy networks. Yet, by increasing the rate at which successful innovations spread through the system, globalization may discourage policy experimentation due to free riding and premature policy convergence. This suggests a counter-intuitive governance prescription: as governments receive more information regarding what other governments are doing, incentives for all governments to continue experimenting (and thus creating information) should be increased.
References:


