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A Conscious Geography: The Role of Research Centers in the Coordination of Innovation Policy and Regional Economic Development in the US and Canada

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Abstract:

Through a comparison of how a "conscious geography" has informed the organization of research centers in the US and Canada, this article contributes to the debate about the role of regions in the devolution of national science, technology, and innovation (STI) policy. A "conscious geography" refers to a policy framework in which the spatial distribution (and concentration) of innovation and/or production is explicitly considered. In both countries, *Centers of Excellence*, either based in, or affiliated with, universities, have become lynchpins of an evolving multi-scalar STI policy.

The geographic consciousness informing each set of institutional structures, however, varies significantly. Early evidence indicates that the Canadian model, which explicitly takes a geography of production and innovation into account, produces more positive policy outcomes than the US model which employs an ad hoc approach to space. The explicit consideration of the spatial distribution of production appears critical to multi-scalar collaboration, contributing to both horizontally-distributed networks across regions and between researchers and vertically-integrated networks within scales (e.g. the national and regional).

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1. Introduction

In the present era of globalization, policy coordination across scales, within and between national contexts, has become increasingly challenging. The rise of multi-national and supra-national agreements and trade blocs, like the European Union and the North American Free Trade Agreement (NAFTA), have drawn attention to emerging models of strategic policy coordination across countries. However, the need to coordinate policies at sub-national scales also deserves attention. According to some observers, "The big questions of the 21st century relate to the nature and dynamics of these multi-scalar governance relations and the implications for policy outcomes over time" (Perry and May 2007).

While an extensive policy discussion about the regional scale and an evolving "new regionalism" has developed among urban planners and economic geographers, the discussion of multi-scalar governance in science and technology policy has generally lagged behind an emphasis on the technologies themselves (Pike, Rodríguez-Pose et al. 2006). The case of research centers, however, has been the exception. As fixed sites of scientific production, research centers have become central spaces for experimentation in the implementation of coordinated national and regional innovation policies.

This article contributes to the debate about the devolution of national science, technology, and innovation (STI) policy through a comparison of how a "conscious geography" has informed the organization of research centers in the US and Canada. A "conscious geography" refers to a policy in which the spatial distribution (and concentration) of innovation and/or production is explicitly considered. In both countries, *centers of excellence*, have become lynchpins of an evolving multi-scalar STI policy. The geographic consciousness informing each set of institutional structures, however, varies significantly.

Since the 1990s, "the region" has emerged as a central scale for urban and metropolitan governance on equity, efficiency, and sustainability grounds (Dreier, Mollenkopf et al. 2001). The region has also emerged as a critical scale for public investment in research and development, innovation, and technology transfer. Despite this consensus on the region as the scale of action, academics argue that "getting the scale right" is only half the objective. It is necessary to get the policies, institutions, and the politics right as well (Markusen 2001). And, action cannot be *limited to* the regional scale (Clark and Christopherson 2008).

Research centers have become critical sites for getting the both the scale *and* the institutions right for the developing multi-scalar science, technology, and innovation policy models appearing in many industrialized countries (Perry 2007). As a consequence, the location strategy of these centers has become increasingly linked to the regional economies within which they are placed. Unlike previous models of isolated researchers on compounds and behind gates, policymakers now see research centers as sites of applied and cooperative research where firms and universities cross traditional boundaries and transfer technologies. These activities build regional capacities through entrepreneurship and innovation. As a consequence, research centers have become central spaces for scientific production *and* for technology-led regional economic development.

The merger of science and technology policy and economic development at the regional scale has led to a variety of national models. Few of these models have escaped some "policy blurring," making the boundaries between policy arenas indistinct. Thus, previous policy typologies which guided the division of responsibilities among scales of governance---national, state, local---are less clear (Lowi 1995; Gieryn 1999). Comparative evaluation of the national models of multi-scalar science and technology policy tend to highlight the specificity of national policy contexts rather than the relative efficacy of the models themselves.

Preliminary evidence indicates that the Canadian model, which explicitly takes a conscious geography of production and innovation into account, produces more positive policy outcomes than the US model which employs an ad hoc approach to space. The explicit consideration of the spatial distribution of production appears critical to multi-scalar collaboration, contributing to both horizontally-distributed networks across regions and between researchers and vertically-integrated networks within nested scales (e.g. the national and regional) which promote a value-added policy approach.

This article begins with a discussion of the theoretical arguments behind the idea that the presence of agglomeration economies is important for innovation policy and regional development. These theories are central to the argument for a conscious geography. Second, the article describes the different models of research centers in the US and Canada and the role of the region in each set of policy frameworks. The final section discusses how and in what ways policy outcomes---particularly the formation of inter-regional networks---are improved in the cooperative, Canadian approach.

2. The Devolution of STI Policies and the Locating of Research Centers

There is an extensive literature in economic geography and in innovation policy on regional innovation systems and the link between regional economies and innovation capacities (Asheim and Isaksen 2002). This literature developed from a series of discussions, notably industry clusters and learning regions, which highlighted the roles of human and social capital and institutional infrastructure in producing territorially-embedded capacities suitable for the ongoing production of enabling and emerging technologies in a competitive global economy (Gertler and Wolfe 2002). While a series of policy frameworks have followed from this extensive literature, the vast majority of policies have been slow to recognize a critical variable in the analysis of innovation and technology transfer: space.

The intensity of the focus on the region as the central scale of economic action (and by extension applied research) is predicated on theories of how the spatial distribution of production results in a particular geography. In the Canadian case, this existing geography has been central to the formation of the *National Centers of Excellence* (NCE) framework (Salazar and Holbrook 2007). While many of these theoretical frameworks have arrived at similar policy formulations, it is important to understand how central space is to the conceptual rationale for investment in institutional research capacity.

2.1 Theories of Innovation and Development in the Region

There are five major theoretical arguments about what makes places competitive in a global economy and why it is critical to understand the spatial distribution of production and innovation. These arguments are not mutually exclusive and exist in tandem across case studies and other empirical work. There are particular implications for research centers and multi-scalar science and technology policy implicit in each of these arguments about regions and industry and technology specializations.

First, places are said to build, sustain, and retain specializations in technologies, products, and processes due to regional path dependencies set by existing firms and localized institutional forms (social, political, and economic) (Patel and Pavitt 1997; Martin and Sunley 2006). These path dependencies then establish the "lock-in" by which institutional forms and technological changes evolve along a common path in regions over time.

Second, and most directly related to the previous articulation of the role of institutional forms and technological "lock-in," is the argument that regional labor market capacities and specifically regional labor market specializations in technologies, processes, and products establish the competitiveness of a regional economy over time. As a consequence, it is the regionally distinct set of private, public, and non-profit education and trainings institutions, labor market intermediaries, and regulatory regimes which establish the production capacity and entrepreneurial ethos of a given regional economy (Peck 1996; Piore 2002; Benner 2003).

The third set of theories broadly relates to the notion that it is territorial governance, or the regional regulatory regime, which most directly influences the evolution of regional innovation capacities and the character and shape of the production process (Braczyk, Cooke et al. 1998; Crevoisier 2004; Morgan 2004). Both the labor market and territorial governance theories provide theoretical explanations to the empirical observations which shape the lock-in and path dependencies arguments.

The fourth theory largely deviates from the regional path dependencies argument by articulating a theory of firm strategies and cooperation and competition among and between firm networks (Dicken and Malmberg 2001; Christopherson and Clark 2007). In this theory, it is not the region which has a distinct culture of "lock-in" but the firms that operate in the region and dominate its production processes. This theory argues not only that firms shape innovation strategies but that they do so while shaping and being shaped by regulatory regimes.

Finally, the last major theory, which directly underscores the regional innovation systems debate, is the idea that regional competitiveness is shaped by the research and development capacities of embedded institutions, like universities and innovation centers, which then transfer that technology and innovation capacity into firms in the regional economy (Florida 2002; Storper 2002; Asheim and Coenen 2006). In this scenario, it its institutional innovation capacity which provides a research and development engine for entrepreneurial activities critical to regional competitive advantage.

All five theoretical trajectories have largely converged on a policy framework that places universities and university-based research at the center of innovation and technology transfer strategies (Bell 1996; Bozeman 2000). This has indeed been the case in North America. The essential variation has been in the structure of the institutional arrangements which organize and administrate the research centers as a network.

2.2 Locating Innovation: Regional Innovation Systems and the Devolution of STI Policy

Much has been made of the expansion and development of territorial innovation systems (Moulaert and Sekia 2003). Territorial innovation systems, sometimes called regional innovation systems, refer to an emerging set of development strategies and policies focused on the sustained investment in place-based research and development capacities (Asheim, Coenen et al. 2007). These systems have become the focus of innovation-led and high technology-focused economic development strategies in both industrialized and industrializing countries. This study of the role of research centers in the development of the US and Canadian STI policy highlights the different approaches to national and regional innovation systems and different levels of coordination in the US and Canada. Nevertheless, research centers play a central role in both policy regimes (Gertler and Wolfe 2002; Feldman and Desrochers 2003; Doloreux 2004).

Unlike industry-focused development strategies, popular in the 1990s, the policy applications of territorial innovations systems prioritize public investment in research and development capacities related to targeted technologies rather than the factor components of specific industrial products (Markusen 1996). In other words, regional innovation systems organize public investment through public, non-profit, and educational institutional actors (embedded in regions) and directed toward technologies (e.g. nanotechnology, biotechnology, photonics) rather than the manufacture of particular industrial products (e.g. automobiles, medical devices, textiles, or furniture). Universities have become central institutions in this policy project balancing the investment in the science behind innovative technologies while simultaneously commercializing those innovations (Rip 2002). This difference, between public investment in innovation capacities rather than in production capabilities makes regional innovation systems a distinct form of economic development investment, predicated on a particular (spatial) theory of what makes a region competitive in the global economy.

It should be noted that the question of the role of space (or territory) in the realm of innovation policy, is an open question. Innovation, as a pre-production process, necessarily cultivates a different geography from the spatial distribution of production from which many of our theoretical models are derived (Simmie 2005). While the theoretical frameworks outlined above vary in their explanations, they point clearly to the research centers as central to evolving models of multi-scalar STI policy (e.g. research and development investment in regional institutions within regional economies with existing capacities).

Once policy recognizes the critical role of space, two questions, shaped by the different goals embedded in the variety of national models in current practice, emerge. First, does the spatial distribution of innovation mirror the spatial distribution of production and what do variations in these geographies mean for lagging regions and for uneven development? And second, at what scale should STI policy be shaped and funded and what is the role of the region in the formation and implementation of national innovation policies? Different national models have emerged with different answers to these questions. In the next section we will look at the variations in the North American context through and analysis of the research centers in the US and Canada.

3. *Centers of Excellence* Models in the US and Canada

The five trajectories of explanation-building around regional competitiveness are deeply intertwined. Indeed, it is the empirical difficulty surrounding the dis-aggregation of competing independent variables that motivates a comparative case study approach to national innovation policy and the role of the region. This article extends analysis to include the US and Canadian cases. In contrasting these cases with a typology developed in a recent special issue of *Regional Studies* on science policy and the emergence of a regional STI policies in Europe, it becomes clear that the North American models of multi-scalar policy collaboration are distinct from those other industrialized countries (see Table 1). This analysis builds on a body of research in Europe and the UK and particularly, the project, *Building Science Regions*, which analyzed the coordination between national and regional innovation systems in several European countries (e.g. the United Kingdom, France, Germany, and Spain) (Perry 2007). The US and Canadian cases extend and complicate this research on the devolution of STI policies by adding the complexity of the North American local and regional development contexts.

Table 1 illustrates four of the dominant models of regional participation in the devolution of STI policy. The US tends to follow either the coordinated model or competitive model while Canada has directed its national innovation policy and particularly the NCE model towards a more collaborative vision. There is a role for the region in both priority-setting for policy and in implementation.

In the US, there is the nationally-coordinated model which sees the region as the site of public investment in scientific production (as in the older model of Department of Energy and Department of Defense research centers). This model holds true to a national science and technology policy. The second model is the competitive regional model of innovation which follows from the technology-led economic development tradition with states and regions making the decisions about which technologies to support, through which regional institutions, and through which funding mechanism (it should be noted that this is often, though not always, state or local financing). The limitation of both of the US models is that they do not take a spatial approach to building a network of scientific production.

Insert Table 1 here

3.1 Background on Research Centers in the US and Canada

In the 1980s, the "*Center of Excellence*" model of applied scientific research reached the radar screens of policy makers working on STI policy and economic development in the US and Canada. Studies by the Organisation for Economic Cooperation and Development (OECD) identified gaps between innovation and commercialization in Canada and similar research in the United States indicated a "crisis in competitiveness," challenging US dominance in the global economy. A series of technology-driven product innovations and shifts in production processes by newly industrialized economies lead to calls for immediate policy responses in the US and Canada. In this context, the research centers model of scientific production developed in North America, with an explicit interest in the connection between advancements in science and technology and the growth of the national economy (Bluestone and Harrison 1982; Zysman and Tyson 1983; Atkinson-Grosjean 2002; Bozeman and Boardman 2004). As a consequence, the research center model of scientific production is deeply intertwined with national and regional economic development priorities in most industrialized countries (Perry and May 2007).

In the United States and Canada, the research centers model did not begin with the major policy transformations of the 1980s. In both countries, the "*Centers of Excellence*" or "innovation centers" model represented a deviation from the network of national government labs implemented over the post-War era and sponsored by a variety of federal agencies. The emphasis of these national labs tended to be on a sector of the economy (e.g. energy or defense) rather than a specific industrial sector (e.g. automobiles or semiconductors) or a targeted technology (e.g. biotechnology, nanotechnology, or optics and photonics). The transformation of the research center model began in the 1980s with the inclusion of an explicit goal of technology transfer, an emphasis on the collaboration between academic researchers and industry with the intention of commercialization, and the reorientation of the research centers towards an emerging technology rather than an established industry sector (Rood 2000).

While often billed as primarily sites of scientific production, the focus on industry collaboration and technology transfer has resulted in a research center model distinctly different from the post-war network of government labs and university research centers. These changes to the public role in basic and applied research and the relationship between academic and industry research, were not wholly new. In the early 1980s, David Noble provided detailed accounts of the intimate relationship between university centers and industry research throughout the post-war era. (Noble 1977; Noble 1986). However, the evaluation of academic-industry projects proved that the models mattered. The uneven success of academic research parks demonstrated that physical proximity was not sufficient for successful technology transfer (Massey, Quintas et al. 1992). The organization, management, and cultural character of university-based research centers seemed to matter to the productivity of researchers, technology transfer, and industrial performance (Gray, Lindblad et al. 2001; Lin and Bozeman 2006; Ponomariov and Boardman 2008). The current research centers model has emerged as distinct from previous iterations, in part, because of the multi-scalar policy coordination between technology and innovation and economic development, and the central role of universities as key policy partners (Bozeman 2000; Godin, Dore et al. 2002; Ehrenberg, Rizzo et al. 2003; Benneworth and Charles 2005; Steenhuis and Gray 2006). A significant consequence of the new research centers model is the implicit linking of national science and technology policy with state and regional economic development strategies in both the US and Canada.

3.2 Collaboration vs. Flexibility: Canadian and US *Centers of Excellence* in Practice

In the mid-1990s the US and Canada undertook two different national strategies aimed at institutionalizing the research centers model within the culture of science, technology, and innovation practice. In Canada, the *National Centers of Excellence* (NCE) program is a partnership of Industry Canada and three other federal agencies: the Natural Sciences and Engineering Research Council (NSERC), the Canadian Institutes of Health Research (CIHR), and the Social Sciences and Humanities Research Council (SSHRC) (KPMG 2002). The NCE program has been based in universities and emphasized a “distributed network approach.” The network approach took two directions. It paired a national network of scientific excellence with a local network of firms and industry actors. Thus, the *Centers of Excellence* were both embedded in existing regional industrial clusters and connected across Canada to a national scientific network (Globerman 2006). Gradually funding for the federal lab system gave way to increased funding for the university-based *Centers of Excellence*. In general, funding and scientific priorities have been set by the federal government and implemented through the university networks and regional institutions (Salazar and Holbrook 2007). This model of multi-scalar STI policy demonstrated explicit administrative collaboration and a consciousness of the geographic context of innovation and technology transfer (see Table 1).

In the US, the research centers model has taken two paths since the 1980s, following parallel but uncoordinated tracks at the state and national levels. At the national level, the *Centers of Excellenc*e model was implemented incrementally through the existing framework of the National Science Foundation. Beginning with the engineering and subsequently with science and technology, the research centers model prioritized collaboration among the sciences within and across institutional and disciplinary boundaries (Harvey 1991; Bozeman and Boardman 2004).

A national model of *centers for excellence*, parallel to the Canadian model, was proposed in the US, particularly surrounding enabling and emerging technologies with established corporate and political constituencies (for example, optics and photonics, a technology specialization in both the US and Canada) (Vlannes 1991). This national model of *centers of excellence* in targeted technologies failed to emerge as a policy priority in the US. Many federal agencies and academic advocates for a national science and technology policy, however, argued for a coordinated national system to improve service delivery and improve data gathering and monitoring. In the US, researchers and policy advocates were well aware that other countries were in the process of implementing and updating STI policies including the process of developing multi-scalar approaches aimed at technology-led economic development (Sternberg 1991; Sternberg 1992).

Beginning in the late 1990s, several states in the US saw the potential of regional *Centers of Excellence* as a mechanism for economic development through investment in research and development infrastructure and an emphasis on technology transfer. In particular, the *centers of excellence* in Ontario, part of the Canadian NCE system, impressed state-level policymakers in the US. In New York State, Georgia, and Texas these research centers have emerged as explicit components of state-driven regional innovation systems intended for economic development and based, in part, on an industry clusters analysis (Porter, Group et al. 2001). In New York, the implementation of these centers was accompanied by promises of impressive job growth, a traditional economic development metric from industry investment (Aaron 2003; Gargano 2006). Like the Canadian NCE program, the state-level *Centers of Excellence* programs orient toward existing industry clusters, regional technology specializations, or specified targeted national or state priorities (e.g. genomics or stem cells). Unlike the Canadian programs, the proliferation of state-level technology-led economic development strategies has developed without explicit national coordination.

Two recent studies of state-level *centers of excellence* in the US indicate significant differences in the path pursued in the US as compared to other industrialized countries. In 2006, WestCamp, a not-for-profit in Utah participating in the National

Institute of Standards and Technology's (NIST) Manufacturing Extension Partnership (MEP) program conducted an update of a 1997 study of state technology development programs focused on *centers of excellence*. Their research found that state-level investment in technology development had tripled in the intervening eight years to almost three billion dollars (not taking into account the three billion California recently earmarked for stem cell research). They also found that forty-two states now invest in technology development in their universities and colleges, an increase of nine states in eight years (Alder 2006).

In addition to the increase in the amount of investment in state-level technology development strategies and the number of states involved in supporting emerging technologies, established industries, and commercialization, there is a proliferation of agencies across policy arenas engaged in STI policy practice. In the mid-2000s, the Minnesota State Colleges and Universities System (MNSCU) began its own *centers of excellence* program. In cataloging the existing policies and projects of other states, MNSCU found (as did the WestCamp study) that in many states a variety of actors coordinated the *centers of excellence* strategies including governor's offices, state college and university systems, economic development offices, and science and technology agencies (MNSCU 2005; Alder 2006).

In the US, the primacy of the regional scale as the site of strategic decision-making, investment, and public/private coordination in economic development stands out among developed countries. In a SPIE (Society of Photographic Instrumentation Engineers) conference on photonics technology and international competitiveness in 1991, there were several papers on specific science and technology polices targeted at emerging technologies (Bozeman and Coker 1991). Case studies included the national cases of Japan, Taiwan, and Israel and the state-level cases of Indiana and New Mexico. Only one was a regional policy, presented by the county economic development agency for Rochester, New York (Clarke 1991). While the concentration of optics and photonics technologies in the Rochester region is one of the distinct industry specialization stories in the US, the presentation of the regional-level innovation-led development strategy along with national and state policies underscores the enduring multi-scalar nature of US science and technology policy and the key role of regions as independent actors (Sternberg 1992; Clark 2004).

These two divergent national stories of the implementation of the new research centers model demonstrate how these practices resulted from and responded to the challenges of a shifting scientific research paradigm which emphasized excellence and relevance, innovation and economic development (Atkinson-Grosjean 2002). While there have been evaluations of research centers as institutional vehicles for economic development and technology transfer, it is difficult to measure the comparative efficacy of these models across national contexts because of the variation in policy goals (KPMG 2002; Wilder 2006). A close analysis of the role of space, however, and particularly the role of the region in policy-making and policy implementation, demonstrates that when space is taken into account, the multi-scalar collaboration of STI policy opens up a series of advantages.

4. Implications: A Conscious Geography in STI Policy

As mentioned previously, the devolution of STI policy has led to multi-scalar innovation systems in many industrialized countries. Further, the region has become a central scale in the conscious geography which characterizes these systems and policy approaches.

> Regionalization of Canadian federal STI has also occurred with deliberate intent, as in England, in the context of a more generalized shift towards 'governance by networks' that has arisen through the dynamic interactions between geography, science and economic development. P. 1042 (Perry and May 2007)

While different countries pursue a variety of approaches to multi-scalar STI policy, it is increasingly clear that the administration and organization of these models substantially influences the potential for national innovation system to produce greater capacity than simply the sum of set of regional innovation systems. Two elements are essential to this "value-added" STI policy model: 1) a network approach (horizontal collaboration) and 2) a multi-scalar strategic orientation (vertical collaboration). Both levels of collaboration require a consciousness of the national geographies of innovation and production.

4.1 Horizontal Collaboration: The "Distributed Network Model"

At the heart of the collaborative, Canadian, approach is the vision of a "distributed network model" in which the research centers organize a network of scientific producers who interact with the concentrations of capital (human, social, and venture) in dominant urban areas. Simultaneously, this model does not limit scientific capacity to those certain places, leaving isolated regions lagging behind the successful agglomeration economies, doomed to a future of second class citizenship. The distributed network model explicitly takes the tension between the goal of providing national access to education and research resources with the imperatives of the highly concentrated and localized geographies produced by technology transfer. The NCE network is intended to allow researchers in Regina to continue to work in place, while reaching through the NCE system to reach entrepreneurs and innovators (as well as fellow researchers) in Toronto or Vancouver. In this way, the Canadian model adds value to the national STI policy through the collaboration of a horizontal network (Wolfe and Holbrook 2002).

The US model, however, does not consider a conscious geography and thus views the distribution and concentration of regional specializations without a spatial lens. As a consequence, inter-regional competition occurs in the US preventing true collaboration and mitigating the "value-added" capacity built through a network approach (Malecki 2004).

Initial indications from comparative research on similar emerging technologies in the US and Canada indicate that Canadian regional innovation systems, based on the NCE model, produce respectable metrics, comparable to (or exceeding) those seen in the US context (examples include photonics, biotechnology, and genomics). While it remains unclear whether lagging regions are advantaged through the distributed network model, the NCE at least does not directly contribute to the series of factors which work against the economic success of peripheral regions (Doloreux 2004; Trippl and Tödtling 2007; Doloreux and Dionne 2008).

4.2 Vertical Collaboration: A Multi-Scalar Approach

While an "unconscious geography" of national innovation contributes to competition between regions for resources and researchers, it also produces a national

STI policy likely to compete rather than compliment existing agglomeration economies. In other words, a vertically coordinated, multi-scalar approach to STI policy recognizes existing innovation and production networks and builds a national system that coordinates across levels of governance. Studies of attempts to establish and nurture nascent biotechnology clusters in locations without previous and related capacities have proven that existing systems of innovation and production significantly affect emerging technologies, not just established industries. However, there appears to be distinct differences across technology and industry classes (Kenney and Patton 2005; Bozeman, Laredo et al. 2007; Boardman 2008). As a consequence, multi-scalar policy collaboration and a consciousness of the specific geographies are critical to avoiding *a one size fits all* national innovation strategy.

In the US case, the National *Centers of Excellence* study of state-level technology investment points out that the loss of potential for "value-added" due to the ad hoc approach to the coordination of a series of federal and state technology programs is significant:

> It is apparent that the magnitude of the programs being committed to and invested in by the states as shown in this document demonstrates an under emphasized phenomenon in the US today that is "technology transfer happens locally." This being the case there is great opportunity for the federal government to "assist" the process. In the past the SBIR/STTR programs and the ATP have provided funding for advancing technologies towards commercialization. A key feature of these programs has been that grants are awarded directly from the federal government to private companies without involving the states. It is apparent through this update that most of the states are trying to influence their own future economies through investment in technology niches. Now seems to be the right time to move beyond the existing programs to help the states be as successful as possible with what they are attempting to accomplish. (Alder 2006) p. 3

The critique of national innovation strategies has been that they are not nimble enough to keep pace with industry innovation. The corresponding critique of regional innovation strategies has been that they facilitate a process of inter-regional competition within countries that siphons local and regional resources from investments needed in public services which are historically provisioned by state and local taxes. The emergence of a distributed network of *centers of excellence*, however, which are both coordinated horizontally and vertically within national innovation systems presents a possible model that is both flexible enough to respond to the pace of change and coordinated enough to add value to regional innovation through a national strategy.

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Table 1: North American Models of National and Regional STI Policy

Country	Models	Regions As…	Characteristics
US	A. Competitive	***Regions as Competitors***	Region makes decisions on implementation and priority-setting and do not cooperate across regions or with the national government
	B. Coordinated	***Regions as Sites***	Nation-State makes decisions on priorities and implementation and deploys to regions (or regional institutions)
Canada	A. Collaborative	***Regions as Stakeholders***	Regional role in implementation strategies but federal priorities and funding
	B. Collaborative	***Regions as Partners***	Regional role in implementation and contribution to national policy-making