The Internet as a Metaphor for the Role of the Modern Government Laboratory

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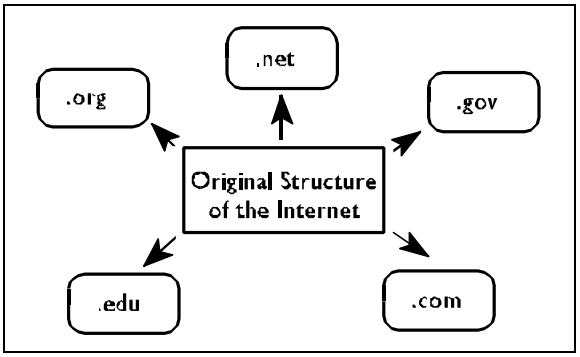
Introduction

Approximately 90 federal laboratories[2] are trying hard to adapt to changing times and expectations; to adapt their role to the emerging needs of the society, the economy, and the government. In the past few years they have received a good deal of criticism and advice on *how* to operate[3], but less guidance on the proper *role* they should play.

What is it that society needs from its public sector labs today? Is it just "commodity science" science that can be contracted to or purchased from a company or university professor, or is there more? Is there a good model we can use to describe the optimum role of the modern, "relevant" public laboratory?

Leaving aside the current temptation to deride anything dot-com, this paper argues that the dotcom world - in particular the Internet - offers a powerful metaphor for the successful modern-day public lab to emulate. We are not referring to the different ways that organizations are using the Internet (electronic business, government online, etc.), but to its taxonomy - its way of describing the world.



Before the recent invention of the .biz, .tv, .info and other trendy designations, the architects of the Internet had a simple 5-fold view of their universe. The original inhabitants of the Internet world were either network providers (.net), companies (.com), educational institutions (.edu), organizations (.org), or governments (.gov)[4].

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[2] A listing of the major laboratory groupings can be found at: http://scitech.gc.ca/fptt/federal.html

[3] For example the Council of Science and Technology Advisors, an advisory committee reporting to the Cabinet Committee for the Economic Union has produced a series of reports on the operation of federal laboratories: Building Excellence in Science and Technology (BEST), Science Advice for Government Effectiveness (SAGE), Science and Technology Excellence in the Public Service (STEPS). (For additional information see: http://csta-cest.gc.ca/publications_e.html.)

[4] Much as transportation departments and telephone companies periodically need to add letters or numbers to keep up with expanding demand for license plates or cellular phones, the Internet had to add new monikers to overcome a shortage of spell-able or pronounce-able names.

What's intriguing about the original Internet taxonomy is that it refers to more than what kind of entity server-owners are they also described what they do. And that's the important thing. The .nets provide Internet services. The.coms do business. The .edus provide education. The .orgs mostly deliver not for profit services. And, of course, the .govs provide public services.

What then does this have to do with the modern public sector laboratory and its search for relevance? Simply this; that to succeed in today's world - and tomorrow's - public sector labs will need to emulate aspects of all 5 Internet domains; they'll need to be able to perform effectively in all of them.

The .GOV Role of Federal Labs

It's not hard to imagine that public labs need to play a strong .gov role because that's after all what they're about. Nearly all federal labs play a direct role in supporting or implementing government policy. They undertake science and technology in support of policy, regulation, standards, health, safety, security, economic development, social development, community development, environmental protection, and all the other traditional roles of government and public administration. Whether developing building codes, food safety guidelines, species-at-risk assessments, pest management techniques, or conducting a myriad of other public good science, federal labs have in innate understanding of their .gov role.

Thus, they are understandably confused when excellence in conducting science and providing science advice to government gains them no respect - and no new investment. For a decade or more, successive governments have shown themselves reluctant to reinvest in federal laboratories and related research enterprises. What new investments the federal government has made in its own laboratory system have more often than not been tied to political problems[5] and opportunities[6], than to any new-found appreciation of the importance of federal labs in providing .gov-style science and technology. In spite of general expressions of support, such as those contained in Throne Speeches[7], in recent years most new investment has flowed to universities and not to federal labs.

[5] For example investments in Health Canada research following the "tainted blood" crisis.

[6] For instance, federal funds for new NRC activities in Alberta and the Atlantic Provinces.

[7] Prime Minister Chrétien's Reply to the Speech from the Throne (January 31, 2001) said that "Canada must have one of the most innovative economies in the world. A key element in getting there is to ensure that our research and development effort per capita is amongst the top five countries in the world. To achieve this objective, the government has a five-part plan ... First, to at least double the current federal investment in research and development by the year 2010. The government over the course of its mandate will increase its investment in the Granting Councils. It will do more for Genome Canada and the Canadian Institutes of Health Research. *And for research within government.*

Perhaps then, the lack of political appetite for investment in government labs lies not in what labs are doing well - that is, traditional .gov science - but in what they are not doing as well. Here's where the Internet taxonomy provides some guidance to labs. In our view - and on the evidence of the post-1995 Program Review era - providing excellent .gov S&T is a necessary condition of success, but by no means a sufficient one. What other considerations apply?

The .COM Role of Federal S&T

One of the consequences of the Program Review-inspired downsizing is that it has driven many labs toward what is euphemistically referred to as "cost recovery". In some labs cost recovery - essentially fee-for-service contract research - accounts for upwards of 50% of lab budgets. Fee-for service research has long been a staple at many labs - for example at so-called "national facilities"[8]. In many instances these institutions were originally constructed because Canadian companies could not afford or did not have sufficient internal demand to make the facilities cost-effective. Provision of the facilities by the public sector on a user-pay basis was often deemed to be the best solution. Likewise, when the benefits of the research in question were deemed to flow primarily to a single company rather than the public good, federal labs charged clients for the use of the facilities and the requisite staff time. Fees were (and in many cases still are) set in relation to the balance of public-private benefit.

Cost recovery is also seen as a test of a lab's "relevance". It is argued that if industry is willing to pay for the services of a lab's researchers and facilities, this indicates that the lab is relevant to the needs of industry[9]. So, in some respects there is nothing new about federal labs playing a .com role, at least with respect to cost-recovery. That said, there is ongoing debate over the proper level of cost recovery activities that a public sector lab should engage in.

The 1980s and 1990s saw a new interpretation of labs' .com role emerge. Though it had always been the subject of discussion, renewed emphasis began to be placed on labs' so-called technology development and transfer activities. This trend preceded the emergence of the "innovation system" and "knowledge economy" paradigms. Governments were seen to be investing significant resources in federal labs, and there was a growing desire for labs to convert those investments into new patents, prototypes, products and services whose sale or licensing would earn revenues for the Crown, and in part repay the original public investment[10]. In practice, there was little incentive for labs to go down this path, because any revenues earned would go back to the consolidated revenue fund and not be reinvested in the lab. Nevertheless, federal labs were increasingly viewed as "engines" of economic development, and new

[8] For instance NRC's wind tunnels, or the Canadian Space Agency's David Florida lab for satellite testing.

[9] The "relevance" debate has been around since the Glassco Commission: Final Report, Royal Commission on Government Organization. Ottawa. 1963.

[10] A similar pressure emerged on universities in the 1990s.

technology transfer offices and networks[11] were established across government. Their aim was to convert the intellectual property in federal labs into revenue-earning technology.

In the mid-1990s the National Research Council took federal labs' .com role a step further. Unique among federal lab organizations, NRC planners grasped the organization's economic development potential in a different way. Under the leadership of their new President, Dr. Arthur J. Carty, and echoing trends in the corporate and university sectors, NRC actively supported the development of so-called spinoff companies, and a new approach to entrepreneurship within the organization. The objective was to develop new companies around technology developed in NRC's labs, and to provide training to interested researchers with an entrepreneurial bent. Under the new approach, in 1999-2000 for example, NRC created seven new spin-off companies to commercialize technologies from institutes and centres, increased technology licensing efforts and undertook co-development and transfer of new technologies to companies, all leading to new products and services.

To date, no other federal SBDA has broken as much with traditional thinking about labs' .com role as NRC. Moreover, NRC has arguably succeeded in using its innovative .com efforts to change its image within government, both among politicians and central agencies. Partially as a result, we would argue, it has recently benefited from new government investment while other SBDAs have not[12]. Granted, NRC enjoys certain advantages - for example its independence[13] and its minimal role in the day-to-day operation of government - but not having these advantages should not prevent other SBDAs from adopting some of NRC's approaches. Most federal labs have not yet successfully developed their own .com vision and role, and still see these in terms of the older cost-recovery and technology transfer paradigms, as opposed to the innovation system and knowledge economy paradigms.

Federal Labs in a .NET Role

The Internet world assigns the .net designation to organizations that provide Internet networking services. These are the organizations that provide the "glue" that makes the Internet work. How does this paradigm apply to federal labs? .net symbolizes a lab's role in what the OECD refers to as "innovation-related networking". Federal labs have great potential - in many cases a unique potential - to act as an honest brokers in the national system of innovation, and to bring together disparate elements of the system to solve national problems and pursue opportunities.

[11] For example Federal Partners in Technology Transfer (FPTT).

[12] Another important factor in NRC's success is its adoption of a community economic development/clusters philosophy, which attempts to leverage NRC science to build innovation clusters in different communities: Ottawa, Halifax, Saskatoon, etc. Also, it has helped NRC's cause that it was willing to locate new initiatives outside of the National Capital Region.

[13] NRC is a Crown Corporation, not a line department.

In areas that are consistent with their core mandates, federal labs should be at the centre of national and international innovation networks, acting as the organizing force for research efforts, by providing leadership, resources, and expertise. Increasingly, science and technology is being seen as a networked activity that takes place in many different centres of excellence in Canada and abroad. With their own resources, federal labs can never have a monopoly on all the knowledge that is relevant to their areas of responsibility. Hence the need to be at the heart of research networks that link together the capabilities and capacity of universities and industry in Canada and abroad, alongside those of government.

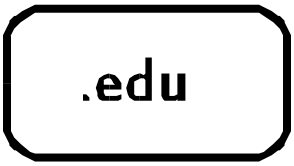
This calls for labs to evolve from organizations that see themselves *conducting* all the S&T that is relevant to their field, to organizations that ensure that relevant research is conducted and used, if not by them, then by other research performers in the network. Their role is as much to *influence, support, collect, and synthesize* research, as to make their own original contributions. Labs can never relinquish their own research, because that is the currency that ultimately buys them a place at the centre of networks, and the credibility to lead. However, they need to become what the Council of Science and Technology Advisors refers to as "inclusive"; in other words to incorporate the best of S&T, no matter where it is found.

But no lab can be at the centre of every network whose work is relevant to its department's needs. Thus the requirement to delineate networks that are *core* to a department's mandate, and where federal leadership is critical, from those that are *ancillary* to a department, and where it can participate in as an equal member with the others, but not necessarily take the lead itself. There is no doubt a third type of network that is *of interest* to a department, but not central to its mandate, where the department might become engaged as an observer rather than a full participant.

The fact that many labs no longer have the resources to be the dominant research performers in their field within Canada, means they will also need to exert greater influence over the research agendas of allied research organizations. In the environmental field, for example, it is unlikely that federal labs will ever have sufficient resources to pay for a national environmental research program. Hence the need for federal researchers to work with external groups to develop a consensus about what research directions are important, where the gaps lie, and who should take the lead in addressing them.

Evolving research networking strategies - .net strategies - will doubtless grow in importance as the world of science and technology continues to expand, and as federal labs' internal research resources fail to keep pace. Each department needs to ask itself "What is our .net strategy?".

The .EDU Role of Federal Labs



Many federal labs have a long tradition of working with the higher education sector - universities and colleges - to address their own priorities and the national interest. For instance, the National Research Council was arguably the paramount "finishing school" for scientists and engineers from the 1950s to the 1980s. NRC postdocs received

advanced training in the different NRC labs and then went on to hold senior S&T positions in universities, industry and government itself.

Providing training opportunities for young scientists and engineers clearly benefited the country, as it built up the base of highly qualified personnel. But it also had important benefits for NRC. First, it brought the best and brightest of a new generation to NRC labs, where their ideas and enthusiasm raised the overall level of performance in the lab. It also gave NRC a "first look" at the new talent, and the opportunity to recruit personnel to its own labs. Just as importantly, the students and postdoc working in NRC labs provided a natural link back to their home universities and professors. There was better exchange of information between academic and government researchers.

Over time, universities have built up their own graduate research training capacity, and many believe that the .edu role of government labs is not so important as it once was. Periodic bouts of "fiscal restraint" forced many SBDAs to cut the funds they used to create linkages with the higher education sector. In so doing, SBDAs inadvertently began to cut their ties to universities and colleges. No longer were they first to see the best and brightest and benefit from the ideas in the university system, but they also had to work harder to maintain their academic contacts

Current demographic conditions are such that federal labs and universities will each be losing experienced staff at a rapid rate in the coming years, but federal labs have narrowed the academic pipeline from which they can potentially recruit new researchers. Evidence of most labs' failure to grasp their .edu role is seen in the fact that only 6 organizations[14] have taken advantage of NSERC's[15] Research Partnership Agreements (RPA) With Canadian Government Departments and Agencies program. This program helps departments to share with NSERC the cost of working with the university sector.

It is also worth pointing out that students themselves have lost opportunities to work with excellent federal researchers, often in world-class facilities that are not present in universities. Students also lose the opportunity to work in large teams and on multi-faceted projects such as are typical of federal S&T.

So, developing - or renewing - a strong .edu role will be essential for federal labs, and will also provide enhanced training and career opportunities for young researchers.

Federal Labs Play a Vital .ORG Role

Another important role that federal labs play in the innovative life of the country is in relation to their .org function - their role in the life of the nation's scientific and technical culture, including societies, associations, publications etc. Federal labs host national and

[14] SBDAs participating in the RPA program include DND, NRC, AAFC, NRCan (CFS), CSA, and NRCan (ESS).

[15] Natural Sciences and Engineering Research Council.

international meetings and conferences. They also support academic and industry associations and professional societies by making grants and contributions, by participating in their governance, and by actively contributing new scientific and technical knowledge to their conferences and learned meetings.

Canada's small population base and proximity to the United States have historically made it difficult to sustain a vital national scientific and technical culture. We have a comparatively small number of researchers in most disciplines, and people are widely spread out. There has always been a tendency for researchers to join larger U.S. or British societies, which has made it difficult to develop our own. Much the same applies to scientific and technical publishing. For example, without the constant support of NRC for scientific publishing in Canada, we would have few if any quality Canadian journals. Most other federal labs similarly support Canadian publications in their own fields.

A large number of S&T professional associations also depend on the direct and indirect support they receive from federal labs. It is almost certain that many of these would disappear, but for the patronage of federal labs.

Thus federal labs play a vital role in the cultural life of the country by taking on a .org role themselves and supporting other Canadian scientific and technical .orgs. Usually, this support accounts for a small amount of lab resources[16], but makes an enormous difference to the partner organizations. Without our federal labs the nation's S&T culture would be immeasurably poorer than it is today.

Conclusion

To flourish in the world of the future federal labs will need to evolve 5 different roles for themselves. The structure of the Internet provides a powerful metaphor for what the successful lab of the future must be.

Labs will need to continue in their traditional .gov role, but will have to re-define what that role is. They will need to evolve from providers of "commodity" scientific and technical research that universities and industry can also supply, to change agents in the innovation system and knowledge economy.

Labs will have to expand their .com role from conventional technology transfer agents and suppliers of fee-for-service research and facility access, to entrepreneurs and innovators who are able to build companies around their ideas.

Because they will not have sufficient resources to conduct all the research they need to support their mandates, labs will increasingly need to adopt the .net model. They need to put themselves at the centre of research networks that are closely aligned with their department's objectives.

[16] Not counting the time that lab employees donate to their respective causes.

They must take a partnership role in other important networks, and play an observer role in networks that are also of interest, but not core.

Increasingly, labs will need to rediscover their training roots and foster closer ties to the higher education sector - universities and colleges - by bolstering their .edu role. They will need to offer more training opportunities to the next generation of researchers. This will help labs in their own recruitment activities, enhance the flow of ideas between labs and universities (and colleges), and strengthen linkages to academic researchers.

Finally, labs will have to strengthen the important role they play scientific and technical life of the country, by understanding and expanding their .org role.

Those labs that position themselves in each of the 5 domains will have the best chance to attract additional investment, while those that do not will struggle.

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