Is Canada Really All That Bad At Innovation?: A Tale of Two Industries

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ABSTRACT

This commentary raises questions about the degree to which global innovation indicators enable us to understand the historical dynamics of innovation in Canada, and about future directions for Canadian innovation policy. By focusing on the automotive and telecommunications sectors, two currently troubled Canadian industries with completely different histories, some of the major successes and mistakes of Canadian industrial policy are assessed critically. The conclusion is that the innovation problem in Canada has less to do with capabilities or opportunities, than with recent tendencies not to follow through when ambitious innovation initiatives in specific industries could be transformed into new national "engines of growth".

THE COUNCIL OF CANADIAN ACADEMIES (CCA) is rendering an invaluable service to the Canadian public. Over a very short period, the CCA has produced several of the most penetrating and useful analyses of the state of Canadian research and innovation to have appeared in a very long time. The most recent report, entitled *Innovation and Business Strategy: Why Canada Falls Short* and released on April 29, 2009 by the Expert Panel on Business Innovation in Canada, is certainly among them. Returning to Canada three years ago, after many years away, I was dismayed at how far general political and public awareness of the vital importance of research and innovation had deteriorated, and how, despite several new and long overdue initiatives, Canadians are still failing to respond positively to many of their chronic industrial challenges. The 'crisis' we now face may have been precipitated by financial adventurism elsewhere, but it has been brewing in our midst for decades.

Responsibility for these failures has been laid at many doorsteps. The university system in particular (unfairly in my view but with its own connivance to be sure) has often been singled out for its supposed underperformance in transferring new knowledge to the market. Government has been blamed for too much red tape on the one hand and too little intervention on the other. Business has been blamed for timidity and reluctance to invest. Organized labor has been blamed for preserving structural obstacles to change. The list goes on and on, and, indeed, none of the accused is entirely blameless.

But as the Panel rightly emphasizes, ultimately, the responsibility for innovation *in* business lies *with* business. And in this regard, it is a simple fact that Canadian business as a whole — particularly our largest industries — never looks

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to be more than a fair-to-middling performer in the international innovation league tables. There is no point in trying to argue with the statistics presented in this report. They say what they say and the same indicators are applied to every OECD country. We cannot wriggle free from their implications with special pleading.

Nevertheless, the crucial task is to interpret these indicators such that creative solutions can emerge that *do* take full account of Canada's own unique circumstances and history. One very important contribution of the CCA report is that it amplifies and contextualizes many of the comparative statistics such that a far more nuanced picture emerges of Canada's innovation profile.

Early on, the report suggests that our national innovation "problem" is extremely broad in scope, stating that "*The causes of Canada's innovation deficiency must run deep in the nature of the economy, and perhaps in Canadian society as well.*" I fully agree. The more I have learned since my repatriation, the more I have become convinced that the crux of our problem — and I am not sure that the Panel's report entirely pins down what that problem is — lies more in our experience and history than in our scientific, technological or business capabilities as such. One of the most positive and refreshing aspects of this report is that the Panel endeavors to get under the skin of these dry and rather abstract indicators and, with Cassius, entertains the possibility that our fault lies not in our stars but in ourselves.

The Panel's report is carefully researched, comprehensive, extensive and detailed. It is also presented critically and fairly. I am content to accept the validity of most of the evidence and analysis it contains. Instead, I will comment in two areas where I remain skeptical. The first concerns the degree to which this body of evidence really enables us to understand the dynamics of innovation in the Canadian experience. The second concerns what to do about it. Can we become more innovative through more R&D investment, tax breaks and university patenting? Somehow I don't think so. But with the reader's indulgence, I will begin with a story.

A Tale of Two Industries

In the past few months Canadians have witnessed serious declines in two of our once strongest industries — automobiles and telecommunications. These two industries have completely *opposite* profiles in Canadian industrial history, and it occurs to me that the way Canada is responding, or not, to their tribulations is highly indicative of our past and present attitudes towards industrial evolution and innovation. It is also indicative of the historical *strengths* as well as weaknesses of Canadian public policy in leveraging large technologically-intensive industries into what I will call national "engines of growth."

In the early 20th century, Canada had a strong domestic automobile industry which was highly innovative, e.g. the saloon car, which eventually became the standard platform for the entire industry globally, was a Canadian innovation. Sadly, Canadian significance as an independent force in the automobile industry dwindled steadily throughout the 20th century. Today, the structural importance of this industry to Canada's economy is based primarily on wages. The fate of thousands of Canadian auto workers and many more besides now lies entirely outside of Canada.

Our auto sector is a prime (though by no means the only) example of a Canadian industry in which control over the real means of wealth production — to *design the product* and to *make the market* — shifted out of the country and where its "engine" function was perceived by successive generations of policy makers as an employment stabilization strategy rather than an industrial strategy. Thousands of Canadians are now paying a heavy price indeed for the col-

lective failure of virtually every institution involved with this industry since the 1950s to deal with this social and economic time-bomb. If that sounds harsh, it is meant to be.

On the other hand, and contrary to the popular mythology that Alexander Graham Bell was somehow a Canadian (he wasn't) and that the telephone was a Canadian invention (it wasn't), Canada was a marginal player in the telecommunication industry until the 1960s. But, through smart business planning, effective coordination with government agencies and labs, productive deployment of Canada's brightest young graduates, and strategic exploitation of unique and time-sensitive market conditions in the United States, by the late 1970s Canada was as important a source of innovation and productivity in this industry as any country in the world. In terms of business expenditure on research and development (BERD), Nortel is probably Canada's one and only indigenous company *ever* to be a global leader in every single category of innovation statistic. At one time it was estimated that this single company was responsible for a significant portion of all of the R&D performed in Canada. Moreover, a huge spillover of new Canadian IT-based enterprises emerged. Despite many us and downs, Canadian companies continue to lead in many of these markets, and we are still generating them (e.g. RIM and Smart Technologies).

Our IT and telecommunication sector is a prime (although by no means the only) example of a Canadian industry in which considerable control over product design and market-making both *emerged* in Canada and *stayed* in Canada. Even when, as inevitably always happens, Nortel globalized its R&D, the company continued to play a structural role in anchoring our IT and telecom industry. But just as importantly, the "engine" function of this industry was perceived by policy makers in terms first of an industrial strategy, in the expectation that it *would become* a significant generator of sustainable jobs (which by-and-large it still is). Nortel employees likewise face an uncertain future, but this is due to questionable business decisions by this particular company. An unusual occurrence? The difference is that the fate of these workers is not irrevocably sealed by systemic institutional failure. The sector will continue to create value in Canada, even if Nortel itself plays a diminishing role.

Another part of our national mythology is that because of our close structural ties to the US economy, we are condemned to be a branch-plant economy. But the story of these two industries illustrates that proximity to US markets can be exploited to our *advantage* as well as to our disadvantage. In particular, they demonstrate the dangers of relying upon foreign direct investment (FDI) to stimulate domestic innovation, which to my horror is becoming a prominent plank in most federal and provincial innovation strategies (inchoate as most of them are). FDI can work, but it works best if a country that is open to FDI is also a significant *exporter* of FDI. That makes the difference between being a branch plant and a global player.

Thus, in terms of trying to define Canada's innovation "problem", I have been struck in particular by the gross imbalance in public perception between the current crisis at General Motors compared to the crisis at Nortel. Canada's declining position in the auto sector, where we have not had a significant home-grown stake in innovation since the 1920s, is daily news. The debate is not whether to invest billions of dollars to preserve jobs, but how many billions. In stark contrast, Nortel was pretty much a one day story. To my knowledge nobody has seriously proposed financial support for this company or this industry. And, indeed, maybe this is not necessary for the best of reasons.

For me, the case of the auto industry exemplifies all of the things that Canadian businesses and governments have done to stifle innovation

and the creation of high-value knowledge-based new enterprise. The auto industry has far too many analogues. On the other hand, the case of the telecommunication industry, at least until recently, represents most of the right things. And we have done basically some of these 'right' things in several other industrial areas as well — aerospace, canola and steam-assisted gravity drainage (SAGD) come immediately to mind. So we cannot let ourselves off the hook by claiming that we need to learn to innovate in order to compete more effectively in domestic and global markets. The problem is more serious and systemic than that.

What Do the Indicators Actually Say About Canada?

One of the few things that I find problematic about the Panel's report is that it takes a very conventional view of what innovation is and how it works. For example, it does not pursue some of the more intriguing new ideas about innovation as a social practice or about the dynamic properties of innovation, most of which come from outside mainstream economics. Indeed, the report casts innovation in rather linear terms as a process of finding solutions to problems.

But surely innovation also creates problems. As Schumpeter pointed out a century ago, entrepreneurs do not respond to demand — they create it! As such, the real risk lies not with the entrepreneur, but with the society that accepts the risk. Thus, the feedbacks from innovation are always diverse and unpredictable, yielding unintended outcomes, some of which turn out to be huge intractable problems — I need only mention our oil dependency. We might even claim that innovation drives growth by never quite solving anything, thus always seeding the field from which some other new idea or practice can emerge.

This observation plays into my nagging doubts about how useful it is to think about innovation too exclusively as an 'economic' phenomenon (responsive mainly to abstract economic stimuli), or to associate it as exclusively with technology as has become common practice. Thus, I find that although the report is forthright in exposing the limitations of the standard set of economically-oriented innovation indicators as deployed in the OECD countries, it is nevertheless drafted mostly in the same conceptual framework from which these indicators emerged.

Although the Panel points out that innovation is about much more than technology, their report still associates it more closely with technology than with any other factor. This is difficult not to do given that virtually all of the standard indicators in the OECD framework — R&D, patents, technology investment and highly qualified personnel (HQP) — are overwhelmingly oriented to technology.

But this is not to say that the R&D-oriented indicators do not tell us anything or that what they tell us is inconsistent with the two stories as told above. In the first place, criticism of these indicators often misses a crucial point. As spelled out clearly in the Frascatti definition, R&D as a proportion of total industrial or national output was intended originally to be an indicator of human capital. Or more specifically, to show changes in the ratio of value-creating human capital to value-utilizing wage labour. Both are necessary, but serve different functions.

As virtually by definition innovation is the product of human capital, gross expenditures on research and development (GERD), BERD etc. are extremely powerful indicators of innovation potential, if perhaps not of actual innovation performance. And potential is extraordinarily important. What you know how to do is as important as what you do. Thus, the GERD score can indicate change in the national stock of human capital. But much more importantly, changes in GERD when compared with other indicators can indicate how effectively human capital is being deployed. For example, a low

GERD score compared to the post-secondary graduation rate may indicate that the human capital stock is under-deployed; i.e. that workers capable of creating new value are employed in sectors that are not creating new value.

Thus, for me, the most important single exhibits in the report are Table 1 Chart 5 (in the accompanying article), which together tell us much about the relative R&D-intensity of key Canadian economic sectors. It is usually reckoned that 80-plus percent of global R&D expenditure is anchored in only about a dozen industries. All of these industries have a presence in Canada. Together, they sustain a high portion of Canadian jobs. And yet, as these tables indicate, only the aerospace, information technology and bio-medical industries re-invest substantial amounts of revenue in R&D that is performed in Canada.

So how does this relate to our stories? Well, globally, for example, the auto industry normally ranks towards the very top in R&D-intensity, but the Canadian contribution is insignificant. On the other hand, aerospace, IT and bio-medicine rank highly both globally and in Canada. But is it significant that we appear to be good R&D performers in only three sectors? Yes and no. It is not good that we deploy so few human resources in the auto and other manufacturing industries which pay such a large part of the wage bill. But other than that, Canada is not unique in having most of its R&D centered in just a few of the top dozen or so R&D-intensive sectors.

There is nothing intrinsically wrong with national R&D specialization and most OECD countries are even more specialized than Canada. The real issue is the extent to which innovation is endemic throughout the entire national industrial spectrum, irrespective of how much R&D we produce ourselves or in which sectors we produce it. Thus, it is important to consider if and how those industries in which we have strong domestic R&D profiles are integrated with other sectors. It is also important to understand the role of knowledge imports and exports in our industrial system (whether between companies, sectors or countries) and to assess national capabilities to absorb knowledge as well as to produce it.

But this means that we have to step beyond the standard indicators and look a lot more closely at the knowledge composition of companies that are not R&D intensive. The real problem with the R&D or technology focus is that inevitably it casts the innovation issue in terms of those relatively few industries whose business and investment models are oriented to a constant flow of new products. For most of these companies, technology in some form is their final product. But most companies are not R&D intensive and there is no reason for them to be. They are capital intensive, acquiring their technology through procurement and deploying this technology as an intermediate good — a means to some other end. But this does not mean that they do not also innovate or that the return from their innovations is any less significant.

Especially given Canada's industrial history and composition, surely the most serious omission in the report concerns the resource industries. It is easy to dismiss these industries as relics of the 'old economy'; part of the problem rather than the solution. And in some cases, forestry being a particularly egregious example, it can be demonstrated that Canada has declined significantly as a global source of innovation.

But the issue is far bigger than this. What do we actually know about the innovation system in these industries? Actually, not very much. We know that they do some conventional laboratory-based R&D, but that they ramp it up and down intermittently and that normally R&D is not a main plank in their strategies. But we also know that in most cases, even though the product remains an undifferentiated commodity, the process of financing, discovering, extracting, processing, distributing and decommissioning most

resource products is radically different than it was even a few years ago. What we need to know is if, how and to what extent Canadian companies have contributed to this innovation process. We also need to know about the spillovers.

The problem is that capturing the innovation dynamics of the capital-intensive part of the economy is far less straightforward than measuring the production and application of technology. As a result, innovative activities in most of our industries — particularly services and natural resources — remain all but invisible to the indicators.

I find it particularly significant in this context that Canadians figured out how to manufacture oil from sand and turn it into a business. This was as major an innovation as any in our history. Canadians also learned to turn a toxic seed into an oil that is both edible and burnable. Another first. Unfortunately, it is also significant that Canadians evacuated the innovation playing field when it came to mitigating the environmental and social impacts of these innovations and to adding yet further value to the resources themselves. Thus, our oil sand developments are held hostage to changing environmental attitudes, and our canola is shipped offshore for transformation into bio-fuels.

These examples and many more like them underpin my final criticism of the report itself, which concerns its narrow (at least in my view) focus on productivity. Certainly innovation can drive productivity, but surely it also matters where productivity increases occur. To return to my stories, I really do not think it matters that for whatever reasons high fuel consumption cars are produced more efficiently in Canada than elsewhere. For a multitude of interconnected reasons that go well beyond greenhouse gas emissions, this product paradigm is steadily coming to an end. I dispute entirely the claim in the report that the main form of innovation in our auto sector has been in process. There is a huge difference between tweaking the normal line of efficiency management (which incidentally can also require significant investment) and incremental innovation which is a source of new value.

Where innovation is concerned, whether radical or incremental, surely productivity is a red herring unless it is positioned on the cusp of some new paradigm. Canada needs to become more productive, but in new markets in which we can carve out high value niches. We desperately need to go further down the road with industries that break out of paradigms than we do at present. But to be fair to workers in our many sunset industries, we also need to figure out how to transpose the knowledge about how to be productive that Canadian workers may have achieved in the manufacturing plants and elsewhere to industries in which we can carve out a higher value stake — where Canadians design the products and make the markets.

What Is Our "Problem" and Are We Fixing It?

It seems to me that the real nature of our innovation "problem" is that Canadians know perfectly well how to innovate, but, for a multitude of reasons, as a society we do not do choose to accept the risks of innovation as often as we could. We do not stay with our successful "engines of growth" as their learning curves steepen in response to competition and changing market conditions, and we remain more committed to preserving jobs in sunset industries than to creating jobs in sunrise industries.

This says a lot to me about our historical 'attitude' to industrial development in Canada. It says that over our history we have received much positive feedback from not exploiting opportunities to innovate. We have become very good at creating a high quality of life by leveraging inputs from elsewhere. As a seasoned reader of the innovation 'tealeaves', this is what jumps out at me from our profile in the productivity and innovation league tables. The gamble we are

taking is to assume that this strategy will continue to work. And as the Panel is well aware, for the first time in our history, irrespective of the outcome of the current financial debacle, the signs are not good.

So what is missing in our 'innovation system'? Although I would not quibble with most of the Panel's conclusions, I was rather disappointed that they were so short on solutions. In the end, I found myself asking 'What measures do I see in other OECD countries that I do not see in Canada?'

Well, mostly I see the same things. Every government in the OECD hopes that by increasing investments in education and R&D, and creating positive fiscal climates, innovation will increase and sustainable prosperity will gear up. But of course, everybody can read the same league tables and most take exactly the same actions. Thus, we easily get caught in a 'Red Queen' effect where everybody runs like mad just to stand still. And indeed, with only a few exceptions now and again, most countries perform pretty much the same in all of the tables from year to year. Even the US is 'best-in-show' on only a few of them. Japan always does superbly on all of them and yet the Japanese economy has been in the tank for at least a decade. Perhaps we should not expect that a change in our position on the tables will indicate progress in meeting our challenges.

What is missing in Canada at this moment, and the Panel gives little guidance here, is precisely that crucial sense of 'system' in the interactions between the various institutions that play different roles in the innovation process — chiefly business, government and the educational sector. Whether by design or practice, most major OECD economies succeed in coordinating these resources such that they generate new industries, not just pockets of activities. In the past, Canada has succeeded with this strategy also. So what happened?

Surely part of the current problem is the evolution of our cranky constitution — the 'factor 10 dilution' as I have come to call it. Unlike the situation in some other federated countries (e.g. Germany or the United States), there are few if any mechanisms in Canada to aggregate our limited resources to support bottom-up innovation initiatives from industries that have a presence in more than one province. Instead, in virtually every key knowledge-intensive sector, there are federal initiatives and typically dozens of provincial initiatives. Nothing is connected or connectable, and the best we often achieve is that everybody gets really good at doing a part of not very much.

Secondly, Canadian governments seem to have a touchingly quaint faith in the sufficiency of fiscal measures to stimulate innovation. Tax incentives are one way of stimulating R&D in some cases in a few industries. But no innovation is entirely dependent upon R&D (many are not dependent upon it at all), and surely no smart business ever does R&D because they get a tax break. Moreover, fiscal policies often just reward patching holes in sinking ships. That this represents the largest share of what government actually does about innovation, our tax credit program embodies our innovation policy problem.

But thirdly and most importantly, the public sector focus in Canada has become too focused on research, and not nearly focused enough on development. Of all the terms in the innovation equation, research has the lowest risk for governments and public agencies for the simple reason that it is a step removed from anything to do with business. But as the Panel also notes (maybe more by implication), when it comes to national economic performance, and to innovation in particular, business and government are never very far apart. The orthodox economic policy catechism mandates that government has no business engaging in or with business. This is an interesting notion. Unfortunately, Canada

seems to harbor the only true believers in this doctrine who also practice it.

At this point it is appropriate to close by noting that virtually all of our major past successes in creating high-value world-beating innovative industries have been engineered by visionary people in all branches of Canadian society who are not worried by doctrine. Such is the case also among our chief competitors. Our emerging 'culture of accountability' is not symmetrical with the realities of entrepreneurship or with the need for government occasionally to take some of the same kinds of risks as businesses take — with the same consequences.

Congratulations to the Panel for bringing all of these and many more issues into relief. I very much hope that their report will be received by industry, government and the academy with the seriousness it deserves. And more importantly, I hope it spurs somebody to action.