

BC/Canada Innovation Competitiveness in Free Fall

PART 1

In 'And Justice for all' Al Pacino ranted 'There is something really really wrong here!!! ...'

All indications for the last few decades are that BC (and Canada) continues on a downward spiral in terms of innovative competitiveness ... once 7th, then 12th, now at 18th and accelerating in reverse ... yet we pour billions of dollars into education and research....

Isn't more spending on education the answer? After all, isn't innovation R&D a people game? And isn't the mantra – *innovation = research = universities = more \$*? Aren't we really good at that ... since we are a world leader in public research and currently sit #1? Yet study after study after study (and yet another study that is going on currently) by the federal government all confirm the continuing slide – and none can discern why it is happening or what to do about it. Very perplexing.

Well... there are a few simple truths here.

Innovation is change. But BC/Canada has never really had to change. We have lived in the lap of natural resource luxury that has always driven and continues to drive our prosperity today. Finland on the other hand (with almost the same population and resource base as BC – 5.5 million folks compared to our 4.4 million) and a similar forestry resource economy is now at the top of the 'innovation' mountain by almost all accounts and metrics. 20 years ago Finland was very similar to us ... 4 researchers/1000 workforce --- and good universities. But Finland has had to continuously change and evolve. Exposed to extreme weather and war – and dire need -- they have had to continuously rebuild and revamp. They have been forced to develop and use new technology to do that. They now make 15% of the world's fine paper, 40% of the world's pulp and paper and forestry machinery (the real value add). And ... to repeat ... they are the size of BC ... (OK about 1/5 larger than us ...but still very very small on the world stage!

For our part, we buy their chain saws and technology to cut down our forests and only produce 7% of the technology ourselves. Canada has never been exposed to war at home (so little change) ... except perhaps ... the 'bark beetle' ... and boy has that sent a ripple through the forest sector ... but we don't know how to handle wars and still haven't really got the message... and the need for aggressive technology change.

But Innovation is also the right recipe. Finland has no real advantage over us in the ingredients needed for innovation. We both have the four major ingredients -- public R&D, private R&D, Highly qualified people (HQP) and risk capital. But just as in making a cake, having the ingredients is just the first step.

The key is getting the right proportions and getting them in the right order. If one takes four major cake ingredients -- flour, water, eggs and salt/sugar – you can get a pancake, a scone, a birthday cake or an angel cake. It's all about in getting the right ingredients in the right proportions and mixing them in the right order. So goes innovation as well. And as one might suspect Finland has figured out (or at least stumbled upon) the right proportions and order. We have not.... largely since we have not had the incentive, the impetus or the insight to do so. And by trying to add more and more ... and then even

more of just one ingredient (in our case public R&D) we are not getting beyond the pancake stage -- while Finland makes angel cakes with much more value add ... and sells them for many times more.

Let's put it another way that Canadians will understand. Finland now has 16 researchers per 1000 workforce and they have a 3/1 ratio of private- collaborative/public R&D ... compared to our 8 researchers where we only have a 1/1 R&D ratio that does not produce the same level of new product opportunities or local jobs for our graduates. This means that the Finnish innovation hockey team has twice as many players on the ice and is getting 3x as many shots as our innovation hockey team. Who do you think is winning this innovation R&D game? Come on now... there has to be some pride in this! These Finnish proportions provide more productivity, more innovative capacity and more leverage ... which combine to produce more competitiveness. (We will explain this in more detail in the next piece).

So what are the takeaways?

First, we need to change ... and yes there is risk in this ... but that is the definition of innovation and R&D. Are we in the game? Second, we need a more competitive BC innovation R&D hockey team ... and this is even more than a matter of pride. Our children and grandchildren want to play innovation R&D hockey at home in BC (with home ice advantage) and not have to go to Finland to succeed. And third, we know the recipe now and can provide reputable metrics. Amazingly, we do not need more ingredients – we have them now – but they are in the wrong proportions and need re-juggling... but at no downside or incremental expense to any of the current stakeholders. A win, win, win.

Read our next piece for the underpinning of the recipe and then the final piece in the trilogy for its implementation ... made in BC.

Cornford, A and Cornford, M.

BC/Canada Innovation Competitiveness in Free Fall PART 2

In our first piece we indicated that there is a 'recipe' for optimizing (economic) competitiveness. But before we dive into details of the recipe itself, let's look at the larger perspective. One key aspect of competitiveness of our economic system is knowledge. One major form of new knowledge creation and dissemination is innovation... and one major part of innovation is driven by R&D processes – public, private and partnerships (PPP).

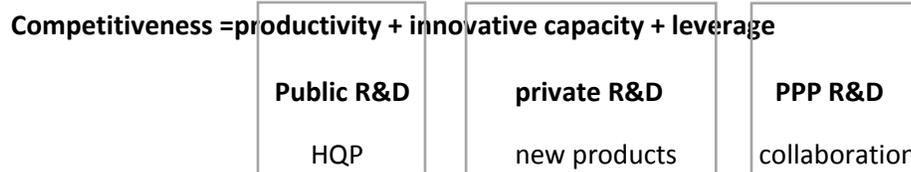
Economic system => knowledge => innovation => research => public, private and PPP

This overall 'knowledge' system is often referred to as an 'ecosystem' --comprised of many ingredients with a myriad of inter-relationships. 'Ecosystem' is a very apt description – since ecosystems are made up of processes and '*processes convert inputs to outputs*'--generating value. But unfortunately there isn't more than a stitch of information in the literature about innovation processes, R&D processes, their inputs, throughputs, outputs and flows. To great extent this is why all of the federal panel reviews have come up dry in trying to understand and explain the current Canadian 'innovation deficit'.

What makes up 'competitiveness'? In short it is a combination of 'productivity' --output per unit of workforce input; 'innovative capacity' which is a continuous stream of locally commercially relevant new product opportunities; and 'leverage' – enhanced value from combinations of assets.

Competitiveness = productivity+ innovative capacity + leverage

These ecosystem objectives may be preferentially aligned with types of R&D processes. The major output of public R&D is highly qualified people (HQP) and new ideas – so public R&D is principally focused on productivity – but is only truly effective if our university grads land in the local (research and development) economy. The major output of private R&D is new products and innovative capacity... and that of partnership R&D is leverage from combined public and private assets – the best of both plus some.



Taken together they underpin important 'ecosystem' inter-relationships:

“Highly qualified personnel are mainly produced by the universities as is pure research. It is difficult if not impossible to separate the important functions of training HQP and doing pre-competitive research from the function of producing commercially relevant R&D. An appropriate balance must therefore be struck – one that in the more innovative economies tends to be weighted towards private R&D relative to public R&D for each new investment dollar, and training and transfer of HQP to the workforce to conduct the private R&D.”¹

¹ Cornford, A. (Edited by Lipsey, R.) Benchmarking Innovative Capacity: Practice and Policy, 2005

To optimize competitiveness then we need to ‘find the balance²’ – and the ‘recipe’ -- among these processing ingredients – to produce the most value per unit of innovation R&D investment.

Without delving into too much detail -- the public R&D process produces almost 100% of HQP researchers but only 1/15 the new product opportunities – the domain of private research³. Both are essential but most effective in the right ratio – which approximates 3 parts private R&D for each part public R&D – a 3/1 ratio. This means that for every R&D dollar performed, 25% develops HQP while 75% develops new product opportunities -- which when combined with management expertise – establish levels of risk capital investment opportunities. This combination along with HQP managers produces new product opportunities which attract risk capital to generate new wealth.

As it turns out the preferred ratio of private R&D/HQP researchers/public R&D/risk capital is 3:2:1:1/4 – almost exactly the same as for angle cake. Finland has this. Canada has a 1:1:1:1/8 ratio – which is much closer to the ratio for pancake.

But it is also essential to do two additional things to the mix at the same time.

The first is the essential need to transfer HQP to local industry to maintain at least 10 HQP/1000 workforce. Canada has 8/1000 and Finland 16/1000. (Remember the hockey game?) The second is to optimize collaborative (public/private) R&D meeting the locally commercially relevant needs of local industry. To do this collaboration (the right way) is key since the # of patents produced/\$100M of R&D for public, private and PPP R&D produce 6, 36 and 52 patents respectively. Quite a lot of leverage if there is collaboration – meeting industry pain!!!

What does this all mean?

The most important takeaway is the need to direct public R&D towards “locally commercially relevant public R&D” --local industry pain -- rather than focusing on public researcher interests and just using them as the prime basis for industry collaboration. When the former occurs, collaborative public R&D may not only produce HQP (a) enhancing productivity but also (b) gain equivalent or greater innovative capacity of private R&D and (c) using collaborative leverage – the best of all worlds in optimizing competitiveness.

It also means that in the last article we can show how this ‘innovative approach’ – in a relatively short period of time – and without more investment – can transition Canada out of its ‘innovation deficit’.

Cornford, A and Cornford, M

²Cornford, A. (Edited by Lipsey, R.) Finding the Balance, ACOA publication, 2006

³Innovation, Porter, M, Stern S, and the US Council on Competitiveness, 1999 (p. 33 and 39)

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PART 3 NOT THE END – BUT THE BEGINNING

In the first PART we indicated that there is a recipe to innovative competitiveness. In the second PART we showed that with better understanding of ecosystem objectives and its processes there is a successful recipe and a solution to the current dilemma. In this last PART we show why Canada will likely remain off-track – but perhaps by a stroke of good luck – if, and only if, we can get beyond our parochialisms – we might be able to ‘luck in’ towards a solution anyway. Read on.

The bad news is that we are still accelerating in reverse – towards greater and greater ‘innovation deficit’. The even worse news is that have given our new R&D review panel the wrong terms of reference to fix things (in the absence of the ability to look at things within the overall ecosystem context). They are only going to be able to ‘fiddle with a part of the ecosystem’-- the public R&D domain part -- and not looking at interactions and interdependencies of this domain within the whole ecosystem – so the terms of reference are missing the point! Even if the panel were composed of Gods they would be challenged:

Any deity worthy of a graven image can cobble up a working universe complete with fake fossils in under a week - hey, if you're not omnipotent, there's no real point in being a god. But to start with a big ball of elementary particles and end up with the duckbill platypus without constant twiddling requires a degree of subtlety and the ability to Think Things Through: exactly the qualities I'm looking for when I'm shopping for a Supreme Being. (Lee DeRaud)

In the absence of the overall ecosystem process knowledge and the inherent interdependencies and trade-offs that need to be made, the panel will not be able to see the forest for the trees... and just end up with a spruced up duckbill platypus all over again. But maybe, just maybe – with the process and recipe knowledge we now have – and a bit of real innovative creativity -- we may be able to help out.

And by good luck or just happenstance there is a ‘silver lining’ in all of this. We are not omnipotent enough to turn bread into fish AND at the same time ... turn water into wine. But just one will do!

In our 1:1:1:1/8 recipe in PART 2, there is a simple way – if, and only if, there is the will – to change the 1 in the ratio to equivalent value of 3s. That is, if the public R&D domain (the one that the panel is looking at now) can markedly improve R&D collaboration--in the right way -- to generate ‘innovative capacity’ flows from public R&D so they are equivalent to (or greater than) those from private R&D ... we can produce outputs at Finnish levels and reverse the Canadian slide. This is what Finland has done. For non-contract work at universities we have less than 5% local commercial relevance whereas they have >66% local relevance.

You will remember that in PART 2 we showed that for 1 unit of R&D investment we get 6, 36 and 52 patents (leading to new product opportunities) output for public, private and PPP R&D respectively. So if

we can convert the public R&D to collaborative R&D based on 'local commercial relevance' we can get 8x the patent output and 15x the new product opportunity output for the same input \$ investment¹.

The solution

Eli Lilly, Proctor and Gamble, 3M and many others post their research needs and have universities submit proposals for solutions. We don't do this in Canada for public research dollars preferring to have idea serendipity and peer review decide the placement of (NSERC) dollars. The result in the former is 100% local commercial relevance and 15x the value of public R&D; the latter unfortunately only produces 1/15 of the innovative capacity outputs of private R&D; the result in Canada is less than 5% local commercial relevance. The result in Finland with public private collaboration is >15x output (as shown by the patent outputs).

We propose a Canadian R&D "pain board" for posting local industry R&D needs and making matches from outside the public R&D realm 'into the university system' – rather than the reverse strategy followed today by NSERC and other federal agencies. Expand the NSERC mandate to erase the deficit – with no new \$ needed... and with results x15 or more... than from current public R&D investment.

We also propose that the incubator system and the generators (a la Discovery Parks in BC) be recognized for what they are – an essential investment element of innovation R&D infrastructure. For ... as we all know ... research = creation + dissemination. Let us repeat that

Research = creation + dissemination

The public investment cannot stop with just doing the research and writing it up in scholarly publications to then talking about it in the ether to get more \$ to do the same again. Those \$ must come from competitive returns on investment – from value –value from industry's new products. Otherwise we die and our innovative competitiveness runs a deficit. Ever heard this before? Valued dissemination comes from the proper combination of (a) pain-driven collaborative research; (b) UILO investments, (c) generators taking in new grads and providing collaborative research venues in the local economy ... and a lot of ecosystem process knowledge – which is currently in short supply!

We have it ... and we would like to share it --- the only prerequisite is that the recipients must be prepared to innovate – and change!

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¹Innovation, Porter, M, Stern S, and the US Council on Competitiveness, 1999 (p. 33 and 39)