



## Reform SR&ED by Adopting TRL

Ron Freedman, CEO

Research Infosource Inc.

[ron@researchinfosource.com](mailto:ron@researchinfosource.com)

© Ron Freedman 2015

# Reform SR&ED by Adopting TRL

Ron Freedman, CEO  
Research Infosource Inc.  
ron@researchinfosource.com

## Introduction

Most analysts are dismayed by Canada's fair-to-middling performance in the international R&D sweepstakes. According to the OECD our GERD/GDP ratio (total national spending on research as a percent of GDP) is 1.62%, which puts us in about 20<sup>th</sup> position among advanced economies. Nearly as bad is the business sector's research performance, where we rank 14<sup>th</sup> overall.

Over the years many reasons have been put forward for this lacklustre situation: Industry sector composition/Structural economic factors; Fewer large companies; Small markets/lack of scale; Low competitive intensity; Shortage of venture capital funding; Poor commercialization of university research; Shortage of direct government funding for research/Over-reliance on indirect funding; Poor business innovation strategies; and, the catch-all Multi-Factor Productivity deficiencies. Indeed each plays a part.

Ultimately, the contributing factors fall into two categories: Those factors that are under the control of businesses and those that are under the control of governments. With regard to the latter - to factors under the control of governments - policies and programs concerned with the funding of business innovation must rank at the top. And the major federal government program that has survived decades of calls for improvement is the Scientific Research and Experimental Development (SR&ED) program, which offers investment tax credits totalling around \$3.5 billion annually. On the evidence, if the policy objective is to increase business spending on research and innovation, SR&ED is simply not working.

## About SR&ED

The SR&ED program is the cornerstone of federal government support for business research. In addition, a number of provincial governments have programs that top-up federal funding. How does SR&ED work? SR&ED will fund Basic and Applied Research and Experimental Development, defined as:

- **Basic research** is work undertaken for the advancement of scientific knowledge without a specific practical application in view. It is usually carried out in a laboratory setting ... The results of basic research are usually published in scientific journals.

- **Applied research** is also work undertaken for the advancement of scientific knowledge, but with a specific practical application in view. Like basic research, the results could be published in scientific journals.
- **Experimental development** is work undertaken for the purpose of achieving technological advancement for the purpose of creating new, or improving existing, materials, devices, products, or processes, including incremental improvements.

Companies that engage in basic research (i.e. research without a specific practical application in view) are eligible to claim SR&ED tax credits. Unexplained, and utterly illogical, is why government would encourage companies to engage in research with no practical application in mind in the first place, let alone fund them to do so?

Note the multiple emphasis in the definitions on “hypotheses”; i.e. hypothesis-driven research. If this reminds you of your high school or university science classes, you’d be right. SR&ED eligibility is based around concepts embodied in the “accepted model” of scientific discovery: namely, that legitimate research begins with a scientific hypothesis, followed by rigorous testing of the hypothesis. This academic research paradigm posits that basic, hypothesis-driven research progresses to applied research which leads to technological development and from there to new products and processes. Companies that engage in applied research that is not hypothesis driven and capable of being published in scientific journals are not eligible for SR&ED support. So, strictly speaking, world-changing innovations such as the steam engine, electricity and telephone would not have qualified for SR&ED funding because there was no scientific hypothesis underlying their development ... the scientific hypothesis came after the fact. Does this make sense?

There are also a number of “tests” that CRA applies to determine SR&ED eligibility:

- Was there a scientific or a technological uncertainty?
- Did the effort involve formulating hypotheses specifically aimed at reducing or eliminating that uncertainty?
- Was the overall approach adopted consistent with a systematic investigation or search, including formulating and testing the hypotheses by means of experiment or analysis?
- Was the overall approach undertaken for the purpose of achieving a scientific or a technological advancement?
- Was a record of the hypotheses tested and the results kept as the work progressed?

No matter that the innovation in question may be entirely new to the firm, if any other firm in the world has done or published something the same or similar, then presumably companies cannot claim “technological uncertainty”. If the development did not require formulating or testing hypotheses it does not qualify. So, a company that develops a new drug using its own knowledge and through trial and error is not eligible for SR&ED support, unless their research was based on a scientific hypothesis. Does this make sense?

## **Research in the Real World**

The problem is, with some notable exceptions, innovation in the real world of business seldom works like the academic paradigm suggests it should. Most companies don't begin research in a laboratory and after years of publishing results in scientific journals, roll out products. Most identify customer needs and assemble existing technologies - some their own and some borrowed - into new products or processes. Occasionally, they will develop technologies themselves; but almost never by starting with basic research. Even without a hypothesis, there's still plenty of room for technological uncertainty for the firm, particularly when the technology is new to the firm.

The exceptions to the hypothesis rule occur largely in the life sciences (i.e. pharmaceutical, genomics) sector, where fundamental laboratory research still underpins much of new drug development. And, a few large firms, such as IBM, still conduct basic research in their own laboratories (e.g. physics research to create new classes of computer memory chips); however, those are the exception rather than the rule. In addition, a small number of companies pull early-stage research out of universities and government labs and develop them into new products. But they seldom do the basic hypothesis-driven work themselves; it's too risky, time-consuming and expensive.

Why, then, does the Canada Revenue Agency persist in using an outmoded paradigm of technological change to fund business research - the academic hypothesis-based approach - when the real world has clearly moved on? Much of the Canadian position comes from slavish adherence to international (i.e. OECD) definitions of research that were developed in the 1960s and still canonize the laboratory-to-market paradigm. That plus a reluctance to let go of the failed orthodoxy because that would be an admission of error.

Another cause for sticking with an approach that is clearly not working is the failure to decide on what it is that governments want firms to do in the first place. The answer is really quite simple; we want firms to develop tradable goods and services - goods and services they can trade on world markets so that the country can earn foreign currency we need to pay for the goods and services we import. The focus of public policy should be on providing firms with the technological capacity - the know-how - they need to develop products and services. The focus should not be on the development of the products and services per se - that is the day-to-day job of business - but on developing the capabilities needed to develop the products and services before they enter the marketplace. In a minority of cases companies will need to engage in hypothesis-driven research in order to develop those capabilities, but in most cases not.

In reality, policymakers should (with the above-noted exceptions) be dissuading companies from engaging in basic and hypothesis-driven research and leave that noble activity to academics and in some cases government labs. Otherwise companies will be squandering internal resources far too early in the product development cycle. Remember, companies buy and sell products (and in some cases technologies), but seldom if ever, basic research or science.

The current CRA approach has un-intended consequences. Firms bend themselves into pretzels to pretend that their R&D is hypothesis-based. They are forced to hire legions of costly SR&ED consultants - often ex-CRA employees - to make it seem thus to CRA auditors. In the process, companies are motivated to spend too long and too much on basic research, because that's where the money is in the short term, and too little on capability-development. Firms that legitimately deserve assistance to develop the capacity to produce tradeable goods and services are shut out.

### **A Better Way**

Is there a better approach? You bet. The better way lies in replacing the current SR&ED philosophy and adopting the military's 9-stage Technology Readiness Level approach to supporting research and innovation:

- TRL 1. Basic principles observed and reported.
- TRL 2. Technology concept and/or application formulated.
- TRL 3. Analytical and experimental critical function and/or characteristic proof of concept.
- TRL 4. Component and/or breadboard validation in laboratory environment.
- TRL 5. Component and/or breadboard validation in relevant environment.
- TRL 6. System/subsystem model or prototype demonstration in a relevant environment.
- TRL 7. System prototype demonstration in an operational environment.
- TRL 8. Actual system completed and qualified through test and demonstration.
- TRL 9. Actual system proven through successful mission operations.

The SR&ED system should ditch its current hypothesis fixation and substitute the TRL approach. SR&ED should be used to fund companies at TRLs 1-6, which are the steps required to develop technological capability. Levels 7-9 cover standard product engineering and as such should not be funded. Note that the current hypothesis-based approach is still covered in TRLs 1-2, so companies working at those stages can still receive tax credits.

The key test that should be applied to individual projects is "Does this project significantly improve the technological capabilities of the firm?" If it does, for example by introducing a new or substantially different technology into the firm, then it should qualify. Simple. Hypotheses if necessary, but not necessarily hypotheses.

In summary, it's time to ditch the outmoded SR&ED definitions and reform the program by adopting a TRL-based approach.

\*\*\*