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Comments on
Review of Federal Support to Research and Development

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1 SUMMARY

Neptec is a highly successful SME in creating innovative technologies for space, military, and industrial applications, and is the only non-U.S. company to win NASA's George M. Low top contractor award. Our responses to the consultation questions focus on several key areas, particularly addressing errors in the models and assertions of the Consultation Paper. The limitation on innovation is in the process, not access to components, and maximizing innovation means leveling the risk across the process by putting most support at the riskiest points. The focus on "competitive strategies" and "competitive intensity" misunderstands the innovation process. These forces also act to decrease productive innovation and reduce investment in R&D by increasing risk. Innovation comes from simultaneously identifying opportunities to combine IP, market opportunities, and sufficient capital support for mitigating risk to make investments that produce customer value exceeding cost. Canadian incentives appear largely aimed at larger companies, who have the means by not the will to do R&D, despite a dominance of SMEs who have the will by not the means. Finally, we suggest that investment in education and training should not be confused with investment in R&D.

2 CONSULTATION QUESTIONS

ANSWER 1. Government should expand the definition of R&D to include activities that support the development, customization, and certification of new products for market. The current definition restricts support to the phases of development which are often the least capital and cash intensive. This leaves a significant gap, especially for small companies for which cash flow is a dominant concern. The justification for this policy would appear to be the assertion in the Consultation Paper that:

> *"the justification for government intervention is strongest in the case of basic research activities. The strength of the justification declines as research activities progress through the various stages leading to commercialization" …"The benefits of these successive activities are progressively more likely to be captured by the R&D performer, and there is correspondingly less likelihood of "spill-over" to the larger economy"*

This assertion appears to us to be incorrect. It implies that if a benefit is captured by a Canadian company that this will not "spill over" into the larger economy. Since the larger economy is made up of such "performers" this seems manifestly contradictory. This attitude amounts to government policy that support of private individuals at university and other research institutions is acceptable but support of private corporations somehow is not. Dispelling this myth is really at the heart of this question. The OECD definition stresses that innovation requires implementation. For the government to provide effective programs to encourage innovation it must provide support for all phases including the final implementation stages "leading to commercialisation".

ANSWER 2. It is not a good model of business innovation. Here are some of the problems:

(1) It is a list of components without any structure that addresses how strategic decisions are made. It suggests that federal support helps businesses to "develop or access these inputs". This is problematic as it is not access to the ingredients that limits innovation; it is carrying out the recipe. The largest risk occurs in the step between the inputs and the increased productivity, represented only by a horizontal bracket in the figure.

(2) It is too simplistic and linear. Innovation is highly iterative. It involves several core components: (a) generation of new capabilities/IP, (b) identifying productivity opportunities, (c) identifying which

combinations of capabilities and opportunities can provide value to customers exceeding the costs, including risks of both, (d) funding the risky parts, and (e) identifying when to kill a product. Components 'a' to 'd' are iterative and innovation can start at any one of them.

(3) The figure does not include the end user or customer in the loop.

(4) The same figure can apply to activities that reduce productivity, leading a company to choose aggressive efforts at acquiring or maintaining market share as a "competitive strategy", such as aggressive advertising, branding, valueless "improvements", misleading, and lobbying. Return on investment on such strategies often exceeds that of productive innovation, particularly for larger companies relying on older models.

(5) The model assumes that innovation is a "competitive strategy" and that assumption is used to evaluate R&D investment in terms of competitive intensity, as on page 12. This assumption is incorrect. Competitive intensity only works to create innovation in a very limited capacity. It is a zero sum game in which one's success means another's failure. More typically, competitive intensity makes R&D investment in new technologies less likely as it increases commercialization risks. Hence there are two errors with the model in this respect:

   a. It doesn't address the reduced productivity of competitive intensity and strategy.

   b. It doesn't address all of the reasons businesses choose innovation as *business* strategy, particularly identifying net added value. Running *towards* opportunities is not a zero sum game and so generally pays off better than running *from* competitors. New markets are opened and comparative advantage creates a multiplicative effect.

(6) The model does not address timing or chance. Innovations rarely, if ever, happen in a planned direction from beginning to end. It is our experience that most R&D investments of that kind fail. Successes usually come from combining IP generated for one purpose in mind with a new opportunity and the timing and funding opportunities aligned with these. Successful innovations follow a highly non-linear punctuated equilibrium. Improvement in the process comes from generating more chances of connecting all of the components at the same time.

ANSWER 3. The supply of risk capital in Canada is not sufficient. One key to unlocking more capital may be to found programs which encourage large companies in Canada to be a source of investment in smaller companies as opposed to encouraging large companies to spend money internally on R&D. Many large companies, especially those that are subsidiaries of large foreign firms lack the processes or mandate to perform strategic R&D within their Canadian operations. However, these same companies probably do have the mandate to perform investment and M&A activities with Canada.

Small companies, on the other hand, are chronically short of capital and often lack the expertise and market reach to make a success of their technology development. It would seem that there may be an opportunity for the government to encourage larger firms (who often lack they will to do effective R&D) to invest in smaller firms (who usually lack the means). There are probably a number of ways that existing programs could be modified to incorporate these incentives. For instance, programs such as SADI could allow for, and even provide, incentives for applicants to use some funding to invest in small companies as part of the larger R&D program. Also, one lever that is currently underutilized is the gap

between the rates of SRED return between small and large firms. Small firms can claim a 42% refundable credit while large companies can claim only a 20% non-refundable credit. This would seem to provide an incentive for large companies to out-source R&D, allow small firms to claim their full credit and negotiate a commensurate reduction in costs – or even for large companies to invest in or even purchase small companies merely for the purpose of taking advantage of the favourable SR&ED status of the smaller company. This rarely happens, in our experience.

ANSWER 4. Yes. We believe that one of the factors affecting the amount of R&D done in Canada vs. the OECD average has to do with the relative importance of small and large companies in our economy vs. other developed economies. More than most of the G-8 Canada's economy is dominated by the large business sector. While small business is, by far, the dominant form of business in Canada, I believe that small business probably makes up a smaller proportion of economic activity in Canada than is true in the other developed economies. It is also true that Canada has a very high proportion of large companies that are subsidiaries of large foreign firms. As noted above, large companies – especially those that are subsidiaries – often lack the mandates or processes to effectively manage R&D in Canada. Further, when they have the capacity to plan R&D effectively they are often forced to "compete" with other jurisdictions for the right to perform the R&D. This competition too often devolves into a comparison of corporate tax rates or other government incentive programs which are very expensive which may generate very proximate returns but which do nothing for the larger R&D climate.

Small companies on the other hand often have the will to do R&D – in fact it may be there only reason for being in existence. However they usually lack the capacity to perform as much R&D as they would like. Too often, they also lack the capacity to implement their innovations fast enough to generate new cash and capital for re-investment in the next product or improvement. For companies that are primarily concerned with cash flow reductions in corporate taxes offer no relief and no incentive to generate more investment. Similarly government programs to reduce the cost of financing large capital investments such as new facilities do nothing to assist small cash-flow focused businesses.

I would therefore argue that many supposed incentives are misdirected in that they aim to provide more resources to organizations who already have significant resources but lack the will or means to deploy them on R&D, while not providing ample enough support to those companies with the will to do R&D but who lack the means.

ANSWER 5. Post-secondary education is a bit of a red herring when it comes to R&D. They are useful institutions for educating and training students, providing a wide range of combinatory skills, and freedom to explore new ideas, and need to be funded as such. But the Consultation Paper and questions imply an assumption that colleges and universities are key generators of R&D and seeds to innovation, or that funding and developing these "ingredients" in Figure 2 make innovation happen. A review of the example funding programs in Appendix 2 bears this out in comparing the number of programs aimed at helping students versus those aimed at helping businesses.

Post-secondary institutions *can* be incubators of innovation, but this is not typical of most successful innovations. The implication makes little sense when you consider that business hire these High Quality Personnel (HQP), after which they become more experienced over time. An experienced engineer in a focused business environment can generally perform the same quality of work on the order of weeks that a grad student does over a 2 year thesis, and for lower *total* cost. The cost *to business* is lower with the student because the government subsidizes them through collaboration programs, but this is

because the government choses to subsidize the student instead of the business engineer. These subsidies are useful for HQP training, but this shouldn't be confused with investment in generating R&D and innovation in a timely fashion.

With respect to partnerships, the biggest issues with post-secondary institutions tend to fall into three categories:

(1) IP rights. Increasingly IP ownership and access are becoming problems. Some university technology offices have set themselves up to be IP generators and licensors to make money. This is not the purpose of universities and it reduces their attractiveness for collaboration. We have been refused quid pro quo rights to the IP for our contributions and have had to threaten to withdraw funding to gain IP rights. Other agreements have taken multiple years to sign.

(2) Time. Universities are not set up to generate results rapidly. Graduate students take years to complete a single topic intermixed with courses and teaching assistantships.

(3) Lack of focus on business interests. *Some* researchers view their work as self-directed, often working in obscurity and only reporting progress when chased. We want them to focus on our needs in the context of the collaboration. This is difficult and time-consuming to police.

ANSWER 6. For small cash-flow limited companies early sales certainty is often the difference between a successful product development and a failure. It is often also a critical decision factor in whether or not to seek outside (often foreign) investment at a stage prior to the realisation of the true value of the technology. As such many good Canadian ideas end up in the hands of foreign concerns and the Canadian economy fails to benefit fully from domestic innovations. Knowing that the government is willing to act as an initial, and possibly an anchor, customer can give small businesses the certainty they need to negotiate the cash intensive period of product introduction and market penetration. As such, being a first customer is an excellent way for the government to focus available funding.

ANSWER 7. As with question 5, this seems to imply that innovation and productivity are driven by graduates. There is a shortage of some advanced and specialized engineering skills in our sector, but that is more an issue of salary costs than of availability.

ANSWER 8. We have no problems with students, but this appears to be a leading question. It implies that collaborating with, and employing, students is important towards R&D success. A more fundamental question needs to be asked about what role post-secondary institutions play in R&D and are they over- or under-emphasized. Education and training is a different issue from R&D and innovation.

ANSWER 9(a). The most successful programs have been ones that address the high-risk areas of innovations, cover the most costs, and include knowledgeable input from the end user community. The greatest impediment to innovation is typically the stage of simultaneously retiring technical and commercialization risks, usually involving iterative prototypes and definition of requirements. If both customers and developers are SMEs, neither can afford to take on the risk.

The CSA STDP and DND TDP programs are set up well to address these areas, particularly given recent improvements which aim at industry and customer input towards what the requirements and goals should be. NRC-IRAP also falls in this category, though is less directly involved.

For post-secondary collaborations, ones providing the highest leverage ratio are the most attractive, particularly if multiple funding sources can be used to extend the leverage. We have had some success with the combined NSERC Collaborative R&D program and CSA Partnership Support Program (PSP).

ANSWER 9(b). Program simply aimed at connecting post-secondary researchers with industry partners have not performed well. Our experience has been that many academic researchers do not understand the R&D process. Some are solely interested in funding pet research interests. Others want to solve problems in obscurity and then license it to the industry partner who will then commercialize it for them.

ANSWER 10(a). As a small company SR&ED operates as direct support to operations. It generates cash flow and/or access to operating credit through by providing security to lenders. It encourages R&D activities by making those activities more lucrative for the company.

ANSWER 10 (b). The refundable portion of SRED is absolutely essential for small businesses. Many R&D-focused small businesses would not survive without the infusion of cash and/or credit provided by SR&ED. The program could be strengthened by finding ways to shorten the time between performing R&D and obtaining the refund. Allowing for intra-Fiscal year or interim filings would certainly help.

ANSWER 11. Expand the program of small business advocacy that has been initiated at PWGSC. Encourage individuals with small business experience to work in or for government directly. Make use of advisory panels or other consultative mechanisms for the purposes of *really* understanding the concerns of business, as opposed to using them as a means of validating government policy that has already been developed. Embrace the concept that government *should* do all it can to help businesses succeed and that success is measured by the generation of reasonable levels of profit.

ANSWER 13. The US SBIR program wherein a portion of every department's spending must be directed toward small business is a model that Canada should study carefully. While it has its weaknesses, it does serve a larger purpose of indicating that the government values the small business sector. The one major advantage of many of the SBIR programs in the US is that they provide small business with the opportunity to secure renewable (based on performance) funding which grows over time with the success of the project. This is a feature that is lacking from most programs in Canada and it is critical to small businesses trying to develop and execute a plan for strategic growth. Any program that helps generate revenue (and attendant cash flow) certainty over an extended period is very important to small companies. Long term cash-flow security is probably (by a large margin) the single most important factory in decisions to initiate and continue R&D activities in small firms

ANSWER 15. Yes. R&D is the process of generating new IP. Most new IP goes nowhere. Some fails to meet goals. Some is successful but finds no opportunities, is not a priority, or is too expensive.

Innovation, in simple terms, is IP that gets used and creates something new. The IP may be new or re-purposed for something new. The key word is *used*. Achieving that requires significant effort in matching IP with opportunities such that the customer value exceeds costs, and in finding funding to bridge the gap between raw IP and raw opportunity by simultaneously reducing technical and commercial risks.

Government needs to address R&D *as a component of* productive innovation. Current effort appears to be focused mostly on R&D. The optimum balance levels the risk across the process from beginning to end which invariably means more funding in the highest risk stages.

APPENDIX A: CONSULTATION QUESTIONS

1. In addition to the R&D activity defined by the OECD, should government be funding other business activities related to the commercialization of R&D? If so, what and why?

2. Does Figure 2, the model of business innovation , capture the key structural factors and inputs to innovation? If not, what is missing?

3. Regarding capital, is there an adequate supply of risk capital for Canadian firms at each stage of their growth (start-up, small, medium, large)? If not, why not? Where returns on investments are low, what are the reasons and potential solutions?

4. Regarding ideas and knowledge, do you believe it is important for Canadian firms to perform their own R&D and, if so, what do you believe are the key factors that have been limiting business R&D activity in Canada?

5. Regarding networks, collaborations and linkages, what are the main impediments to successful business-university or business-college partnerships? Does the postsecondary education system have the right capacity, approaches, and policies for effective partnerships with business?

6. Regarding the creation of demand for business innovation, what role, if any, do you believe that government should play in being a "first customer" for R&D investments in Canada?

7. Regarding talent, is Canada producing sufficient numbers of graduates with the right skills to drive business innovation and productivity growth? If not, what changes are needed? Where demand for advanced skills is low, what are the reasons and what changes, if any, are needed?

8. Can you describe whether and how your firm employs students currently enrolled in community colleges, polytechnics and universities, and what government measures could make it easier to work with students during their academic programs and to recruit them after their graduation?

9. With which federal programs supporting business or commercially oriented R&D in Canada do you have direct experience and knowledge? In your view:

    a. Which of these programs are working, and why?

    b. Which programs are not working, and why not?

10. If you have direct experience and knowledge of the SR&ED tax credit, what are your views in relation to the following:

    a. Does the current structure of the SR&ED tax credit encourage incremental investment in R&D? Does it free up capital to invest in other aspects of innovation activities in the firm? Does this vary by size, ownership, sector or nationality of firm?

    b. What are the strengths and weaknesses of the refundable portion of the SR&ED tax credit for Canadian-controlled private corporations and to what extent does it encourage the growth and commercial success of SMEs?

c. NOT ADDRESSED

11. How could the Government of Canada lighten the administration requirements of its programs on recipients and improve outreach to business?

12. NOT ADDRESSED

13. Are there any gaps in the Government of Canada's support to business and commercially-oriented R&D? Do firms performing R&D in other countries have an advantage over Canadian firms because of access to programs that are not available in Canada? What would be the principal features of new programming to fill these gaps?

14. NOT ADDRESSED

15. 15. Is there a difference between R&D and innovation? If yes, how are they different? Should government focus on R&D or Innovation? What should the balance be?