Creating New Industries by Increasing Business Involvement in R&D

Dr. Rowan Gilmore, CEO, Australian Institute for Commercialisation

Abstract

The creation of new businesses and ultimately industries around them requires new ideas, new skills, and plenty of capital. Although publicly-funded research produces many such ideas, the skills and capital needed to seed companies and grow new industries from this research are frequently lacking. Unlike business-sponsored research, the discovery process in universities and other publicly funded research institutions may not follow a business-driven agenda i.e. seeking a solution to a known problem. To achieve commercial outcomes from such research is frequently an afterthought, rather than the primary driver.

However commercialisation of such research is important, because business investment in research and development (R&D) in Australia lags well behind the OECD average, and as a nation we risk missing out on developing new industries and the opportunity to grow our own global giants. Public investment in research, while no substitute for business investment, can help to provide the new ideas and identify the opportunities that can be harvested to produce beneficial outcomes. This paper discusses how a new program that has been developed for the commercialisation of public research is helping to improve business involvement in R&D, and drive new opportunities.

Innovation and technology commercialisation

Those of us involved in innovation usually have a common objective: to create stronger economies, more vibrant companies, and to build wealth, jobs, and better social outcomes for the community. Myriads of economic development agencies, chambers of commerce, industry groups, businesses, research organisations, and technology transfer offices espouse the cause of innovation to help achieve such outcomes. The Australian Institute for Commercialisation (AIC) is among them.

One role of the AIC is to help increase the flow of R&D from Australia's publicly-funded research institutions into commercial outcomes. In doing so, it seeks to share leading practices in commercialisation among its stakeholders, and to build scale and increase interactivity among industry, the Australian states and territories, and research institutions. The AIC's core business is to help identify ideas, seize opportunities, and create innovation outcomes. By doing this, we will help generate high value jobs, exports, and wealth.

To some, 'commercialisation' is little more than the well understood task of product, service or process development followed by business development. In companies, these steps are usually well 'gated' to weed out failures early. However, ideas from public research institutions are usually at a very early concept stage and therefore generally lack capital, channels to market, and often, clear market

application or customers. In such cases, the gates are usually uncontrolled and irrelevant, their existence and purpose generally not even recognised until too late in the development process.

Unlike industry-sponsored research, the discovery process in publicly-funded research organisations will frequently not follow a business-driven agenda i.e. seeking a solution to a known problem. To achieve commercial outcomes from publicly-funded research is often an afterthought, rather than the primary driver. This is the classic problem of 'technology push'.

Business R&D drives profitability and economic growth

It is recognised and accepted in most developed nations that R&D is a key driver of technological innovation that results in the development of new products and services. Businesses investing and engaging in R&D activities, whether established internally or sourced through external collaborations with research institutes, have a greater potential to develop new products and services that will stimulate growth for the business and result in the creation of new jobs, export dollars and wealth within the economy. This has been the case for economies, such as Sweden, Finland and the USA where business investment in R&D has been encouraged and supported. As a result these economies have been recognised as "first-tier innovator nations" having a comparatively high innovative capacity.

In Australia however, some representatives in industry have recently argued that international comparisons should not apply to Australia's laggard performance in business R&D investment because of structural differences in the make-up of business from country to country. The case of Finland and Nokia is frequently cited i.e. Finland leads the world in business investment in R&D because its industry contains technologically based companies like Nokia.

How easy it is to confuse cause and effect! In 1989, Finland was at risk of becoming an economic basket case because it had lost its Soviet markets. Nokia was a mere rubber goods and forestry company. The Finnish Government's strategic decision that year to begin investing heavily in R&D, and Nokia's well-timed choice to invest in new product innovation, was to create the most robust of the European economies. Finland would still be in dire straits had it heeded such arguments! The Finnish R&D sector in fact provided a pool of new discoveries that were to become the foundations of successful industry restructuring.

Moving to first-tier innovator status is critical for Australia, if we as a nation want to remain competitive. Governments in Australia, on behalf of the taxpayer, invest over $5 billion in research at institutions throughout the country. This investment is frequently justified by the human capital and skills that are developed and the capabilities it infers, but direct commercialisation outcomes are also part of the equation. A study of the economic benefits to the nation of following a strong direct commercialisation path recently predicted that revenues from newly created spin-off companies could exceed $20 billion by 2020, most of it from exports.

Research and development can be of great benefit to individual companies as well: the 30 top R&D spenders in Australia had a five-year weighted average return on shareholders funds of 17.1 percent compared with 7.7 percent for the nation's Top 1000 enterprises, more than double!

Benefits will also accrue at the local level. When a research-based university is fully integrated into its local community, the rewards can be enormous. Start-up companies created from Stanford University accounted for about 60 percent of total Silicon Valley revenues in both 1988 and 1996, and include companies such as HP, Sun Microsystems, Silicon Graphics, Adobe, and more recently, Yahoo!. The research organisations' role in developing human capital is also crucial. Companies formed by graduates and faculty of MIT would rank as the 24th largest economy in the world if measured among nations. MIT graduates have founded 4000 companies with 1.1 million employees.

But such outcomes cannot be achieved without the injection of business skills and investment capital. Unfortunately, as a nation, we lag seriously behind in business investment in R&D. Ironically, the task is not made easier by Australia's economic performance, which has been exceptional in the past decade-and-a-half, surpassing most other developed economies. But this performance was first driven by tremendous macro-economic reform and productivity improvements, and more lately through the commodities boom, rather than through the growth of knowledge-based industries. And even in the best of economic times, Australia still imports more than it produces.

To strengthen economic performance into the future requires a concerted effort to raise business spending on R&D, and to greatly improve the efficiency with which publicly-funded R&D is converted into commercial and economic outcomes. As we will demonstrate later, business R&D can indeed build on publicly-funded R&D. To achieve the full potential from our investment in research, it is essential that an even greater focus be placed on commercialisation, particularly at the very early stage of research when market input can be accommodated with minimal cost and adjustment.

Better exploiting publicly-funded research and development

In spite of the potential returns from Australian research, it is surprising how few incentives and resources are directed to its commercialisation. Less than one percent of the total public R&D spend is invested in direct commercialisation of that research. This is of course the complete inverse of what it costs businesses to take a product to market, where multiples of ten to one hundred times the cost of the research itself are the normal expense for taking an idea to the marketplace.

It has proven stubbornly difficult to commercialise research from publicly-funded institutions. In attempting to find a buyer for its technology, an institution is most likely engaging in **'technology-push'**. Those working in a business environment readily admit that **'market-pull'** should instead be the initiator for product development. Yet technology transfer and commercialisation offices around the world are 'pushing' their technologies out, hoping to find customers or venture capitalists to create a new business opportunity. Some will succeed with blockbusters; others will have discovered the better mousetrap that has customers knocking at their door; but the statistics prove that more generally, start up companies created through technology-push will fail.

Furthermore, the commercialisation process itself is typically only a secondary or tertiary goal of most research organisations. The principal mission of most universities and many other research institutions is not to create ideas with immediate business application, and even if it were, it is rarely to set the technology transfer process in motion on their own. Developing businesses and products out of research done for the sake of science, rather than commercial outcomes, is just plain hard! A national,

independent, not-for-profit body such as the AIC can help highlight what needs to be done, and implement programs to catalyse the right sorts of activities to restore the equilibrium.

The AIC's activities are therefore focused on reducing the key barriers to commercialisation. Effective commercialisation requires:

- good management of intellectual property (IP);
- incentivised researchers and business people skilled in taking the IP to an investible proposition;
- an understanding of the marketplace; and of course,
- the liquidity of capital.

To realise these, we believe the biggest innovation challenge Australia faces is to establish stronger linkages between its research sector and business. Links need to be strong in both directions: 'IP push' from the research agencies on the supply side, and 'demand pull' from business. These activities and linkages need strong encouragement by the relevant boards of Directors, many of whom appear to focus more on achieving profits through cutting costs rather than via growth through innovation.

The policy response

Policy-makers are increasingly recognising the importance of high technology and innovative industries to the economic well-being of nations and regions and are adjusting policy accordingly. In this context there are two critical policy trends.

First is an increased emphasis on small firms and entrepreneurial activity. In many countries small businesses have played a prominent economic role over the past decade. Some countries are highly reliant on SMEs for their economic and social well-being. Public policy has placed a greater emphasis on small firms because of their perceived link to competitiveness in the knowledge economy. The growing emphasis on entrepreneurial activities and small business is a response to the critical role of innovation and knowledge creation in modern economies. The generation and use of new ideas has become increasingly important, as has the capacity to test those high-risk and uncertain ideas in a commercial setting.

Second, the view that knowledge has become the foundation of economic competitiveness has given rise to a re-conceptualisation of the role of research organisations as key knowledge institutions in contemporary economies. The importance of research organisations to the knowledge economy is explained in terms of their contribution to economic development through intellectual property output, new products, R&D infrastructure, knowledge generation, new firm spin-offs and incubator facilities. The three-node model of government-university-industry relations has emphasised the blurring of the role of research organisations in contemporary economies, as they take on the functions of both government and industry in coordinating activities and engaging in commercial ventures.

There are already several policy initiatives within Backing Australia's Ability I and II to stimulate research commercialisation. In Australia, governments have emphasised the need to enhance university-industry engagement as a basis for innovation and economic competitiveness. Public policy initiatives in this area have sought to enhance the social and economic benefits of research

investment by encouraging commercialisation, entrepreneurial activity and technology transfer of publicly funded research. A recent paper by the Department of Industry, Tourism, and Resources has shown that firms that engage in collaboration, and have diverse collaborations, are up to 70% more likely to have new-to-the-world innovations than firms that do not. However, apart from the CRC program and early-stage ARC Linkage Grants, government initiatives have rarely involved both the research community and industry together. Such programs have tended to be exploited by larger businesses as a proxy for performing their own R&D, or by research organisations trying to bolster their R&D funding.

Translating policy into program

The AIC TechFast Program addresses these market gaps by using a market-pull approach to create and accelerate knowledge and technology transfer and adoption into SMEs from publicly funded research organisations. It turns the traditional model of commercialisation of publicly-funded research on its head. Rather than starting with the IP and pushing it to market, it starts with small existing technologically-receptive companies that already have existing sales channels, and a track record in product and business development. After identifying and analysing their needs, TechFast farms new IP for them from Australian universities and CRCs to extend or enhance their product line, thus accelerating their growth. With its industrial incubation of R&D, this program is helping to build linkages and skills, and to help remedy low industry involvement in R&D. It is unique in several respects.

First, business involvement in public R&D commercialisation is encouraged because the program focuses on market-pull technology transfer and R&D that is relevant to the business. Market-pull technology transfer is critical as it provides the opportunity for more rapid diffusion of innovations because there is an existing demand from technology ready partners for the new technology. The significance of TechFast is that by facilitating market-pull technology transfer, it is expected to have a more significant economic impact.

Second, business involvement in R&D is encouraged because the program focuses on engaging existing Australian SMEs as business partners. As noted above, SMEs make an important contribution to innovation in the knowledge economy, because of their small size, decentralised organisational structures and capacity to radically change strategic direction in response to changes in markets and technologies. SMEs involved in the program have leveraged the public investment in R&D into their own.

Third, the program has been successful because it enables third party facilitation of the technology transfer process. Imperfect knowledge on the part of potential exchange partners (universities and firms) necessitates the intervention of an intermediary as match-maker because those with intellectual property and innovative products in their research and development pipelines, and those in need of products to improve their market standing, remain unaware of each others existence. In the case of market-pull technology transfer, there is often a problem of information asymmetry, or imperfect knowledge between the technology supplier and the recipient. The intermediary is truly independent of any vested interests, and can also provide an additional project resource when needed to ensure knowledge transfer does not stall. The intermediary can also help each party understand and navigate the differing and non-aligned cultures within the parties.

The changes induced by the program are behavioural and endemic to the national innovation system. During the TechFast pilot program, we have already observed:

- Creation of new long-term collaborative interactions between SMEs and research organisations;
- Cultural change in research organisations, and in SMEs that for a variety of reasons had previously been unable to collaborate independently with them;
- Increased commercial relevance of research activities as a result of researcher exposure to real life business problems brought by TechFast;
- Broadening of commercialisation avenues for many research organisations;
- Previously unidentified new market applications for researchers' know-how and intellectual property;
- Assistance to smaller, regional research organisations, which currently perform at a lower level of productivity than the larger, well-funded organisations that are close to a critical mass of deal flow and expert competencies;
- Attraction of private sector investment to the SME innovation sector;
- Secondary benefits, including the establishment of new business to business links, identification of off-the-shelf solutions, and referrals to other assistance programs and organisations;
- Demonstration effect – the concept of market-pull is becoming widely accepted as an essential approach for commercialisation.

In its first year alone and for a tiny fraction of the cost of the research itself, the program looks set to achieve a 30 to 40% increase (compared with previous years) in the volume of interactions between the entire Australian research sector and small companies. 47 Australian research organisations and 23 SMEs are currently involved in the national pilot, half of them in regional locations. Business investment in R&D is increased because the firms involved are developing new products (at the 'D' end) from the research obtained (at the 'R' end).

Conclusion

Innovation is the wellspring of economic growth. Australia cannot continue to live on the fruits of its natural endowments. Increasingly in the twenty-first century, a nation's prosperity and competitiveness will be derived from its ability to create new products and services, adapting continually to remain ahead of its competitors.

Establishing Australia as a "first-tier innovator nation" requires a systematic upgrade to the national innovation and commercialisation environment. Such an environment is a result of a combination of factors such as well-trained people, an innovation-oriented corporate investment climate and greatly improved collaboration between research organisations and businesses.

Fortunately, Australia's research capability is often world class. Where it performs less well is in the process of converting its excellent research into social and economic capital, new businesses and new jobs. The AIC is working to improve the skills required to better commercialise intellectual property, along with developing programs and policy recommendations to change the culture to embrace outcome-based research, collaboration with business, and sensible calculated risk-taking behaviour.