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Discovery for discovery's sake pays the biggest dividends

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What sort of investor are you? Do you take a long-term view, with a position that might yield a huge return on investment?

Chances are if you've been in the game a while, say 25 years, and didn't cash out when times got tough, you can look back now and see what sound decision making and patience has meant for you over the long haul.

You would hope when it comes to your tax dollars the government is taking the same kind of approach. When it comes to basic research, though, it's not.





In 1992 Australian scientist John O Sullivan, then with the CSIRO, invented Wi-Fi using maths he developed for detecting radiation from black holes. **Jacky Ghossein**

At the recent National Math Festival in Washington, DC, Eric Lander, co-chair of President Barack Obama's Council of Advisers on Science and Technology and one of the architects of the Human Genome Project, described how governments in recent times have started redirecting research funding toward the short-term goals of bolstering technological innovation by industry and generating jobs.

Australia is no different. Australian researchers are similarly required to describe the socioeconomic impact of their proposals when applying for funding.

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"Now, how could you possibly disagree with such prudent investing of dollars?" Lander asked. "How could you possibly disagree with accountability, transparency?" Like any investor, you'd like to see a business plan with a direct connection between investment and return. So what can possibly be wrong with wanting to have a clear case for precisely how investments in basic research will pay off?

Lander continued: "The answer is: absolutely everything. Everything is wrong with it."

Lander's argument is that time and time again basic research pays huge returns and can completely transform society and the economy. Lander's point is that a "prudent", short-term approach to funding basic research is a poor strategy, as it will result in ordinary returns. Truly transformative ideas and discoveries often come out of left field, but have played, and will continue to play, an essential role in applications that we can no longer live without, such as the internet, online banking, Wi-Fi and GPS.

Miracle machine works again and again

Lander called it the "miracle machine": it works again and again. A great example is Einstein's theory of relativity, which has its roots in mathematics. Lander couldn't have explained it better:

"You know, if you were explaining to, let's say, a congressional committee in the 1800s why you were funding a grant on non-Euclidean geometry, you'd be saying: Yes, yes, Mr Congressman, I realise that for 2000 years we've known that parallel lines never meet, but let's just imagine that what we know isn't true, and let's fund someone to study what would happen in a counterfactual world where all lines intersected and there were no parallel lines."

In the current environment such a grant proposal would have a hard time getting funded as it doesn't describe the real world and therefore is impractical. Except, of course, we now know that it does describe the real world, and mathematics was ahead of our understanding of the curved space-time general relativity. As for practicality, smartphones have built general relativity into their GPS software to adjust for the time dilation experienced by satellites orbiting the earth as, otherwise, the estimated position would be wrong by about 10 kilometres a day.

Other well documented examples include: number theory, because public-key cryptography is fundamentally based on the difficulty of decomposing numbers into their prime factors; the mathematics of Wi-Fi, originally developed for detecting black hole radiation by the CSIRO's John O'Sullivan; Google, an example of a 100,000-fold return on a \$3.6 million dollar grant investment on basic research; the early hesitation about applicability of lasers; and the serendipitous discovery at the Walter and Eliza Hall Institute of colony-stimulating factors leading to new chemotherapy drugs.

Lander argued that the "miracle machine" must have two components. The first is significant public investment in basic research. While private investors will not invest if they cannot own the fruits, the public can invest because it gets its return in the form of benefits for society and in greater tax revenues from economic activity. The second component is private investment in the commercialisation process.

An approach where public investment is moved from long-term basic research to research with short-term goals is fundamentally wrong: it will result in only modest returns. Public investment in basic research can be enhanced by a reduction in research administration and reduction of expensive assessment exercises and red tape.

Rather than diverting money from basic research by encouraging universities to commercialise research outcomes, governments should provide incentives for venture capitalists to engage with the second part of the "miracle machine".

As Lander said: "The true verification of whether such investment in basic research is worthwhile and proper use of taxpayers' money is not to ask what it is going to deliver over the next 25 years, but to ask what the payoff has been over the past 25 years."

Viewed from that perspective we have done amazingly well and we can have every confidence that we will continue to do as well in the future.

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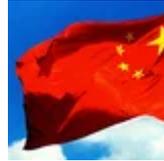
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