

Extract: Executive Summary

The Allen Consulting Group

Outcome Review of the STI Initiative

November 2003

Report to the Department of Innovation, Industry and Regional Development

Executive summary

Summary of key findings

The assessment of outcomes to date from each of the STI funded projects indicate that the *STI Initiative: First Generation* is performing above the average for publicly funded research in Australia on a number of important early outcome indicators. Economic impact modelling conducted in this study forecasts that the STI Initiative will, over the period to 2014, make a significant net positive contribution towards the Victorian Government's over-arching goal of increasing living standards for all Victorians.

Projects receiving STI funding have subsequently attracted considerable funding from other sources, including from outside Victoria. Investment has come from overseas philanthropic investors, multinational companies, the Commonwealth Government and national companies. The total investment to date associated with the elements of the STI Initiative included in the economic impact assessment undertaken in this study is over \$1 billion with Victorian Government investment accounting for under 25 per cent of this figure. A key question concerns the extent to which the over \$750 million of funding coming from other sources was 'additional' to that which would have occurred in the absence of the STI Initiative. Our assessment is that overall about 40 per cent of this non-Victorian Government funding would not have occurred in the absence of the STI Initiative.

In assessing the likely net economic impacts of the Initiative, two rounds of economic modelling, which fully account for the opportunity cost associated with resources invested in the STI Initiative, were conducted by the Centre of Policy Studies using their MMRF-Green general equilibrium model of the Victorian economy and the scenario assumptions provided by The Allen Consulting Group.

A conservative set of performance assumptions was used for one round of modelling (the 'average performance' case) while a somewhat more optimistic, but in our opinion more likely accurate, set of performance assumptions was used for a second round of modelling (the 'premium performance' case).

The modelling conducted forecasts that the STI Initiative will generate the following *net* (the opportunity costs of investment in the STI Initiative are accounted for) economic impacts (in net present value 2003 terms using a 5 per cent real discount rate) for Victoria over the 2000-14 period:

- total real investment in Victoria over the 2000-14 period is cumulatively \$767 million ('average performance') to \$868 million ('premium performance') higher than it would have been in the absence of the STI Initiative;
- real Gross State Product over the 2000-14 period is cumulatively \$1.58 billion ('average performance') to \$2.18 billion ('premium performance') higher than it would have been in the absence of the STI Initiative;
- real private consumption over the 2000-14 period is cumulatively \$280.1 million ('average performance') to \$420.4 million ('premium performance') higher than it would have been in the absence of the STI Initiative;
- real Victorian Government consumption over the 2000-14 period is cumulatively reduced under both scenarios by a total of \$255.2 million as a result of government expenditure being redirected to STI investment over the 2000-03 period; and
- by 2014 the STI Initiative generates an overall increase in employment in Victoria of 1,100 ('average performance') to 1,700 ('premium performance') jobs.

These results suggest that, ten years from now, the *STI Initiative: First Generation* will be viewed as a successful long term Victorian Government investment that has achieved higher living standards for Victorians.

Project context

The Science Technology and Innovation (STI) Initiative: First Generation, was a key government program aimed at supporting the development of Victoria's science and innovation system. It provided \$310 million in funding focused primarily on strengthening the scientific and research base in Victoria. This was achieved by providing support for major physical infrastructure development and capability building in priority sectors and strategic technologies. Support was also provided for building skills and improving the environment for commercialisation of research results.

The STI Initiative has acted as a catalyst for knowledge, wealth creation, collaboration and scientific achievement through:

- building world class research and innovation infrastructure;
- attracting and retaining the best people;
- developing the skills base;
- fostering a culture of innovation, improving community awareness and understanding; and
- positioning Victorian as a national and world leader in science.

The STI Initiative should be seen as a major investment by the Victorian Government in supporting higher living standards for Victorians through enhancing Victoria's science and innovation system.

The purpose of this study is to assess the returns on the Government's investment delivered by the STI Initiative. As such, this study is primarily an economic impact study rather than a review of program design and implementation issues.

Approach taken to assessing outcomes

Given that the review of the outcomes of the *STI Initiative: First Generation* is occurring relatively soon after funding has been provided, with some funded projects still in their very early stages, it is important to recognise that not all, or, in some cases even most, of the eventual outcomes from the initiative have yet occurred.

Our primary focus in this study has been on the quantitatively measurable outcomes that have already occurred and those that can be forecast to occur with a high degree of certainty. An example of the latter are investment agreements where the research funder has contractually committed to provide funding in coming years to STI funded projects (e.g. the out year funding committed by the Commonwealth Government to Major National Research Facilities and CRCs that involve STI funded projects).

Not *all* of the investment being made by non-Victorian Government investors in STI funded projects has been included in the economic impact modelling conducted in this study. This is because some of this investment may well have occurred even in the absence of the STI funding. Therefore, we have only assessed 'additional' leveraged investment in the modelling of economic impacts. If we had simply included *all* of the investment made by non-Victorian Government investors, significantly higher forecasts, in this case around 85 per cent higher, of the economic impacts of the STI Initiative would have resulted.

Projections of future possible investment, contract research income, research breakthroughs and so on contained in project business plans cannot be assumed to definitely occur in the future. The economic impact modelling is therefore based upon the outcomes that have been demonstrated to date. Of course if all *hoped for* future outcomes from *all* projects had been included in the modelling the economic impacts projected for the STI Initiative would be very large indeed. However, it is well recognised that scientific research is inherently risky and that not all projects will in fact achieve all their *hoped for* outcomes. Therefore, treating business plan projections as a proxy for likely future events was not seen as a credible approach to adopt in this study.

In assessing outcomes we have, however, included some qualitative discussion of a number of outcomes that may be expected in the future. This has been done to provide a sense of the potential future outcomes that the STI Initiative may generate.

Key benefit channels from the STI Initiative

STI funded projects could be expected to generate measurable impacts on Victorian living standards through the following key benefit channels:

- the leveraging of additional investment, in particular investment from international sources (including philanthropic organisations and industry) and the rest of Australia (including Commonwealth Government and interstate industry), into science, technology and innovation capability and projects in Victoria directly contributing to knowledge creation in the state;
- productivity improvements in Victorian industry resulting from the additional skills formation occurring due to STI Initiative funding;
- productivity improvements in Victorian industry resulting from the application of IP generated by STI funded research;
- productivity improvements associated with the more rapid and effective adoption and integration of knowledge generated outside Victoria as a result of STI funded collaborative research projects improving Victorian access to such knowledge; and
- increased industry turnover associated with the direct commercialisation (via new company formation and the licensing of IP by existing companies) of IP generated by STI funded research.

Other benefit channels from the STI Initiative include environmental, human health and social benefits.

Assessment of performance in key outcome areas

To assess the performance of the STI Initiative in achieving its overarching objective of raising Victorian living standards, monitoring of the program has focused on five core outcome areas:

- collaboration outcomes;
- science awareness outcomes;
- skills base outcomes;
- commercial outcomes; and

- scientific research outcomes.

A review of outcomes to date in each of these areas has found strong initial progress being made. Particularly noteworthy outcomes to date are that:

- rates of industry co-funding of, and collaboration in, STI funded research projects clearly exceeds the average level of industry collaboration with publicly funded research activities in Australia. As a point of comparison, Round 1 Infrastructure Grant funded projects have attracted a 35 per cent private sector funding rate compared to the 19 per cent industry contribution rate associated with Co-operative Research Centres over the past 12 years.;
- in addition to attracting considerable investments from Victorian, Commonwealth Government, interstate and international sources, STI funded research projects appear to be generating new IP of potential commercial value at higher than the average rate (per dollar of research funding) in Australia;
- 62 highly qualified scientific and scientific/business staff have been attracted to Victoria from interstate (23) and overseas (39) to work on STI funded projects; and
- early indicators suggest that STI funded projects will soon be producing scientific publications at higher than the average rate (per dollar of research funding) in Australia.

While it is still too early to measure with certainty the extent to which such important early outcomes will ultimately be converted into additional economic impacts for Victoria, they do suggest that the STI Initiative will generate economic impacts higher than is the average for public science, technology and innovation funding in Australia.

It should be noted that there has been a range of performance to date across the STI funded projects. Some funded projects have already achieved outcomes such as:

- attracting significant additional investment from outside Victoria;
- generating multiple research findings requiring IP protection;
- generating highly cited research articles;
- securing research contracts with industry; and
- attracting new staff to Victoria.

However, other projects, some of which have only recently been established, have reported fewer such outcomes to date. As a result, a relatively small number of funded projects actually account for a sizeable share of total reported outcomes from the STI Initiative.

This variation in project performance is not surprising, however, given the inherently risky and uncertain nature of scientific research. As is the case with early stage venture capital investment, it is simply not possible to only invest in 'star' performers. Information available at the time of investment does not allow for such accuracy in investment selection decisions. Investment in scientific research by Government should be seen as a portfolio of investment, just as venture capital funds invest in a portfolio of companies, where strong performers can balance out lower performers so that the portfolio as a whole generates positive returns.

Findings from seven project case studies

In the conduct of this study, seven detailed project case studies were developed to:

- provide insight into how the projects have worked in practice, through presenting qualitative and quantitative evidence that complements the broader analysis being undertaken in relation to the program as a whole;
- enable more detailed assessment of benefits that can be used to inform reasonable assumptions in the broader economic modelling activity; and
- suggest conclusions about lessons learned and key success factors.

The seven projects funded through Rounds 1 and 2 of the STI Infrastructure Grants Program profiled in detailed case studies were:

- Neurosciences Victoria (Round 1) – has recorded particularly strong outcomes in terms of investment by the Commonwealth Government and multinational companies in this high impact area of research;
- The Microarray Technology Consortium (Round 1) – has resulted in the introduction of a new platform technology which has already led to significant research findings adopted in the agricultural and health sectors;
- The Innovative Foods Centre (Round 1) – has involved 30 research collaborations comprising 7 overseas partners and 20 Australian industry participants, contributing to valuable benefits for the processed foods industry;
- The National Printing Laboratory (Round 1) – has become an integral part of a new Melbourne-based CRC for Functional Communication Surfaces and a valuable resource for the printing industry;
- The REDlab test facility (Round 1) and the Collaborative Optical Leading Testbed (COLT) project (Round 2) – contributes to enhanced value creation in small and medium sized telecommunications enterprises by providing research and product development support;
- The Centre for Drug Candidate Optimisation (Round 2) – has strong long term potential to generate both health and commercial benefits by reducing the costs and lead times involved in the development of new drugs; and
- The Research Centre for Advanced By-Wire Technologies (Round 2) – is positioned to play an important role in building, and diffusing to the wider Victorian automotive industry, valuable know-how in the creation and application of emerging 'By-Wire' technology.

The findings from the case studies suggest that, taken as whole, these projects have resulted in a significant leveraging of additional investment into the Victorian science and innovation system with some projects already beginning to generate measurable economic outcomes over and above the initial investments. Box ES.1 shows the high benefit-cost ratios that have been already generated by one of the First Round case studies, the Victorian Neuroscience Consortium (Neurosciences Victoria). A particularly important aspect of this project is the close fit achieved between Victorian and Commonwealth Government priorities.

Box ES1

VICTORIAN NEUROSCIENCE CONSORTIUM — NEUROSCIENCES VICTORIA

The Victorian Government, recognising the opportunities for high impact research in the emerging field of neuroscience, committed \$13.34 million for investment in research infrastructure associated with the establishment of Neurosciences Victoria (NSV).

Co-investment by the Consortium partners of \$28.7 million, taken together with the investment under the STI initiative, resulted in the establishment of six technology platforms at three nodes.

Subsequently the Commonwealth Government as part of its round of decisions under the Major National Research Facilities (MNRF) program decided to award an \$18 million grant to NSV — the Victorian Government invested an additional \$4.5 million as part of the MNRF decision.

Recognising the world class nature of NSV, Schering, a global life sciences company, has now placed with NSV a \$25 million research contract which is due to run for five years.

NSV researchers have also been successful in winning additional Commonwealth Government research grants worth about \$20 million.

The Victorian Government's investment of \$17.84 million (the original STI investment plus the additional MNRF commitment) has been successful in leveraging investment by other parties and the winning of research grants and contracts to the value of \$91.6 million — a "gross" benefit cost ratio of 5:1. Even when allowance is made for the fact that some parts of the co-investments and research grants probably would have come to Victoria even without the STI funding, the "net" benefit cost ratio is impressive. We assess that it is in the order of 3:1 (i.e. \$60 million in benefits compared to \$17.84 in investment by the Victorian Government).

While not the our primary focus in the case studies, it should be noted that the case studies also demonstrate considerable innovation in the governance and management approaches they use. For example, Neurosciences Victoria, which involves four foundation research institutions, has established a dedicated management team tasked with ensuring high degrees of collaboration and cooperation between the consortium members and securing agreements on their behalf.

Development of economic impact modelling scenarios

To assess the economic impacts of the STI Initiative, modelling was undertaken by the Centre of Policy Studies using their MMRF-Green general equilibrium model of the Victorian economy. Through this modelling, the economic impacts of the Initiative in Victoria over a 15-year period (2000 to 2014 inclusive) is calculated using a range of performance assumptions.

A conservative set of performance assumptions was used for one round of modelling ('average performance' case) while a somewhat more optimistic, but we believe more likely accurate, set of performance assumptions was used for a second round of modelling ('premium performance' case).

Given the information gathered from a range of Australian and international studies, a reasonable estimate of the average social rate of return on publicly funded research and development in Australia appears to be around 25 per cent. In the 'average performance' case the social rate of return on the 'additional' investment in science and innovation in Victoria occurring due to the STI Initiative is specified as 25 per cent (but occurring with a time lag of five years between investment and commencement of benefits) while in the 'premium performance' case the social rate of return is specified as 37.5 per cent (again with a five year time lag)

Measurable benefits and costs to date including in the economic modelling are:

- the overall 'additional' investment in Victoria's innovation system that is occurring due to the STI Initiative;
- the reduction required in general Government expenditure to 'pay' for the STI Initiative investment; and
- compliance costs incurred by industry in applying for STI Infrastructure Grants.

Key findings from economic impact modelling

The 'average performance' modelling of the economic impacts of the STI Initiative conducted by CoPS forecasts the STI Initiative to have a significant positive impact of Victorian living standards over the period to 2014.

Key findings from the modelling are that:

- Total real investment in Victoria in 2014 is \$29.5 million higher (after peaking at \$155.1 million higher in 2004) than it would have been in the absence of the STI Initiative;
- Real Gross State Product (GSP), after falling in years 2000-02, by 2014 reached a level \$293.6 million higher than would have been the case in the absence of the STI Initiative;
- Real private consumption, after falling slightly in years 2000-02, grows strongly from 2003 and by 2014 is \$75.6 million higher than it would have been in the absence of the STI Initiative;
- Real Victorian Government consumption is reduced by \$61 million each year over the 2000-03 period as government expenditure is redirected to STI investment.; and
- By 2014 the STI Initiative generates an overall net increase in employment in Victoria of 1,100 jobs (these are likely to be high skill/high value added jobs).

These economic impacts of the STI Initiative on real investment, real Gross State Product, real private consumption and real Victorian Government consumption over the 2000 to 2014 (inclusive) period can also be expressed in terms of their net present value in 2003 terms. In converting returns to their 2003 net present value, a real inflation rate of 3 per cent has been applied to 2000, 2001 and 2002 impacts and a real discount rate of 5 per cent has been applied to results from 2004 to 2014 inclusive. This relatively high real discount rate (almost twice the real Government bond rate) has been used to reflect the fact that benefits from research in the out-years of the model cannot be assessed as certain to occur.

The 2003 net present value of the impacts of the STI Initiative on real investment over the 2000-14 period is that real investment is \$767 million higher than it would have been in the absence of the STI Initiative.

The 2003 net present value of the impacts of the STI Initiative on GSP over the 2000-14 period is that GSP is cumulatively \$1.58 billion higher over the period than it would have been in the absence of the STI Initiative.

The 2003 net present value of the impacts of the STI Initiative on real private consumption over the 2000-14 period is that real private consumption is \$280.1 million higher than it would have been in the absence of the STI Initiative.

The 2003 net present value of the impacts of the STI Initiative on real Victorian Government consumption over the 2000-14 period is a \$255.2 million reduction over the period compared to what it would have been in the absence of the STI Initiative.

Under the somewhat less conservative, and we believe most probably more realistic, assumptions used in the ‘premium performance’ case modelling of the economic impacts of the STI Initiative conducted by CoPS, the STI Initiative is forecast to have a considerably higher positive impact of Victorian living standards over the period to 2014.

Key findings from the modelling are that:

- total Real Investment in Victoria in 2014 is \$45.7 million higher (after peaking at \$155.1 million higher in 2004) than it would have been in the absence of the STI Initiative;
- Real Gross State Product (GSP), after falling in years 2000-02, by 2014 reached a level \$435.1 million higher than would have been the case in the absence of the STI Initiative;
- Real private consumption, after falling slightly in years 2000-02, grows strongly from 2003 and by 2014 is \$114.0 million higher than it would have been in the absence of the STI Initiative;
- Real Victorian Government consumption is reduced by \$61 million each year over the 2000-03 period as government expenditure is redirected to STI investment.; and
- By 2014 the STI Initiative generates an overall net increase in employment in Victoria of 1,700 jobs (these are likely to be high skill/high value added jobs).

These economic impacts of the STI Initiative on real investment, real Gross State Product, real private consumption and real Victorian Government consumption over the 2000 to 2014 (inclusive) period can also be expressed in terms of their net present value in 2003 terms. In converting returns to their 2003 net present value, a real inflation rate of 3 per cent has been applied to 2000, 2001 and 2002 impacts and a real discount rate of 5 per cent has been applied to results from 2004 to 2014 inclusive. This relatively high real discount rate (almost twice the real Government bond rate) has been used to reflect the fact that benefits from research in the out-years of the model cannot be assessed as certain to occur.

The 2003 net present value of the impacts of the STI Initiative on real investment over the 2000-14 period is that real investment \$868 million higher than it would have been in the absence of the STI Initiative.

The 2003 net present value of the impacts of the STI Initiative on GSP over the 2000-14 period is that GSP is cumulatively \$2.18 billion higher over the period than it would have been in the absence of the STI Initiative.

The 2003 net present value of the impacts of the STI Initiative on real private consumption over the 2000-14 period is \$420.4 million higher than it would have been in the absence of the STI Initiative.

The 2003 net present value of the impacts of the STI Initiative on real Victorian Government consumption over the 2000-14 period is a \$255.2 million reduction over the period compared to what it would have been in the absence of the STI Initiative.

Table ES1 summarises the economic impacts forecast for the STI Initiative under the two performance scenarios.

Table ES1

FORECAST ECONOMIC IMPACTS OF THE STI INITIATIVE

	'Average performance' case	'Premium performance' case
Real Investment (2001 dollars): NPV (2003) of cumulative impact 2000-14	+\$767 million	+\$868 million
Real GSP (2001 dollars): NPV (2003) of cumulative impact 2000-14	+\$1,580 million	+\$2,180 million
Real Private Consumption (2001 dollars): NPV (2003) of cumulative impact 2000-14	+\$280 million	+\$420 million
Real Public Consumption (2001 dollars): NPV (2003) of cumulative impact 2000-14	-\$255.2 million	-\$255 million
Victorian Employment: Net impact in 2014	1,100	1,700

Source: CoPS and Allen Consulting Group analysis

Concluding thoughts

Key lessons to emerge from the *STI Initiative: First Generation* include:

- insights into how the potential for achieving high impacts on investment by the Victorian Government can be maximised; and
- how outcomes reporting in the future, particularly for Government agency projects, can be optimised.

Maximising impacts of Victorian Government investment

The Victorian Government under the STI Initiative can be seen as playing the role of ‘strategic investor’ in the State’s science and innovation system with the aim of generating high returns for Victoria. As a strategic investor it is aiming to produce outcomes for the State which would not necessarily otherwise occur, or occur to the same extent, without its involvement. The basis for such strategic investments is the presence of market failures of one kind or another.

Over and above this, because at any given moment there may be many projects that possess these characteristics, being a strategic investor also requires the Government to have a view about which projects are likely to have the highest impacts for the State.

Figure ES1 provides a schematic overview of the key judgements the Victorian Government has to make in acting as a strategic investor. Key judgements are required if the Victorian Government is to:

- behave as a strategic investor with its own objectives and to only invest when such investment will ‘make a difference’;
- take into account the context of the Victorian, national and international scientific and industry environment so that it invests in high potential impact projects;
- properly take into account the priorities of the Commonwealth Government when assessing potential to leverage additional investment in projects; and
- play a catalytic role by investing in the early stages of the development of projects, allowing it to ensure that;
 - opportunities for collaboration are realised,
 - the scale of operations is appropriate to allow for reasonably open access for researchers to the new infrastructure, and
 - projects have in place at the outset clear business plans and commercialisation pathways for research finding.

To maximise the impacts of its investment in research infrastructure the Government should therefore aim to be investing in projects that fit in the top right quadrant.

Figure ES1

VICTORIAN GOVERNMENT INVESTMENT: MAKING A DIFFERENCE



Source: The Allen Consulting Group analysis

The nature of the State Government’s strategic investment through the STI Initiative suggest that the potential for leverage of investment and influencing project outcomes is strong. This reflects the following aspects of the Victorian Government’s investment behaviour that have been identified in the detailed analysis of seven project case studies. These features include:

- government was involved at the early stage of the projects. Government plays the role of an anchor investor. This is appropriate as it is at the early stage that market failures are particularly pronounced and the relative pay-off from government involvement is greatest. This role is important in consolidating the economics of a project in the initial stages until a point where sufficient results and momentum have been achieved leading to the attraction of other partners and co-investment;
- government has identified high impact areas for Victoria which are also a good fit with Commonwealth Government priorities;
- government has contributed in cash. This has signalling effects far in excess of what can be generated through in-kind support;
- government has required the project partners, as part of their business case, to identify pathways to the market and usage through the requirement for business plans; and
- reporting requirements placed on project partners provide an important ongoing planning discipline on the funded projects.

The importance of outcomes monitoring and reporting

Clear outcome monitoring and reporting obligations on research project funded by the STI Initiative are important for the effectiveness of the program. They not only help in assessing the performance of projects ‘after the event’, they also provide an ongoing planning discipline on projects that can actually result in improved project performance. They assist in the early identification of both problem areas within projects and, just as importantly, identification of the areas within projects that have the highest potential for the future.

The effectiveness of clear planning and reporting requirements is highlighted by the fact that projects funded through Round 2 of the Infrastructure Grants program appear to have ‘hit the ground running’ as a direct result of being required to have in place, prior to receipt of funding, a detailed business plan.

In regards to outcomes reporting, there have been some problems associated with the quality of data provided in relation to a number of government agency projects funded under the *STI Initiative: First Generation*. However, it appears that these problems have been recognised by STI Initiative administrators and that remedies are being implemented ahead of any future agency grants being made through the forthcoming *STI Initiative: Second Generation*.

STI has developed an Outcome Monitoring Tool to measure the range of benefits achieved over time. This aims to collect both qualitative and quantitative information by STI projects over time to assist STI to define and articulate the range of accumulated outcomes.

The STI Initiative represents a very significant investment in Victoria’s science and innovation system made in the expectation of generating strong returns to the State. In order to demonstrate the returns that are being made, having in place an effective outcomes monitoring and reporting system is essential.

