PRODUCTIVITY COMMISSION INQUIRY INTO SCIENCE AND INNOVATION

SUMMARY

- Positive outcomes from public support for innovation are more likely if:
  - the current predominance of the 'science and research push' approach to innovation is replaced by one that supports *business engagement with customers and markets;*
  - the key output to be sought is evidence of *transformed business models,* encompassing not only new products and technologies, but novel processes, work and organisational practices and market and business relationships;
  - priority attention is given to programs that enhance the ability of enterprises to *absorb and use* knowledge from external sources and that *foster reciprocal knowledge flows and working relationships* between enterprises, and between enterprises and other key economic actors, including researchers;
  - the competitive realities facing business enterprises in *appropriating value from innovative activities* are recognised and supported, eg. assistance with managing uncertainty, discovery of opportunities, market access, execution of business and management systems and the like;
  - specific attention is given to *increasing the global engagement* of Australia's resident firms, including sustaining long term international ventures.

- Public support for science and innovation should be shaped by a more comprehensive and accurate *understanding of the nature of innovation*, its measurement and its connection to the end goal of fuelling competitiveness and economic development.

- Innovation is *business transformation*; it is more than research and development or science, but less than just any business improvement.

- The end goal of public support for innovation needs to be redefined. Not more R&D and science, but *more internationally competitive private firms resident in Australia* with superior abilities to absorb and apply economically useful knowledge that transforms their business offerings to better meet market needs.

- Public support for science and innovation requires judicious policies that do not distort market processes, but rather enhance the ability of resident enterprises to compete successfully in cross-border markets. In particular, *governments can position themselves* to do this by strengthening their roles as:
  - *a demanding leading edge customer*;
  - *a responsive and sophisticated regulator*; and
  - *a catalyst for industry clustering and participation in global production chains*.

PRODUCTIVITY COMMISSION STUDY INTO PUBLIC SUPPORT FOR SCIENCE AND INNOVATION

SUBMISSION BY THE AUSTRALIAN BUSINESS FOUNDATION JULY 2006

1. BACKGROUND

The Australian Business Foundation is an independent, apolitical and non-partisan research think tank founded in 1997 by the eminent industry organisation, Australian Business Limited to produce fresh insights and practical intelligence to enhance Australia's capabilities and global competitiveness.

The body of research and scholarship generated over nine years has probed beyond the obvious to advance knowledge about what makes Australia competitive and what will support Australia's enduring economic prosperity, levels of employment and enhanced living standards.

This paper is the Foundation's initial submission to the Productivity Commission's research study on public support for science and innovation in Australia. It has been developed specifically in response to *Public Support for Science and Innovation. Productivity Commission Issues Paper, April 2006.* The Foundation's submission focuses on the following elements of the Productivity Commission's terms of reference:

- commenting primarily on the economic impacts of public support for innovation, with a preceding analysis of the nature of innovation and economic performance, approaches to measuring impact and the role of public support;
- impediments to the effective functioning of Australia's innovation system, both systemic impediments and the benefits of fostering demand-led innovation rather than relying on supply-driven innovation; and
- policy issues to the extent of specific comment on decision making principles and program design elements.

In commenting on these aspects of the Productivity Commission's terms of reference, the Foundation draws on broader scholarship from Australia and elsewhere, as well as distilled intelligence from its own body of research. Where this submission refers to material published previously by the Foundation, those documents are available in printed form on enquiry to the Foundation, or in electronic form from the Foundation web site.

The Australian Business Foundation's submission was prepared by the Foundation's Chief Executive Narelle Kennedy, Research Analyst Dr Matthew Steen and the Managing Director of ThinkEvans Pty Ltd, Carolyn Evans.

More information about the Australian Business Foundation and access to electronic copies of Foundation publications can be found at http://www.abfoundation.com.au.

2. IMPACT OF PUBLIC SUPPORT FOR INNOVATION

In order to address the Productivity Commission's terms of reference on the impacts of publicly supported science and innovation on Australia's productivity performance, the Australian Business Foundation first needs to comment on three defining issues:

(i) the nature of innovation and economic performance;

(ii) approaches to measuring impact; and

(iii) the appropriate role of public support .

We discuss each of these issues below, highlighting our key insights and conclusions primarily about economic impacts of public support for innovation.

INNOVATION AND ECONOMIC PERFORMANCE

Nature of Innovation

Innovation is a broad concept and is often used interchangeably with other terms such as invention, research and development, technology advances, discovery and science. However, in policy making or economic endeavour, innovation should be distinguished from discovery and the creation of scientific knowledge or its application, notwithstanding that in some cases, innovation and science are closely related.

Innovation, especially when its impact on productivity and economic performance is being analysed, must be decoupled from a predominant focus on its link to science, research and technology, which are all supply-side elements. Rather, in these circumstances, innovation should be viewed in relation to factors like customer and market demand, where innovation encompasses enhanced production processes, organisation and work practices and new business models and relationships.

The Productivity Commission Issues Paper takes this broadly based view in its definition of innovation, but tends to revert to a narrower scope in what is defined as public support, ie. largely funding arrangements for R&D expenditure, scientific research and commercialisation of inventions or new technologies.

The importance of maintaining a wider angle on innovation when assessing impact on economic performance was summarised well in recent research undertaken on behalf of the Foundation by Professor Keith Smith:

> *'Innovation can be seen as the development of technologically changed processes, products and services, the creation of new markets, and the use of new products. With that definition in mind, innovation is a key issue for both corporate managers and public policymakers because it jointly determines the business performance of firms and the path of economic development.'*[1]

Science and invention, as elements of innovation, are usually measured by expenditure on research and development and the number of registered patents. These are inadequate measures of innovation, since innovation includes many business activities that are not captured by these indices. Such non-R&D business innovation activities include:

- market research;
- training and skill development;
- design;
- the application of new capital goods;
- engineering development; and
- knowledge drawn from patents and licences.

Of the total expenditure on innovation in Australia for 2002-03, only one-third consisted of direct spending on research and development.[2]

In the same research by Professor Keith Smith, he points out that in Australia, as in most advanced economies, high technology or science-based industries and the technologies underlying them are very important, but they are also very small. He notes that high technology industries account for only around 3% of Gross National Product (GNP) in most OECD economies.

More significant to our understanding of the knowledge economy is the way innovation and growth occurs in the low and medium technology sectors, which form the bulk of the economy in Australia and in the OECD. These sectors include food processing, metal products, chemicals, timber products, printing and publishing, transport, mechanical engineering, mining, the hospitality industry, financial services, health and the like.

Innovation in such industries is not based on investment in research and development, but on the painstaking development and execution of distinctive business offerings that are demand driven; that

is, they either solve consumer problems or meet market demands. The reality of innovation is that it rests not on scientific discovery, but on learning and problem-solving by firms.

UNCTAD makes an important observation which puts this into perspective:

> *'Tacit knowledge can only be transferred effectively if the recipient develops capabilities to learn and incorporate the knowledge . . . The development of new capabilities applies to both technical functions and managerial functions: organizational and marketing innovation is as important as technical innovation to growth and competitiveness.'*[3]

Having determined that innovation is more than research and development or the commercialisation of inventions, it is equally important to stress that it is also less than just any improvement or change made in the operations of an enterprise.

Innovation is transformative rather than just remedial. Business transformation is more profound than simple business improvement, and by definition should exclude activities that are essentially routine.

Similarly, mere creativity does not amount to innovation. Only creativity and change that constitutes a distinct break with existing industry practice should be described as innovative.

Taking all of these ideas together, the process of innovation can be viewed quite broadly as encompassing the transformation of business through the application of tacit skills and knowledge.[4]

More specifically, the economic ramifications of innovation are best captured when innovation is defined as business transformation, the non-routine activity of an enterprise specifically encompassing the creation of:

- new goods or services, or new bundles of the two; and/or
- new combinations of inputs, such as new techniques of production, new forms of work organisation, or the absorption of new business knowledge from internal or external agents.

Therefore, as the Commission's Issues Paper defines, innovation includes broader business activities such as acquisition, adoption and absorption of external knowledge, relevant equipment and machinery, market preparation and training. However, these should only be included to the extent that they do more than allow one enterprise to catch up to its competitors (whether those competitors are domestic or foreign). For example, managerial improvements that simply bring the enterprise up to the standard set elsewhere among competitors should not be considered innovation, such as training expenditure to address sub-standard skills, or adopting new accounting procedures or achieving more efficient use of existing resources.

In short, in investigating the impacts of public support for science and innovation, it is important to fine-tune the understanding of the nature of innovation. Innovation is business transformation; it is more than research and development or science, but less than just any business improvement. Innovation is a demand-driven process, the economy's capacity for which is limited by the concomitant supply of all essential ingredients. These essential ingredients clearly include scientific knowledge, but also include the capabilities to identify and solve problems, and to harness and make use of specialist forms of knowledge such as work design, tooling, market intelligence and so on.

The benefits to innovation of increasing the supply of one input will necessarily be constrained by the ambient level of supply of other inputs, unless proportional increases of other inputs are achieved also.

The Australian Business Foundation submits that there are clear shortcomings in an environment unduly focussed on engendering and measuring the increase in supply of a single input (eg. research and development) at the expense of other inputs that are also essential and that linking these inputs to outputs and outcomes is also required.

Public support for innovation is more likely to render positive results when broadly based business engagement with customers and markets is included.

Economic Performance

The Foundation's body of research work highlights a recurring theme that innovation underpins the competitive performance of firms and industries, and therefore the growth of labour productivity and national income. This view is by no means unique to the Foundation.

UN economists affirm that:

> *'… all analysts accept innovation to be a vital ingredient of competitiveness'.*[5]

And

> *'In a globalizing world with rapid technical change, strong and growing innovative capabilities are essential to economic progress. This is as true of resource-based economies as of others and it applies as much to services and agriculture as it does to manufacturing.'*[6]

Similarly, the OECD has emphasised the centrality of innovation in a number of reports that detail the findings of leading economists.[7]

The critical question, however, is gaining a greater understanding of the way in which innovation underpins sustained economic success and prosperity. This is a vital prerequisite to commenting on the economic impact of public support for innovation.

The view that business innovation is the driver of economic growth and development has its origins in the analytic work of Joseph Schumpeter, who drew a useful distinction between:

- growth (steady quantitative expansion); and
- economic development (qualitative changes to production that disrupt business routines).[8]

Moreover, he stressed that incessant 'industrial mutation' or 'creative destruction' is 'the essential fact about capitalism'. This mutation consists in:

- the introduction of a new commodity, or a new quality of an existing one;
- the introduction of new methods of production or transportation;
- the opening of a new market;
- obtaining a new source of supply for inputs; and
- any form of industrial reorganisation.[9]

Since Schumpeter wrote, his general propositions have been confirmed by numerous empirical studies throughout the world. From the consequent body of knowledge, prominent commentators on innovation concur that:

- the competitive advantage of firms (and the nations in which they produce) hinges ever more on the accumulation and application of knowledge, and ever less on the exploitation of given factor endowments;
- investment expenditure is increasingly being directed towards intangible assets;
- freer cross-border flows of trade, finance, foreign direct investment and research and development are heightening the interdependency of firms;
- successful innovation commonly requires local concentrations ('clusters') of interconnected companies and institutions in specific fields;
- innovation fosters new services, which provide employment for significant numbers of workers;
- higher real wages and profits prevail in those countries that harbour innovative activities;
- governments play an integral role in providing the physical and intellectual infrastructure that makes sustained innovation possible; and

- innovation success and failure are cumulative, and governments cannot rely on market mechanisms to correct persistent trade deficits or to direct FDI to places where capital is scarce.[10]

Clearly, a crucial aspect of the link between innovation and economic performance is the competitiveness of private enterprises. The conventional view is that firms are competitive to the extent that their market structure approximates the model of perfect competition.

That is, firms are judged to be competitive if they:

- compete with a large number of sellers;
- are able to enter and exit the industry with ease;
- sell commodities that are identical or highly similar to those of their competitors;
- have negligible influence over market price; and
- receive a 'normal' rate of profit that tends to equal the opportunity cost of operating.

Under these conditions, competitive advantage is attained either by selling a given rate of output at the lowest possible cost, or by maximising output with given costs.[11]

However, this conventional view of competition is inapplicable to an economic system driven by innovation. This is because innovation is an evolutionary process that does not lend itself to undifferentiated production or the optimal use of given inputs.

Traditional criteria of optimality rest on static, timeless analyses, in which there is no uncertainty (only probabilistic risk) and price flexibility is the dominant form of competition. Conversely, the hallmarks of the process of innovation are uncertainty and ambiguity, because the process hinges on:

- the creation and deployment of knowledge that is tacit (i.e., uncodifiable and untradeable);
- the possibility of unknowable outcomes (without which there could be no novelty); and
- non-price forms of competition (e.g., real or artificial product differentiation, privileged relationships with customers and suppliers, entrepreneurial flair, etc.).

So, an enterprise does not become competitive when it optimises with respect to an objective production function. Rather, it survives (or thrives) when it generates knowledge capable of transforming itself at (or above) the prevailing rate for its industry.[12] As Metcalfe puts it concisely:

> *'Being continually better than one's rivals is the only route to sustainably superior profitability, which in turn provides the link between competition and the stimulus towards improvements in transformation pressures.'*[13]

Moreover, where enterprises compete through innovation, the existence of oligopoly or monopoly is not indicative of weak competition or arrested economic development. On the contrary, a degree of monopoly is both a precondition and effect of successful innovation.

On the one hand, enterprises cannot afford to finance unpredictable, costly innovation programs without the suspension of complete freedom of entry and the persistence of 'supernormal' profits. On the other hand, price flexibility would destroy enterprises undergoing a disruptive innovation process. There is no evidence that large, innovative firms generate less output at a higher price than smaller, more 'purely' competitive ones. On the contrary, large enterprises are generally superior in terms of technical efficiency, owing to their ability to attain economies of scale and scope.

Therefore, the economic performance of innovating enterprises cannot reasonably be explained or assessed by the traditional model of perfect (or relatively pure) competition. Rather, market structures shaped by innovation exhibit:

- real-investment decisions that are based on uncertain conjectures rather than reliable calculations of risk;
- a variety of goods and services produced within the same industry;
- a degree of monopoly, in terms of the bundles of knowledge that are peculiar to each enterprise;

- a constant pressure to transform business activities and secure niche markets; and
- the persistence of imperfect competition and supernormal profits in the long run.

When competitiveness is conceived as an adequate rate of business transformation (dynamic efficiency) instead of minimal-cost production (static efficiency), it is easier to discern the crucial role of public support for science and innovation, which is discussed further in a later section of this response.

Alternatively, taking an evolutionary concept of competition highlights the uncertainty and path dependence of innovation, and the absence of a market for transformative business knowledge.

With this viewpoint, the implication for policy is that there are measures specific to government that are necessary for the generation and absorption of business knowledge by private firms. Further, it is the international competitiveness (or relative innovativeness) of companies resident in Australia that ultimately determines national economic advantage.

APPROACHES TO MEASURING THE IMPACT OF SCIENCE AND INNOVATION

The Productivity Commission Issues Paper correctly highlights the difficulty of measuring the economic impacts of innovation, especially in terms of causal relationships. The Foundation would add that the problem with existing approaches is that they focus on the few innovative activities that can be measured directly (chiefly, expenditure on research and development and the registration of patents). This is at the expense of many other important innovative activities that are much harder to gauge.

Consequently, many quantitative surveys reinforce the misperception that innovation is a linear process of commercialising scientific ideas. Conversely, these surveys obscure the networks of non-scientific and indirect knowledge flows that are major determinants of innovation.

A preferable alternative is to construct composite indices that include less precise – but more relevant – indicators of the generation and absorption of new business knowledge.

In particular, the Australian Business Foundation would like to direct attention to the following two aspects of measuring innovation and its impacts:

- The actual drivers of innovation must be carefully distinguished from the indices used to represent them.
- The usefulness of the index of total or multifactor productivity as a measure of the effects of innovation is undermined by fundamental conceptual flaws.

Drivers vs Indices

Since what *can* be measured is often confused with what *should* be measured, the Foundation maintains a rigorous distinction between the 'indices' and 'determinants' of innovation. The indices are simply numerical representations of activities deemed to be innovation inputs and outputs, from which functional relationships (correlations) can be derived. In contrast, the determinants of innovation are the socio-economic structures and relationships that give effect to business transformation.

For public policy making, the Foundation views it as crucial to recognise that attempts to construct *precise* indices of innovation are at best partial and at worst misleading. This is because:

- The determinants of successful innovation (eg. tacit knowledge, collaboration between diverse agents, entrepreneurial judgement, etc.) are not observable or easily estimated.
- Innovation is a process that is *fundamentally* uncertain; that is, it cannot be meaningfully reduced to statements of probabilistic risk.[14]
- The effects of innovation are ambiguous: the impact of a particular innovation usually unfolds for several time periods after its implementation; and the scope of its impact may well extend beyond the innovator's industry and geographic location.
- The time horizon for the benefits of any given innovation may well be longer than anticipated by any analyst or government.[15]

- Current indices of innovation typically present data in strictly national terms, belying the increasingly transnational character of contemporary innovation.

In other words, because innovation is an uncertain process that generates ambiguous effects over various time intervals, quantitative models that impose a closed system of causal relations should be interpreted with great caution. In particular, models that rely on a small number of indicators are likely to present a distorted picture of innovative activity, especially if these indicators are biased towards scientific practice rather than business transformation proper.

As mentioned earlier, research and development is a striking example of a particular index that is often misinterpreted as adequate measure – and even determinant – of business transformation. In their most recent *World Investment Report,* UN economists justify their decision to use research and development as a major proxy for innovation as follows:

> *'R&D is only one component of innovation activities, but it represents the most developed, widely available, and internationally comparable statistical indicator of industrial innovation activities.'*[16]

The authors proceed to construct the 'UNCTAD Innovation Capability Index', which combines standard national research and development indicators with those which measure the skill and literacy of the labour force.[17]

Notwithstanding the benefits of relying on data that are widely available and internationally comparable, the Foundation contends that indices like the UNCTAD Innovation Capability Index place far too much weight on stocks of knowledge that are codifiable and scientific, and far too little on flows of knowledge that are tacit and extra-scientific. UNCTAD itself admits that their index captures the outputs of technological invention, rather than new commodities or modes of business transformation.[18]

Total Factor Productivity

The standard concept used to estimate technological and organisational change is total factor productivity (TFP), also known as multifactor productivity (MFP). However, this is a measure which is burdened by severe problems of aggregation and omission.

TFP measures the change in output not attributable to quantitative changes in the stock of capital and labour. This residual change is often equated with technological improvements (including changes in work organisation). The referent of total factor productivity is well summarised by Professor Richard Lipsey and Dr Ken Carlaw:

> *'Changes in [TFP] are correctly described as changes in the difference between measured outputs and increases in measured inputs. Changes in TFP do not measure technological changes...'*[19]

So the problem is that total factor productivity measures the supernormal profits that accrue to technological change, not the change itself. TFP also suffers from severe conceptual problems that render its results unreliable and distorting.[20]

The Foundation recognises that it is theoretically difficult, and practically impossible, to separate quantitative growth in real capital goods and human capital from the qualitative changes that more inputs enable.[21] A preferable aggregate measure is total labour productivity, since long-run growth in GDP can reasonably be presented as a function of labour productivity, which in turn is a proxy for business transformation. However, aggregate labour productivity is no substitute for specialised indices of knowledge creation and absorption, which are required to guide innovation policy.[22]

Emerging Alternative Innovation Measures

It is obvious that finding more inclusive yet subtle measures of innovation poses difficult problems for analysts, policymakers and business people. The ABS notes that:

> *'There is no internationally agreed framework for measuring the extent to which an economy or society is knowledge-based.'*[23]

But, there are encouraging developments in seeking to capture wider and more informative measures of innovation.

For example, the Commonwealth Department of Industry, Tourism and Resources (DITR) has constructed the 'Australian Innovation Scorecard' to compare Australia's innovative effort to that of other OECD economies. The 2004 Scorecard organises fifteen indices of innovation under six heads:

- Knowledge creation, which includes research and development expenditure in government and higher education sectors as a percentage of GDP, scientific and technical articles per million population, number of US patents per million population, and business sector research and development expenditure (BERD) as a percentage of GDP.
- Human resources, which consists of the percentage of the workforce with tertiary education, number of science graduates per 10,000 persons in the labour force, and researchers per 10,000 in the labour force.
- Finance, which is equated to investment in venture capital as a percentage of GDP.
- Knowledge diffusion, which includes investment in information and communications technology as a percentage of business sector gross fixed capital formation, Internet users per 1,000 population, and investment in new equipment – investment in machinery and equipment as a percentage of GDP.
- Collaboration, which consists of the share of foreign affiliates in manufacturing research and development, and the breadth of international science and engineering collaboration.
- Market outcomes, which is measured by annual growth in total factor productivity between 1997 and 2001, and expenditure on innovation as a percentage share of total sales in manufacturing.[24]

While the Australian Innovation Scorecard does exhibit a conventional bias towards the generation of scientific knowledge and the commercialisation of inventions, the Foundation acknowledges that it does constitute a step in the right direction by considering the financial and collaborative aspects of innovation. In addition, the inclusion of an indicator that measures residents' access to the Internet throws light on the potential national stock of people working in knowledge-intensive occupations, which (as mentioned later in this submission) is a factor in effective national innovation systems highlighted by US economist Robert Reich.

Similarly, the ABS itself has proposed a framework for measuring innovation, which consists of three 'core' dimensions and two 'supporting' ones. The core dimensions are:

- Innovation and entrepreneurship, which includes the potential for knowledge creation and commercial research, the degree of knowledge sharing between firms and nations, and the creation of new firms.
- Human capital, which includes the stock and flows of skilled people, expenditure on education and training, and access to lifelong learning.
- Information and Communications Technology, which includes relevant infrastructure and access, the use of this technology by households, business and government, the prevalence of electronic commerce, and the share of information-and-technology workers in the labour force.

The two supporting dimensions are:

- Context, or the economic environment as measured by conventional macroeconomic performance indicators.
- Economic and social impacts, which include measurements of social cohesion, demographic patterns, health status, crime levels and income distribution.[25]

The ABS framework for measuring innovation is notable because it considers the close connection between the social and economic factors which make up a national innovation system.

Furthermore, ABS with the Department of Industry Tourism and Resources has attempted to gather more refined information about innovation in Australia, through its Innovation in Australian Business 2003 survey and related report on Patterns of Innovation in Australian Businesses. This survey

focuses on goods and services and processes that are new to individual businesses, together with innovations that are new to the industry, Australia and the world. The attention given by the ABS to novelty at the business level is welcome; for it captures incremental and adaptive improvements at the firm level.[26]

Notwithstanding the technological bias and other limitations of existing government efforts to measure the impact of innovation, the Australian Business Foundation strongly supports endeavours to extend and refine innovation indices and surveys. The Foundation therefore recommends that the Federal Government increase its support of this process, either by conducting additional research itself, or by funding relevant scholarly work.

ROLE OF PUBLIC SUPPORT

The more nuanced approach to innovation, economic performance and its measurement argued previously in this submission necessitates an equally nuanced understanding of the role of public support for innovation.

The Foundation contends that the Productivity Commission's investigation is at risk of compounding a mistaken view that the supply of science and research capacity determines innovation capability, with resultant flawed conclusions about the desired objectives and impacts of public support for innovation.

Professor Keith Smith articulates the Foundation's concerns well:

> *'It is not valid to picture research and development as the only significant input to innovation and technology creation . . . This leads to a misrepresentation of the technological change process (by focusing excessively on research and development as an input), and in particular to a more or less complete neglect of non-research and development aspects of the innovation process. [eg. improved labour skills, changed organisation, enhanced equipment]. Moreover, [this focus on commercialisation] leads to an underestimation of the costs of innovation (and hence to an overestimation of the returns to research and development).'*[27]

And further,

> *'The really important problem here is that the overemphasis on research and development leads to the adoption of some version of the so-called 'linear model' [commercialisation] of innovation – namely the idea that innovation is essentially based on processes of scientific or technological discovery, and that the innovation process consists of translating research results into new products. In this approach, innovation depends on science or research and development as its originating moment, and then sequentially develops discoveries into engineering concepts and then into product development. In fact, very few industries innovate like this.'*[28]

If this erroneous picture of innovation persists and serves to drive future public support, then policies that merely increase Australia's supply of science and research can, perversely, lead to the loss of intellectual capital and skills from Australia. This can be the impact of failure to give equal policy attention to increasing the absorptive capacity of Australian enterprises, ie. their capacity to take up knowledge and ideas generated from the research community and other external sources, to invest in them and to apply them in ways which create imaginative business offerings that are valued by customers.

Increasing the amount of research and scientific knowledge, without investing in increasing the capacity of firms and industries to use this knowledge, results in 'orphan intellectual property', readily susceptible to being acquired by offshore interests in our global, open economy. Consequently, the benefits of Australian public support for science and research (in the form of intellectual property and skilled people) may fail to be captured by the Australian taxpayer.

To redress this negative impact, the Foundation recommends a change of focus to capture the 'demand pull' dimension of innovation policies and programs. This would give priority to those initiatives that foster capacity for innovation at the company level in response to market and customer requirements, particularly solving problems for demanding customers and building the systems and businesses processes to replicate and scale up such business offerings for global markets.

The implication of this is that the scope of public support for innovation is widened beyond specific science and technology programs and extends to areas of export and trade promotion, investment attraction, structural adjustment, industry extension and support, clustering, small business services and the like.

To boost business innovation, it is not enough just to invest in programs that encourage R&D, patents or the spin-off of technologies from universities. Support must be given to programs that impact on firms' investment, production, marketing and distribution capabilities. These business systems allow firms to absorb new knowledge which they use to produce the types of products and services that fulfil market demands and solve problems in the community.

A recent study of the success factors for Australian growth industries undertaken by analysts at the Australian Stock Exchange for the Australian Business Foundation illustrates the importance of investing in actions that foster and sustain business capabilities and skills. It also emphasises the role played by external institutions, knowledge diffusion mechanisms and collaborative relationships that serve to support the growth and global competitive success of firms.[29]

The Australian Business Foundation submits that the scope of public support for science and innovation should abandon the existing predominant linear commercialisation model of innovation. This model impacts on value creation far less than boosting the ability of resident enterprises to meet the needs of demanding customers in transnational markets. Governments can augment the innovative capacity of resident enterprises by offering selective assistance in areas beyond just R&D incentives, like in skills and capacity building and market access.

3. IMPEDIMENTS TO AUSTRALIA'S INNOVATION SYSTEM

SYSTEMIC AND DELIBERATE ACTION

The single most critical impediment to the effective functioning of Australia's innovation system is that it is not conceived of as a coherent system. Further, little political priority seems to be given to the deliberate and integrated action across government needed to ensure judicious, enduring investment in all elements of the innovation system to ensure its effective functioning as a whole.

A national innovation system can be defined as the way in which a nation's private enterprises, universities and research bodies, financial and legal system, monetary policies, corporate governance, regulatory and tax environments and institutional and cultural norms work together to influence the development and utilisation of new knowledge and learning. Nations that are adept at fostering the linkages, networks and knowledge flows between components of the innovation system gain a competitive advantage which strengthens and shapes both their innovation capacity as a nation and the high performance capabilities of resident firms.

If a country is to enjoy a trend of private innovation and robust productivity growth on the one hand, and increasing flows of aggregate income on the other, it must consciously develop a socio-economic system that links private and public agents of innovation in ongoing and purposeful relationships[30].

It seems that it is the deliberateness and intent of this development which constructs an innovation system. Arguably, the mere presence of universities, enterprises and such in an economy does not constitute a system at all, being a haphazard collection of organisations that may have some scientific, inventive, or other capacities.

Roos *et al.* allow that the lack of deliberate action identifies a mediocre system, and go on to spell out the requirements for a successful national innovation system. At a summary level, the items in their list incorporate intent to operate as a system and deliberate action to this end, and are each a necessary but not sufficient condition for a successful national innovation system. Their list includes:

- Recognition of the need for cohesive, deliberate action by governments, and delivery against this need, to invest judiciously in each of the elements of the innovation system, so the structure works together as a whole.
- A globally focussed economy which is flexible and adaptable.
- The existence of demanding sophisticated leading-edge customers.

- A high level of networking among innovators.
- Improved linkages between science and industry.
- An increasingly diversified base of research and development performers.
- High business and government expenditure on research and development.
- A supportive financial system that ameliorates the costs of investing in uncertain innovative projects.
- Above average rates of investment in education, research and innovation.[31]

This view is consistent with the Productivity Commission's conception of the innovation system as extending well beyond the elements of the economy that produce research and development. Similar arguments have been made by the European Commission:

> *' … for countries where innovation performance is high, marginal gains are optimised when all dimensions of innovation are addressed together.'*[32]

It is not good enough to focus attention on just one or two components of the innovation system, like boosting R&D expenditure or increasing the number of scientists and engineers. Rather, adequate investment is required in all components and in how the system functions seamlessly together.

The work of Robert Reich affirms that structural changes in the world capitalist economy have given rise to 'global webs of enterprise', which produce and distribute commodities across borders and which elude national classification. Critically, Reich stresses that demand-driven problem-solving by loosely connected business units has displaced supply-driven research and development by bureaucratic national corporations.

Consequently, governments cannot assume that public support for locally owned companies will enhance national income and employment. Rather, the challenge for national governments is to attract and retain high value-adding businesses within their borders, irrespective of the nationality of their directors or shareholders. For in a world of extremely mobile capital and intense crossborder competition, it is only knowledge-intensive occupations that can sustain high real incomes within a nation.[33]

Reich proceeds to argue that selective government policies are vital to the participation of domestic agents in global webs of enterprise. In particular, he exhorts governments to provide their citizens with the education and training necessary to perform non-routine, high value-adding tasks. According to Reich, sustainable employment and high real wages depend upon the bulk of the workforce being 'symbolic analysts'; that is, people who can either identify problems or solve them, or else link problem-identifiers with problem-solvers. (In contrast, the positions of 'routine producers' and 'in-person servers' are becoming ever more precarious.) Taking adequate healthcare and safe environments as given, Reich suggests several measures to boost the supply of symbolic analysts:

- encouraging upward economic mobility by maintaining a progressive tax system;
- extensive public investment in tertiary education, vocational training, research parks, airports and other facilities conducive to symbolic-analytic work;
- inducements to transnational enterprises to contract with domestic residents to identify and solve complex problems;
- increasing workers' access to computerised information, and therefore their ability to alter business practices and generate new efficiencies; and
- specific educational and training programmes for the long-term poor, which make their chances of employment equal to the rest of the labour force.[34]

Reich's policy prescriptions are echoed in the analysis of Michael Porter. Like Reich, Porter points out that it is firms, not nations, which compete, and that national economic advantage derives from the knowledge and employment effects of hosting 'clusters' of high-productivity firms. These clusters consist of local concentrations of interconnected companies and institutions in specific fields. They are characterised by the synthesis of robust competition and cooperation, strong connections between

sophisticated customers and suppliers, greater and speedier access to inputs, lower costs of entry and experimentation, and the encouragement of new enterprises.[35]

Porter opposes his theory of the 'competitive advantage of nations' to the traditional idea of 'comparative advantage', whereby nationally based firms – facing 'given endowments' – each specialise in what they can produce at the least opportunity cost to themselves. While comparative advantage implies no state action apart from the promotion of free trade, Porter insists that governments play a key role in providing the laws, institutions and policies that sustain the productivity of domestic industries and workers vis-à-vis their best foreign competitors.

STRUCTURAL CONSIDERATIONS

There are several characteristics of Australia's economy and industry structure which affect the effective functioning of Australia's innovation system. These are covered below.

Small and medium sized enterprises share the nature of employment and local capability

According to the ABS, 1.1 million non agricultural small businesses account for more than 96% of all businesses in Australia, and at last count provide 3.3 million jobs to employ 47% of private sector, non-agricultural employment.[36]

Key issues relating to SMEs include:

a) SMEs (which by definition have less than 200 employees) account for around 40% of BERD, which is a very high proportion for small firms when compared to OECD nations. SMEs are already investing in R&D and their ability to take on more of the load is questionable.

b) The preponderance of small business in Australia is concentrated in the construction, retail and property & business services sectors. These are all industries that do not have significant exports. Austrade research shows that close to 30,000 Australian businesses export, which accounts for just 4% of the firms in Australia. Furthermore, many of these are one-time exporters.[37] Clearly, a rather modest number of high-achieving exporters are doing a lot of 'heavy lifting' for the rest of the Australian economy. Growth in trade to GDP remains unremarkable in comparison to many other countries and is below the OECD average, according to the *OECD Factbook 2006.*[38]

c) SMEs are limited in their ability to absorb and use knowledge, simply by their size and resource constraints and by their capacity to manage uncertainty. While Australia has strong knowledge infrastructure through grants and tax concessions for research and development, support to universities, publicly funded research institutes and Cooperative Research Centres, it has relatively weak knowledge diffusion mechanisms. SMEs as a rule do not have the capacity to take up knowledge generated from universities and the like and apply it to create products and services that attract and sustain sales worldwide. The result is often that Australian-created intellectual property is acquired by off-shore interests and capabilities and wealth are consequently lost from Australia.

Industry is highly dependent on transnational enterprises

According to Thorburn *et al.*, Australia is one of the most dependent of OECD countries on the operations of firms headquartered overseas.[39] Australia has about 2,500 foreign affiliates, which in 2000 accounted for 17.9% of industry revenue with the 500 largest transnational enterprises accounting for 90% of that share (or 16% of the total).[40] Australia's largest businesses (which employ more than 1000 people), many of which are multinationals, account for 34% of total business expenditure on research and development. But, the benefits to Australia are limited because this research and development primarily serves the global interests of the parent firm, not necessarily Australia's national interests. Further, the bulk of research and development conducted by transnational enterprises in Australia is focused on product modification for the Australian market, not the creation and diffusion of new knowledge. There is little attention to technology transfer or global supplier linkages, which limits the innovation return to Australia.[41]

Limited ability to hold critical mass in key sectors

There are limitations on Australia's ability to hold critical mass in key industry sectors where it has created innovative products and services and secured entry into global markets. Australia suffers

from an industry structure in many sectors populated by one or two large players and a vast bulk of SMEs, but with few home-grown world-class major 'platform' companies, like Nokia in Finland, Ericsson in Sweden or Phillips in Holland. These platform firms have the capability of capturing and holding the economic 'value-add' from their innovative technologies and global brands and bringing a stream of both novel products and entirely new businesses to the market. The existence and success of such enterprises ensures the continued viability and contribution of those industry sectors to their national economies. Australia can build successful companies that operate globally but, in many instances, the sector gradually falls to foreign ownership, with the bulk of the value created flowing to overseas equity holders, eg. mining, food processing, wine.

Signs of decline in Australia's market share of global exports

2004 WTO data shows that after 15 years in which Australia's share of the global market for goods and services was slowly rising in trend terms, it lost that momentum and has been falling since 1997.[42] The growth of China and its appetite for Australian primary exports may be masking such underlying vulnerabilities in Australia's current economic growth performance. With fully fledged participation on the world economic stage by rapidly industrialising countries like China and the rebalancing of trade relationships that will result, Australia's share of global economic activity could well decline, taking us deeper into a niche role. This makes it even more imperative for Australian enterprises to boost their level of international investment and trade, so as to secure a place for themselves in distributed global production and supply chains, including those in the emerging economies of China, India and even Latin America.

The Australian Business Foundation contends that the foregoing structural impediments are more significant factors in whether Australia's innovation system can operate to its potential than any of the specific impediments (like workforce skills, commercialisation barriers or international agreements) given as examples for comment in the Issues Paper.

4. DECISION MAKING PRINCIPLES AND PROGRAM DESIGN

In relation to this aspect of the Productivity Commission's terms of reference, the Foundation notes that the focus is on general lessons and conclusions for innovation policy decisions and program design, not detailed analysis of particular and programs or levels of public support.

Therefore, in addressing questions of how funding levels are determined, allocation choices made and programs designed, delivered and administered, the Foundation emphasises the importance of prioritising the policy outcomes to be achieved, rather than debating the alternative means to achieve the end. Our comments are consequently made at this level of granularity.

The starting point for the Foundation's comments is that in relation to public support for innovation, business enterprises (as the primary economic actors) are central to deliberations on productivity performance. Innovation is the task of business, but the behaviour of business is amenable to policy action.

Ultimately, innovation is a means to an end. It is the fuel of economic growth and development (as distinct from simple expansion of the economy). Public support for innovation needs to be linked to such competitiveness and economic development objectives themselves.

When competitiveness is conceived of as an adequate rate of business transformation, instead of minimal-cost production, then the policy principles and program design elements become clearer.

From our earlier analyses of innovation and economic performance, the Foundation contends that the policy actions likely to have the most robust effects on productivity enhancement in businesses are those that either reduce the transaction costs for firms acquiring knowledge, on one hand, and those that either help to share the risks or to appropriate value from embarking on new areas of economic endeavour, on the other.

Given this, the following headline decision making principles and program design elements are highlighted for action:

Focus on global market success, not on market failure

Much public policy affecting the business environment seeks to address market failure, rather than facilitating market success. This applies to the productivity debate where attention to date has been focused on the vertical economy-wide pillars of microeconomic reform, competition policy, labour market flexibility, taxation and macroeconomic settings. These policies have resulted in productivity enhancements in terms of the efficiency and flexibility of the Australian economy.

In a globalised knowledge-based economy, however, the conditions for future productivity enhancement are likely to extend to the dynamics of global market success, and therefore the horizontal policy platforms that facilitate improvements in business transformation, capability and innovation performance.

An important policy response is to extend effective debate on productivity beyond reforms for economy-wide efficiency and flexibility to actions for promoting business success in global markets at the sector level, especially those sectors which play to existing national competitive advantage.

The implications of this for funding allocation and program design are three-fold:

1) More investment is needed in policies and programs that foster innovation at the company level, applying and diffusing economically useful knowledge to achieve business and commercial outcomes and to solve problems for customers.

2) Similarly, priority should be accorded to policies and programs that enhance the capacity of existing firms and industries (especially SMEs) to make the significant investments, to manage the inevitable uncertainty and to meet the difficult management and operational challenges of embarking on innovative business initiatives.

3) Include in the scope of public support for innovation, those programs and policies that aim to assist enterprises enter and succeed in global markets. In addition to continuing investment in Austrade export and trade facilitation programs, there are unexplored opportunities for international trade by Australian firms in distributed global production chains, especially in the Asia-Pacific region. Further, given Australia's concentration of large multinational corporations, there is also potential for Australian firms to make greater use of these multinationals to extend their international reach and as source of personnel, knowledge transfer and technology diffusion.

   Similarly, public support efforts need to recognise that business must adopt a global focus to access markets and knowledge. The quality of the business operating environment will be increasingly judged by the extent to which it facilitates global integration and supports global business strategies (trade – eg. harmonisation with international standards; investment – eg. tax policies; knowledge flows – eg. foreign investment (inwards and outwards), skilled people, international research alliances).

Capitalise on identifiable and specific patterns of Australian innovation and industry capability

It is important to understand what is possible and natural for Australia, given our size and the structure and composition of SMEs and multinational corporations in our economy. There is an argument for building Australian capability in customised value-added niches, not in low cost high volume segments.

It is also important to recognise the identifiable and specific patterns of Australia's current innovation and capabilities. New valuable opportunities for Australia are most likely to be built by exploiting opportunities adjacent to existing capabilities and strengths. For example, environmental biotechnology applications might better suit Australia, as development time is not as great as for pharmaceutical applications and capacity is anchored in local natural resources.

Increase the innovation yield from economic activities

Innovation should be an outcome of a wide range of economic endeavours, not just confined to explicit areas of innovation policy. From this perspective, it is possible to gain an innovation yield from addressing significant national problems or stresses in the economy with action to broker market-based solutions to issues like the National Water Initiative; aged and health care, given the economics

of an aging population; or Australia's carbon constraints affecting climate change, energy and environmental sustainability.

These are all areas where Australia has demonstrated strengths, that align with National Research Priorities and where there is a likely profitable market for solutions to these problems, both domestically and internationally.

Bridging national and corporate interests

There is a divergence of interest between corporate well-being and national well-being. In a globalised knowledge-based economy, this divergence is increasing, and now affecting small and medium enterprises not just multinationals, as in the past.

Action to better align private corporate interests and national community interest is acknowledged as legitimate in other countries, eg. USA and China's pragmatism, the management of uncertainty and sharing its costs in the UK, Sweden increasing its innovation return on existing expenditure.

In Australia, there is a reluctance by governments to intervene, with questions of where governments can best add value and not create unintended consequences from their actions. There is also lack of tolerance in the media, the political system and the community at large of failure by governments, and this 'micro-accountability' inhibits policy prototyping.

The question becomes one of how to ensure that market success for Australian businesses can also result in a strengthening of Australia's economy as a whole, with resultant benefits in terms of jobs and quality of life evident across the entire Australian community.

The Foundation suggests that the goals of private interest and national interest can be bridged and that productivity gains can be made from strengthening the roles of government as:

- a demanding leading edge customer;
- a responsive and sophisticated regulator, attuned to the 'licence to operate' issue for business; and
- a catalyst for industry clustering and for participation in global supply and production chains.

The best guidance that the Australian Business Foundation can give in this respect is a reference to the recently published book by respected economists Richard Lipsey, Kenneth Carlaw and Clifford Bekar, which details a strong, evidence-based argument for design and operational characteristics of public support initiatives that distinguish policy successes from failures.[43]

ENDNOTES

[1] Smith (2005, 3).

[2] ABS and DITR (2003).

[3] UNCTAD (2005, 101).

[4] For example, Metcalfe (1998, 28); Hodgson (1998, 180) and Loasby (1998).

[5] UNCTAD (2005, 112).

[6] UNCTAD (2005, 116).

[7] See, for example, OECD (1995, 1998, 2002, 2005, 2006b).

[8] Oakley (1990, 102).

[9] Schumpeter (1954, 83); Oakley (1990, 104); see also Marceau *et al.* (1997, 6).

[10] For example, see Reich (1993); OECD (1995; 1998); Porter (1998) and UNCTAD (2001-2005).

[11] See the classic text by Paul Samuelson (1961, Chapter 24).

[12] Schumpeter (1954**,** 84ff); Hodgson (1998) and Metcalfe (1998 15-24, 35f 94-97).

[13] Metcalfe (1998, 36).

[14] See, for example, Smith (2005, 14) and Lipsey and Carlaw (2004).

[15] Thus the judgment of the European Commission (2005, 6) that Sweden and Finland record superior returns to innovation because they have fostered innovation systems for much longer than other advanced economies.

[16] UNCTAD (2005, 103).

[17] UNCTAD (2005, 113).

[18] UNCTAD (2005, 111).

[19] Lipsey and Carlaw (2004, 1142). They go on to declare: 'since part of the return to innovation reimburses the (widely-defined) development costs and thus show up as offsetting input costs. Changes in TFP are correctly interpreted as being an imperfect measure of the returns to investing in new technologies that are in excess of the return to investing in existing technologies, that is, the super normal gains of technological change. It is conceptually possible, therefore, to have sustained, technologically driven, economic growth with zero changes in TFP.'

[20] Critically, TFP rests upon the formally discredited concept of an aggregate production function. This concept was renounced some time ago by internationally renowned economists, who agreed that heterogeneous and privately owned real capital goods cannot be aggregated without: (a) lapsing into circular reasoning; or (b) imposing the extremely restrictive assumption of no 'capital reversing'.

Pasinetti (2000, 27-31) summarises the problem of circularity as follows: an aggregate production function treats labour and capital symmetrically, each being expressed in physical terms. Yet while heterogeneous labour can be measured in terms of natural units (labour hours by each class of worker), the yields of heterogeneous capital goods can only be summed in value terms. Hence, the rate of profits is not determined by the quantity of capital, but by its value. The latter is obtained by multiplying the physical quantity of capital by its price, which is in turn dependent on the rate of

profits. This means that for any model involving two or more goods, it cannot be said that the rate of profits is a function of the marginal product of capital. The solution put forward by postwar neoclassicists was to represent aggregate capital in terms of its *current value.* Yet this still entails assuming what needs to solved: the rate of profits.

As for 'capital reversing' (or 'reverse capital deepening'), it refers to the possibility that at a *lower* rate of interest, a less mechanised technique becomes *more* profitable than a *more* mechanised one, which was equally or more profitable at the previous (higher) rate of interest. The phenomenon of capital reversing all but rules out the generic, neoclassical production function, according to which the price of capital services (the rate of interest) is a continuous function of the relative scarcity and marginal productivity of aggregate capital, and lower rates of profit are related to higher values of capital per worker, higher capital-output ratios and more mechanised methods of production (see Samuelson 1966; Pasinetti 2000, 29-34; Cohen and Harcourt 2003, 205fff).

[21] Lipsey and Carlaw observe that current estimates of human capital growth cause understatements of embodied innovative knowledge. The same applies to estimates of capital growth, even when calculations are made at industry level. Furthermore, the same innovations can yield radically different contributions to TFP growth, depending on the timing and duration of their impact, and the weight of their industry in total output (Lipsey and Carlaw 2004, 1127, 1130, 1133f, 1139).

[22] While no economist has yet worked out how to measure aggregate capital meaningfully, or to separate the quantitative and qualitative effects or positive net real investment, the productivity of aggregate labour has proven to be a less problematic concept. Since most economists accept that heterogeneous labour can be summed with respect to output per unit of labour time, labour productivity can be pointed to as an indicator of the effects of changes in technology and work organisation (notwithstanding difficulties in measuring services output and accounting for work intensification and cost reduction). (See Smith 2005, 7f.)

[23] ABS (2002, Preface).

[24] DEST (2005b, 6).

[25] ABS (2002, Chapter 4).

[26] ABS and DITR (2006, 16f).

[27] Smith (2005, 11f).

[28] Smith (2005, 12).

[29] Ramsey and Bladier (2005).

[30] For a longer discussion of the importance of a national innovation system, see Roos *et al.* (2005)

[31] Roos *et al.* (2005, 4f).

[32] EC (2005, 20).

[33] Reich (1993, Chapters 1-3, 7-11).

[34] Reich (1993, Chapter 20).

[35] Porter (1998, 3fff).

[36] Trewin (2001).

[37] Austrade (2002).

[38] OECD (2006a, 233).

[39] Thorburn *et al.* (2002).

[40] UNCTAD (2001).

[41] Thorburn *et al.* (2002, 71).

[42] Colebatch (2004).

[43] Lipsey *et al.* (2005).

REFERENCES

ABS (Australian Bureau of Statistics). 2002. *Discussion Paper: Measuring a Knowledge-based Economy and Society – An Australian Framework*. ABS: Canberra

http://www.abs.gov.au/Ausstats/abs@.nsf/0/fe633d1d2b900671ca256c220025e8a3?OpenDocument

ABS and DITR (Federal Department of Industry, Tourism and Resources). 2006. *Patterns of Innovation in Australian Businesses 2003.* Canberra: ABS and DITR.

http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/9B7B5E6344A53669CA2570F80013FC91/$File/81630_2003.pdf

Austrade (Australian Trade Commission). 2002. *Knowing and Growing the Exporter Community.* Canberra: Austrade.

http://www.austrade.gov.au/publications/k_g.pdf?1107149601007

Bryan, Dick. 2001. 'Global accumulation and accounting for national economic identity', *Review of Radical Political Economics* (Cambridge, Massachusetts: Blackwell Publishers for the Union for Radical Political Economics), 33: 57-77.

Cohen, Avi J. and Geoff C. Harcourt. 2003. 'Whatever Happened to the Cambridge Capital Theory Controversies?', *Journal of Economic Perspectives* (Nashville: American Economic Association), 17 (1): 199-214.

Colebatch, Tim. 2004. 'Exports share takes dramatic plunge', *The Age,* 6 September, 2004.

DEST (Federal Department of Education, Science and Training). 2005a. *Australia's Science and Innovation System - A Statistical Snapshot*. Canberra: DEST.

——— 2005b. *Backing Australia's Ability: The Australian Government's Innovation Report 2004-05*.

http://backingaus.innovation.gov.au/reports/04_05/pdf/baa_innov_report.pdf

——— 2005c. *Measure by Measure - Advancing commercialisation, collaboration and coordination in Australia's science industry*. Canberra: DEST.

——— 2006. *Backing Australia's Ability: The Australian Government's Innovation Report 2005-06.* Canberra: DEST.

EC (European Commission). 2005. *European Innovation Scoreboard 2005 - Comparative Analysis of Innovation Performance.* EC: Brussels.

http://trendchart.cordis.lu/scoreboards/scoreboard2005/pdf/EIS%202005.pdf

Hodgson, Geoffrey M. 1998. *'Competence and contract in the theory of the firm'*, Journal of Economic Behavior & Organization (Amsterdam: North Holland Publishing Co.), 35: 179-201.

Lipsey, Richard G. and Kenneth I. Carlaw. 2004. 'Total factor productivity and the measurement of technological change', *Canadian Journal of Economics* (Oxford, UK and Cambridge, USA: Blackwell Publishing Inc.), 37 (4): 1118-1150.

Lipsey, Richard G., Kenneth I. Carlaw and Clifford T. Bekar. 2005. *Economic Transformations: General Purpose Technologies and Long Term Economic Growth.* Oxford, UK: Oxford University Press.

Loasby, Brian J. 1998. 'The organisation of capabilities', Journal of Economic Behavior & Organisation (Elsevier Science: London), 35: 139–160.

Marceau, Jane, Karen Manley and Derek Siklen. 1997. *The High Road or the Low Road? Alternatives for Australia's future: Summary Report.* Sydney: Australian Business Foundation.

Metcalfe, J. Stanley. 1998. *Evolutionary Economics and Creative Destruction.* London and New York: Routledge.

Oakley, Allen. 1990. *Schumpeter's Theory of Capitalist Motion: A Critical Exposition and Reassessment.* Aldershot, Hants, UK: Edward Elgar; Brookfield, Vermont, USA: Gower Publishing.

OECD (Organisation for Economic Co-operation and Development). 1995. *National Systems for Financing Innovation.* Paris: OECD Publications.

——— 1998. *The OECD Jobs Strategy: Technology, Productivity and Job Creation: Best Policy Practices.* Paris: OECD Publications.

——— 2002. *Dynamising National Innovation Systems.* Paris: OECD Publications.

——— 2005. *Governance of Innovation Systems* (in three volumes). Paris: OECD Publishing.

——— 2006a. *OECD Factbook 2006: Economic, Environmental and Social Statistics.* Paris: OECD Publishing.

——— 2006b. *Economic Policy Reforms: Going for Growth 2006.* Paris: OECD Publishing.

Pasinetti, Luigi L. 2000. 'Critique of the neoclassical theory of growth and distribution', BNL (Banca Nazionale del Lavoro) Quarterly Review, 205: 383-431. Available as a stand-alone document at http://www.unicatt.it/docenti/pasinetti/pdf_files/Treccani.pdf

Porter, Michael E. 1998. *The Competitive Advantage of Nations.* Second Edition, Houndmills, Basingstoke, Hampshire, UK and New York: Palgrave.

Ramsay, Colin and Robert Bladier. 2005. *Success Factors in Australian Industries: Levers for Fostering & Sustaining Growth Industries – A Synthesis of Earlier Research*. Sydney: Australian Business Foundation.

Reich, Robert B. 1993. *The Work of Nations: Preparing Ourselves for 21st-Century Capitalism.* Paperback Edition, London, Sydney, New York, etc: Simon & Schuster.

Roos, Göran, Lisa Fernström and Oliver Gupta. 2005. *National Innovation Systems: Finland, Sweden & Australia Compared.* Sydney: Australian Business Foundation.

Samuelson, Paul. 1961. *Economics: An Introductory Analysis.* Fifth Edition, McGraw-Hill Book Co. Ltd.

——— 1966. 'A Summing Up', *The Quarterly Journal of Economics* (New York: Wiley), 80 (4): 568-83.

Scott-Kemmis, Don; Magnus Holmen; Antonio Blaguer; Robert Dalitz; Kevin Bryant; Alan J. Jones and Judy Matthews. 2005. *No Simple Solutions: How Sectoral Innovation Systems Can Be Transformed.* Canberra: Australian National University.

Schumpeter, Joseph Alois. 1939. *Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process*, Vol. I. New York and London: McGraw-Hill.

——— 1954. *Capitalism, Socialism and Democracy.* Fourth Edition, London: George Allen & Unwin.

Smith, Keith. 2004. 'The Knowledge Economy in the Australian Context'. Published in *Innovation & the Knowledge Economy in Australia,* 2006. Sydney: Australian Business Foundation.

———— 2005. 'Promoting Innovation in Australia: Business and Policy Issues'. Published in *Innovation & the Knowledge Economy in Australia,* 2006. Sydney: Australian Business Foundation.

Trewin, Dennis. 2001. *Small Business in Australia*. Canberra: Australian Bureau of Statistics. http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/C639A01ED725ADABCA256C54000336D1/$File/13210_2001.pdf

Thorburn, Lyndal, John Langdale and John Houghton. 2002. *Friend or Foe: Leveraging Foreign Multinationals in the Australian Economy.* Sydney: Australian Business Foundation.

UNCTAD (United Nations Conference on Trade and Development). 2001. *World Investment Report 2001: Promoting Linkages.* http://www.unctad.org/en/docs/wir2001_en.pdf

———— 2002. *World Investment Report 2002: Transnational Corporations and Export Competitiveness.* New York and Geneva: United Nations. http://www.unctad.org/en/docs/wir2002_en.pdf

———— 2003. *World Investment Report 2003: FDI Policies for Development: National and International Perspectives.* New York and Geneva: United Nations.
http://www.unctad.org/en/docs/wir2003_en.pdf

———— 2004. World *Investment Report 2004: The Shift Towards Services.* New York and Geneva: United Nations. http://www.unctad.org/en/docs/wir2004_en.pdf

———— 2005. *World Investment Report 2005: Transnational Corporations and the Internationalization of R&D.* New York and Geneva: United Nations. http://www.unctad.org/en/docs/wir2005_en.pdf