Industry Policy as Innovation Policy

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This submission relates to items 1,2 and 3 of the Productivity Commission's Terms of Reference for its study of public support for science and innovation in Australia.

Introduction

Many innovation policy programs of both national and state governments in Australia are implicitly or explicitly directed at seeking to transform the industrial structure of the economies to which they are applied, so that some types of industries gain prevalence (i.e. grow or create jobs) relative to other types of industry. Queensland's *Smart Queensland: Smart State Strategy 2005-2015*[1], for example, states that a desired outcome is for Queensland to move beyond 'rocks and crops' to develop more and bigger knowledge-based industries.

It is also common for industry policies in Australia to claim that 'innovation' is a desired outcome of their execution. Many industry development programs are directed at increasing aspects of innovation such as knowledge transfer, technology acquisition and transfer, skills development, commercialisation and collaboration between research organisations and industry[2].

As policy currently stands in Australia there is much overlap between the content and intent of industry and innovation policies and programs. This suggests that the relationship between processes of industry development and innovation, and the interaction between policies designed to promote them, need to be better understood.

In this submission it will be argued that, when built up from first principles, optimal innovation policy and optimal industry policy should actually be identical both in form and aim. This implies that one or the other of these policy categories is redundant, and it will be argued here that it is innovation policy which should replace industry policy as a label and as an approach. The best industry policy, in short, is an effective innovation policy.

What Is Industry Policy?

Industry policy in Australia has a long association with the tradition of picking winners. This is a legacy of the protectionist era when tariffs were high and competition was considered an optional factor in generating economic growth. This was also an era when the application of lobbying pressure by special interest groups to obtain unusual favours with public money went largely unquestioned in Australian society.

The demise of the protectionist era began with Whitlam's across-the-board slashing of import tariffs in 1973 and culminated in the formalisation of the National Competition Policy in 1996. While this death endured over 20 years, it is now a full decade since the criticality of competition and, correspondingly, the futility of protectionism was codified into the Australian policy landscape.

Yet the Australian tendency to want to pick winners persists. A cursory glance at the policies and programs of Federal and State industry development agencies shows that industries ranging from

[1] See Introduction to Smart Queensland: Smart State Strategy 2005-2015.
[2] Note that these five aspects of innovation are mentioned specifically in item 2 of the PC study's Terms of Reference as potential impediments to the effective functioning of the Australian innovation system, but they are also the specific subject of many 'industry development' programs (see for example the 'Innovation' page of the Australian Federal Government's Department of Industry, Tourism and Resources).

automotives to printing to wine enjoy access to special grants, investment schemes and other forms of selective treatment. Typically, the justification for the support of some industries over others is made using terms such as 'key', 'core', 'priority' and 'emerging'. The provision of special treatment seems to rest on the proposition that these industries are themselves somehow special. Yet the logical basis for this argument is nowhere made clear, and an empirical evidence base that might demonstrate why some industries are 'key' but others are not is neither provided.

It is tempting to conclude that the rationale for selective industry policy - the 'picking winners' approach - is one of political expediency. Be that as it may, there may also be sound reasoning behind the choice of particular priority sectors in particular jurisdictions, but this reasoning is not made public. Neither is the effectiveness of sector-specific programs in promoting the growth and success of the selected industries quantified (at least publicly). This in turn means that the relative value of public expenditure on these industries as opposed to other sectors, or as opposed to areas such as health or education (that is, the opportunity cost of selective industry policies) cannot be evaluated.

It is therefore difficult to comprehend the empirical justification for the picking winners approach to industry policy. More than $35 billion has been spent on industry assistance by the Australian Government alone in the past decade (and all State and Territory governments allocate funds to industry development programs as well). There is no evidence to suggest that these expenditures have made a significant positive impact on the competitiveness, growth or innovation capacity of either the industries involved or the economy as a whole. This is unsurprising when the actual processes by which industries develop and grow, and the nature of innovation, are properly understood.

What Is Innovation?

Innovation is the process by which ideas are translated into new sources of economic value. Innovation occurs in every sector, in every economy, and has been the origin of wealth creation since humans learned to trade. In other words, innovation is not new, and neither is it peripheral to the economic system. Innovation is the process by which industries start, develop and eventually die, and it occurs, and has always occurred, whether government industry and innovation policies exist or not[3].

Importantly, innovation is different to science. Science, like some other types of human activity, generates ideas but does not guarantee the creation of new economic value; it is therefore a *potential* source of innovation. Art, too, generates ideas, as can relatively new activities such as web-based information and opinion sharing (e.g. blogging). What distinguishes science is its non-market-based rules for the selection and reward of potentially useful knowledge, in the well-established system of peer review and publication. While the output of scientific endeavour can (and very often does) feed the innovation process, the incentives for and returns to science itself are non-economic in the sense that the selection mechanism in use is not market-based.

Of course, scientists often engage in research with the hope of generating new sources of economic value (that is, in pursuit of new innovations); this characterizes a large part of businesses expenditure on R&D. But while they are conducted by scientists, these activities fall outside the system of science to the extent that their value (actual or potential) is selected by market processes, rather than peer review and publication. Patents, therefore, created to protect potentially commercially valuable knowledge, are outside the scope of science as it is this way defined. R&D, and especially in some sectors more than others, may lead to neither patents nor scientific output in the form of peer reviewed publications; it still produces knowledge that may have commercial value and therefore feeds the innovation process.

[3] This view of innovation derives from the literature on evolutionary economics, as elaborated in the PC submissions by Jason Potts and the ARC Centre for Creative Industries and Innovation.

Science, in other words, contributes to the growth of knowledge by maintaining a very specific set of rules for the generation, testing and acceptance of new ideas. Not all knowledge produced in this way leads to innovation; and neither is the system of science (i.e. the institution) the only mechanism by which new sources of economic value are created. Figure 1 provides a representation of the relation between these types of knowledge-creation.

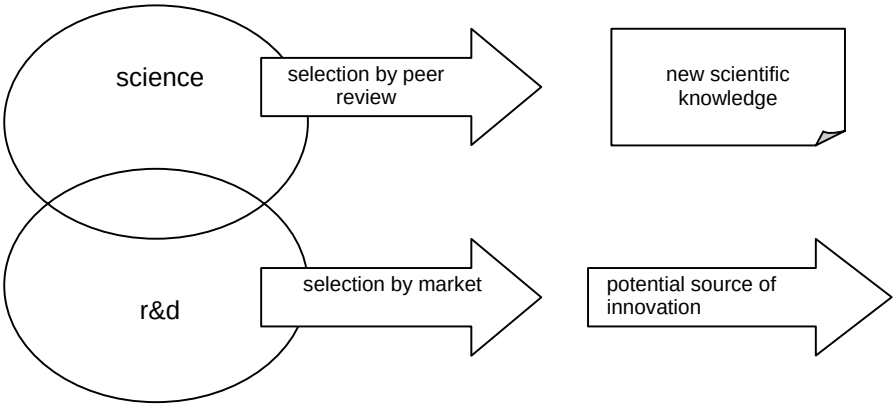

Figure 1: The activities that occur with science and R&D can overlap, but each system is defined by the fact that the knowledge it produces is acted upon by different selection mechanisms. However, science can produce knowledge that is selected by market processes because it is a potential source of innovation, and R&D can produce new scientific knowledge.

Some brief definitions may assist:

Science is the set of non-market based rules that act as a selection mechanism on new scientific ideas to establish new scientific knowledge. Science is thus a non-market institution for the production of new scientific knowledge.

Scientific knowledge is the output of science, of which some will have direct commercial application; some will be never used to create innovations; and some will be a (direct or indirect) building block that underpins the future development of further scientific knowledge[4]. While all scientific knowledge is produced by the system of science, it often cannot be known in advance what the impact on innovation of any particular scientific knowledge will be.

R&D describes the set of activities specifically directed at creating new sources of knowledge that have potential economic value. R&D may produce scientific knowledge (as defined above) as a by-product, but its core aim is to feed innovation. R&D may create operational knowledge, market knowledge, strategic knowledge and other types of knowledge (that furthermore may be either tacit – such as domain 'know-how' - or codifiable, such as patents). In all cases the value of new knowledge produced by R&D is determined on the basis of its actual or potential economic value, not on the basis of scientific selection[5].

Innovation is the translation of knowledge into new sources of economic value. The knowledge that feeds innovation may be generated by scientific endeavour, by R&D (including that which is conducted by scientists), by some combination of science and R&D, or by other means (in part or in whole) such as artistic or creative endeavours, learning-by-doing, or sheer serendipitous imagination. Innovation can only be said to have occurred once the ideas that feed it have been

[4] The latter type of scientific knowledge is generally referred to as 'basic' science.
[5] Or if R&D does produce scientific knowledge this is a by-product, as shown in Figure 1.

selected by market processes, in other words, profit has been generated[6]. All knowledge that feeds the process of innovation has a potential market, but it may be the case that this market potential is never realised, in which case innovation on the basis of this knowledge has failed. New ideas that do find their market will diffuse through adoption and adaptation, until the market for any particular idea becomes saturated and the new knowledge that it embodies becomes embedded in the economic system.[7]

The point of proposing these distinctions between the concepts of science, R&D and innovation is two-fold. First, the intent is to emphasise that *innovation is a necessarily market-based process*. It may be catalysed by science and other non-market forms of knowledge production (or it may not be), but the test of innovation is whether market selection has acted to generate a new source of economic value (usually understood as a new source of profitability). Another way of saying this is that science produces knowledge that does not necessarily lead to innovation. It is only when *demand* for a solution based on new knowledge[8] has been realised or created that innovation can be said to have occurred. In other words, innovation is an unambiguously economic phenomenon because it relies on the market process to unfold.

Second, and related to the focus of this submission, is that innovation is the process by which industries develop. As new knowledge, from whatever source, is developed into new solutions to customer's problems, whole new industries can be created (as occurred, for example, with the creation of the personal computer industry). New knowledge can also dramatically affect existing industries, as seen currently in the impact of nanotechnology on paint, glass and textile production, or in biotechnology's effect in agriculture and pharmaceuticals. Innovation can make industries obsolete (as would be the case if the accounting profession was replaced by rule-based software, for example) or can offer hope for firms in saturated industries to diversify into new markets (as could occur through the production of biofuels from sugarcane). Innovation changes market boundaries, and sometimes by stealth, as demonstrated by the fact that the largest producers of digital cameras are now mobile phone companies. This process is ongoing and unavoidable, and this is why industry development must be understood from the perspective of innovation.

Innovation and Industry Policy: What Do Firms Want?

While it is true that innovation has always underpinned the dynamics by which industries emerge, grow, change and die, there is a further argument to be made that this process, in the late 20th and early 21st centuries, has accelerated. Reasons for the increase in the pace of innovation mainly centre around the widespread adoption of web-based communication, and explanations of its widespread consequences are generally linked to increased global trade; in any case, the broad recognition of 'innovation' as a real and economically significant phenomenon is reflected in the ubiquity of the term in many modern firms' strategic statements and business plans.

In other words, many (if not most) firms accept that innovation is a ubiquitous process that affects significantly their choice of investment and strategy, the skills and capital they require, and the competitive pressures that they face. Firms understand that innovation, and the knowledge

[6] Where this profit does not necessarily accrue to the individual or organisation that generated the relevant knowledge.
[7] In the evolutionary economics literature, this generalized process is referred to as a meso trajectory. See Dopfer, Potts and Foster (2004).
[8] Where this solution can be in the form of a new or significantly improved good or service, including those services that deliver new organizational forms such as new business models to a customer base. Thus, a firm re-structuring itself is not classed as an innovation in this view, but the creation of a consultancy service that provides advice and procedures for adopting a new organizational form for which clients are willing to pay is. Similarly, the creation of a new publicly-funded science precinct does not automatically lead to innovation. An innovation outcome will only occur if the activities conducted within the precinct generate a method, technology, patent, device, product, consultancy service or other knowledge in tradable form that somebody is willing to pay for. That is, innovation, by definition, must create a solution to someone else's problem; this is the characteristic that allows the generation of new sources of economic value (for the buyer, because it solves a problem, and for the seller, because it generates a new revenue stream).

required to catalyse it, is the primary determinant of competitive advantage in the current economic landscape, and that this can involve the re-definition of industry boundaries and positions of market dominance on, historically speaking, very rapid timescales. The wealth of information made available at low cost by the Internet and through increased exposure to international trade should effectively guarantee that those involved in enterprise, who are able to effectively compete, accept and understand the importance of innovation as it relates to their own opportunities, risks and competitive threats.

From this perspective, it seems useful to ask what firms might want, and should be reasonably able to expect, from modern industry development policies.

It first seems clear that no firm which recognises the nature and significance of innovation, and the global market dynamics by which it operates, would expect government to artificially extend the life of a particular industry in a particular region just 'for the sake of' keeping incumbent firms alive in that place. Modern enterprises understand that the responsibility of finding competitive advantage in a particular location – the choice of where to establish headquarters and branch offices - is their own, not to be solved by government. If comparative advantage through a 'hub' or 'cluster' is to emerge, this will occur because the firms involved can offer a globally competitive solution, not because it has been crated by government decree. Further, innovative firms acknowledge that valuable and (at the moment in Australia) relatively scarce human capital should not be locked up in uncompetitive pursuits, especially when these firms can provide good incentives for skilled people to re-locate and/or re-train.

As well, competitive firms recognise that there is an opportunity cost associated with government support for the viability of picked 'winner' industries. Perhaps surprisingly, this cost is not seen in terms of the support that could have been, but is not being, received by the competitive firms themselves: it is not a case of 'well, xyz industry is getting special assistance, so we should be too'. Instead, modern innovative firms take full responsibility for their own competitive capabilities, but do recognise that they are reliant on government in a few very specific ways - none of which correspond to the picking winners approach to industry development policy.

Innovative enterprises, in order to grow and stay competitive, and therefore create high-value jobs, need:

- cost-effective access to reliable transport, energy and telecommunications infrastructure;
- to operate in a competitive environment in terms of input markets;
- access to finance on terms and conditions appropriate to their needs;
- a stable macroeconomic environment, appropriate company, commercial and intellectual property law, and minimum (by the standards of global best-practice) business regulation and red-tape; and,
- access to an appropriately skilled and experienced labour force (or human capital base).

Of course, this list does not define the entire suite of resources and capabilities required by firms in order to remain competitive; a population of businesses in an environment described by these characteristics will produce both more or less successful firms (i.e. there will be winners and losers) as is the nature of market-based competition. These are necessary, but not sufficient, conditions for firm-level success based on innovation in global markets.

What does delineate these requirements is that they specify the areas – in fact are the only areas – where modern innovative firms require 'support' from government. They are, therefore, the proper foundations for industry policy reconceived as effective innovation policy.

Industry Policy As Innovation Policy: What Changes?

It should be clear that this view of industry policy differs most substantially from current approaches to industry development in Australia because it does not seek to pick winners. The policy objectives listed above, broadly speaking, either exist or do not; in this sense - and to the extent that they are in place - they apply to all industries, and all firms within all industries, with equal force and implication.

So industry policy as innovation policy does not pick winners. But there are important ways in which this approach extends the current remit of industry policy, and this is most clearly the case with regards to human capital development. As it stands, policies relating to education, skills and training are, at best, seen as orthogonal to government innovation programs and strategies. Yet every business survey and economic modeling exercise emphasises that public investment in improving educational attainment levels and the relevance of skills (especially those in science, engineering and technology) are – in the best sense of the word – key to competitiveness and innovation outcomes. The recognition of ageing populations and the increasingly global market for skilled people only underline the point: that industry policy properly understood as innovation policy places human capital development – that is, investment in the improvement of education, skills and training – at the centre of its approach.

Aspects of industry policy as it is currently conceived are congruent with this new innovation-based perspective. Programs such as COMET and TechFast are non-selective with respect to their attempts to improve the commercialization of new ideas or the diffusion of existing technologies (respectively) across the economic system. As long as these programs remain open in the sense that they do not pre-select either the sources of new, potentially valuable knowledge, or the domains in which they might be applied, they fit within the view of innovation-driven industry development. What is missing, though, is the systematic evaluation of how effective these programs are in producing their desired intent.

A re-conceptualisation of industry policy as innovation policy might usefully be based on the following core principles:

- **Flexibility**: when it is recognised that industry boundaries and competitive positions are likely to change in extremely rapid order, the ability of firms and individuals to quickly adapt to new economic circumstances can be assisted by government in two areas:
  - In business regulation: e.g through the reduction of unnecessary red-tape in start-up, mergers and acquisitions and ongoing operational issues such as occupational health and safety; thorough improved employment flexibility (e.g. dismissal laws); and through non-legal penalisation for business failure.
  - In the workforce: e.g. through education based on the use of creativity and imagination and exposure to non-routine tasks; the combination of scientific/technical knowledge with business/entrepreneurship skills; and improved levels of general educational attainment[9].
- **Information brokerage**: it can be argued that in many cases government is able to identify and evaluate problems of information asymmetry as they relate to changes in technology and, consequently, industry structure. Examples include hosting forums that allow existing firms to understand the implications of new technologies (such as nanotechnology), facilitating networks so that new partnerships, alliances or joint ventures can be formed, and providing export market intelligence through trade offices and targeted trade missions. Importantly this does not include the provision of grants - it is simply a knowledge-provision service. In many instances there may be a strong case for external experts/consultants providing this service more efficiently on a commercial basis, and it may also be the case that government could reasonably expect matching funds for these services from the firms thus benefited.

[9] Improving general levels of educational attainment (as well as high levels of business research and development intensity) is thought to increase the 'absorptive capacity' of a population so that individuals and firms can more readily and effectively adopt and adapt new knowledge and technologies. See Cohen and Levinthal (1998).

- **Adjustment assistance**: as particular economies continue to specialise in response to changing technologies and market conditions, some skills and industries will become obsolete; this is a natural part of economic evolution. There is thus a potential argument for government provision of adjustment assistance to both individuals and firms in order to minimise under-utilisation of human, physical and financial capital in a particular jurisdiction. In the case of individuals, this can be achieved through short-term structural unemployment benefits combined with re-training and/or re-location assistance[10]. In the case of industries this could mean the provision of incentives to diversify into other, more competitive, economic activities and/or re-training or re-location benefits for individual employees.

It is currently the case in Australia, at both national and state levels, that policies in these areas exist. The point is that effective industry policy – industry policy as innovation policy - should be about no less, but no more, than the achievement of these principles. Specifically, there is no room in this view for policies that pick winners by giving selective support to particular firms or industries, because this perspective recognises that innovation, as both cause and consequence, is common to all.

Conclusion

Whether there is an unambiguous case for government support of science is not the primary focus of this submission. If it is accepted that science is a non-market institution for the production of new scientific knowledge that may or may not have value for innovation, it can be argued that there may be a case for public funding of those scientific organisations and individual scientists that have demonstrated an ability to produce knowledge which leads to innovation outcomes. As acknowledged, the relevance of new scientific knowledge for future innovations can be difficult to assess in advance. Institutional designs which provide a market-facing orientation for scientific work can partially solve this problem; this is the model used by the Cooperative Research Centres in Australia and their 'closeness to market' may go some way towards explaining their perceived success.

Of course, some types of scientific endeavour are best typified as 'basic' in the sense that they aim to produce building blocks for future knowledge production. Whether there is a case for government funding of the organisations (e.g. laboratories or equipment such as the Victorian Synchrotron) or individuals who pursue these outcomes is a matter for case-by-case evaluation, preferably augmented by the collection of preferences (such as willingness-to-pay data) from the local population asked to provide the support for each project or initiative.

So there are two broad categories for justifying government support for scientific endeavour: first, where the market-orientation of the scientific institution implies a relatively direct contribution to innovation outcomes (e.g. the CRCs); second, where the community has ratified funding for individuals or organisations pursuing basic science, where the future value of the knowledge thereby produced is difficult to assess in advance. What is common to both categories is that specificity in policy is crucial: one type of scientific endeavour at any given time may have enormous implications for innovation outcomes, and similarly there may be strong community-based support for the funding of particular projects in a particular jurisdiction at a particular time. Establishing common procedures for the ongoing measurement and evaluation of the value of each funded science project is therefore a necessary first step if systematic decision-making in the domain of 'science' policy is to be achieved.

With regards to the innovation policy domain it seems possible to infer, at least, some general principles.

[10] This is typically referred to as 'displaced worker assistance'.

If it can be accepted that innovation is a necessarily economic phenomenon that both relies on the market process and is the prime catalyst for changes in industry structure, then it seems clear that the relation between industry policy and innovation policy as each are currently implemented should be re-assessed.

From the perspective of innovation-driven economic development and growth, there seems to be no defensible case for picking winners in modern industry policy. However, firms who are aware of and responsive to the ubiquity and significance of innovation do rely on government support in foundation areas such as infrastructure, finance and human capital development. Further, where industry policy as effective innovation policy seems to have most potential value is in the promotion of flexible institutions, in providing brokerage services, and in assisting with re-adjustment where skills and industry specialisations have been rendered obsolete by the ongoing process of economic evolution.

Many further implications from the re-conceptualisation of industry policy as innovation policy will emerge, not least in terms of departmental structures and responsibilities including the allocation of government resources to the ongoing measurement and evaluation of innovation programs. A useful first step forward would be to conceptualise and define science and innovation as they relate to processes of industry development and economic change, so that newly effective policy frameworks can be established and operationalised.

References

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