Productivity Commission submission: Public Support for Science & Innovation

The Innovation System & Economic Evolution

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Analysis of public support for science & innovation should begin with the primary relation, namely economic evolution. Material 'public support' is tapped from the wealth of the economic system, and innovation draws upon science to evolve the economy. Public institutions support the economy and economic growth strengthens public institutions. So, the real question here is with the role of the state in economic evolution. How can public support drive economic growth and evolution? This is a big question that deserves a good answer. My submission is this: evolutionary economic theory can provide such analysis and, given that, the Productivity Commission should consider trailing evolutionary economics in its report. Some specific references and analytic suggestions regarding focus and method are hereby offered for consideration.

The purpose of this submission is to clarify the goals of the Productivity Commission report with respect to the economic principles and theory that connect science and innovation in the first place, as well as public support for science and innovation. The connection is this: science produces new ideas or technologies, and new ideas and technologies lead to innovations which power economic growth and transformation. Public support for the creation of new ideas produces change in economic wealth just as private support does. The question, then, is with the balance of these two forces. Conventionally, the relevant economic principles are the structure of incentives to produce novel ideas (the micro economics of science) and the relation between new ideas and economic growth (via innovation systems and macro growth models). And this, it seems, is to be the framework of reference. This is good, but perhaps it could be better.

Modern evolutionary economics (Nelson and Winter 1982, Metcalfe 1998, Potts 2000, Foster and Metcalfe 2005, Dopfer 2005, Lipsey and Carlaw 2005, Dopfer and Potts 2006, McKelvey and Holmen 2006, etc) is the new analytical framework that goes beyond neoclassical, New Classical and Keynesian analysis to focus explicitly on the economic order as a complex adaptive system that is continually being transformed from within by novel ideas that are differentially adopted inducing continual structural change and transformation. This process is innovation and it results in new institutions (including new technologies and markets). The concept of an 'innovation system' was an early product of this framework (e.g. Nelson 1993, Freeman and Soete 1997), but it has been significantly developed in the past decade through empirical and theoretical research that

has tended to highlight: (a) the complexity of innovation systems; and (b) the fact that innovation is a process that is embedded in the economy in a fundamental way. The major implication for the purpose of the PC review is that science and innovation are very different things. Science is a method for generating and testing ideas. Innovation is the means by which economic systems grow. All value in an economy is the consequence of past innovation.

An 'innovation system' is misunderstood when conceived as if it were an additional system that attaches onto 'the economic system' to increase its performance and dynamic efficiency. The simple category error is that 'the free market economic system' is an innovation system (Baumol 2002). This risks falling into the trap of thinking that the innovation system can be designed and planned based on objective evaluative measures. The issues paper notes this difficulty, but then misses an opportunity to think more deeply about this point. I would suggest that the evaluative endeavour is being focused on the wrong sorts of data, and indeed questions, if it continues to suppose that the innovation system is (a) structurally invariant, and (b) meaningfully evaluated in terms of objective efficiency. The innovation system is embedded across the entire economy in all its aspects that facilitate the creation of novel ideas (including science) and the adoption and retention of such. Now this does not mean that it is beyond evaluation, but rather that innovation policy is always bound up with, and often most effective as, competition policy.

There are two specific recommendations I would make. First, the standard micro-macro framework may be less well suited to this task than the new evolutionary economic analytical framework of 'micro meso macro' (Dopfer, Foster and Potts 2004, Dopfer and Potts 2006). This has two major advantages: (1) it centres on the knowledge-based building blocks of an economy (meso units) and defines innovation as the origination of new meso units and the process of change in these; and (2) it provides a natural hierarchy of the types (or orders) of rules in an economy that distinguishes between constitutional (or 0^{th} order) rules, generic (or 1^{st} order) rules, and mechanism or (2^{nd} order rules).

The operational capabilities of an economy are determined by its stock and coordination of 1^{st} order rules. Public policy and governance furnishes 0^{th} order rules. But the innovative capability of an economy depends upon its 2^{nd} order rules for origination, adoption and retention. An innovation system, in this view, consists of the set of 2^{nd} order rules for the origination, adoption and retention of novel ideas. This argument is set out in the book 'The general theory of economic evolution' (163pp, forthcoming with Routledge) which outlines this method in detail, and a pdf version is available upon request from j.potts@qut.edu.au.

Second, evaluative measurement of the properties of an innovation system might be better focused not on the efficiency of outcomes in a return on investment sense, but, given than the essence of such a system is experimental trial, the evaluative properties of a 'healthy' innovation system stem from its ability to maintain complexity and diversity in the economic order (see ch. 5 on evolutionary economic policy in Dopfer and Potts 2006). A similar idea is also argued in the work of Joseph Schumpeter, Amartya Sen and

recently by Paul Ormerod (2005). The quality of an innovation system is the ability of it to maintain the complexity of the system and an innovation system fails when it results in a reduction of diversity (i.e. degrees of freedom or the space of opportunity). This is no less easy to measure than the spillover benefits of say public sector R&D, but according to evolutionary economic theory this is at least what should be being measured. In this respect, focus on the extent of failures (including failures to commercialize) might be an interesting part of the study not as a loss of efficiency, but as an indicator of diversity. The point, then, is that a successful innovation system will naturally and normally generate a large amount of failure (and therefore seeming inefficiency.) The PC should be careful not to misjudge this.

So, while these two points are only briefly elaborated here, source work is to be found in Dopfer and Potts (2006). To recap:

(1) An innovation system is embedded and enmeshed across the entire economy and is very difficult to separate out into systems components that can be evaluated independently. Public willingness to pay for such services is even more fraught with difficulty. I suggest that the micro meso macro framework can provide a general and coherent analytical foundation for the identification and assessment of the Australian innovation system in its proper and full relationship to the Australian economic system.

(2) The evaluation of such systems is incorrectly conceptualized in terms of some distance from optimal efficiency measure. Instead, the proper measure is with respect to complexity. A healthy innovation system maintains the complexity of the economic order by maintaining the flow of new ideas, the possibilities for adoption of new ideas and the retention of existing ideas. By definition, this process will be wasteful as by definition this process is experimental. Public support for innovation, then, when it is done best, will necessarily be wasteful and is improperly measured if it seeks to eliminate all such waste or to evaluate its current position with respect to a zero waste (maximum efficiency) position (see Pelikan and Wegner 2003, Dopfer 2005b).

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