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# The New Economics of Entrepreneurship, Innovation and Institutions: Considerations for Australian Agriculture

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# The New Economics of Entrepreneurship, Innovation and Institutions: Considerations for Australian Agriculture

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**Abstract**
Agriculture is often represented as a case study in perfect competition, with a large number of small price-taking producers choosing an optimal input mix from a simple production function to maximize profits. Entrepreneurship and innovation do not seem to enter into this story, and nor do institutions. But this characterization misrepresents the complexity and niche competition in agricultural markets and the opportunities for cooperation. Old models of innovation policy emphasized market failure and recommended more or less direct government support to fund R&D investment. Examples were public funding of agricultural science. But new approaches to economics of innovation emphasise the role of entrepreneurial or market (rather than technical) discovery, and the increasing use of private institutions to solve the innovation problem through pooling innovation resources in the 'commons'. This shift from market failure to collective action models of the innovation problem, and from government solutions to governance solutions, represents a fundamental shift in modern economic thinking about how industries grow through entrepreneurship and innovation, and the role of government in this process.

## *1 Thesis – The new economics of innovation, and why this matters for AA*

All economics of innovation is essentially Schumpeterian in the sense of *innovation* as the proximate and ultimate driver of economic growth and development as new ideas and technologies become new firms and industries through an evolutionary market process of 'creative destruction' (Schumpeter 1912, 1939, 1942).

However, there are two very different interpretations of what Schumpeter means as 'the innovation problem'. The standard neoclassical and neo-Schumpeterian interpretation is that this is an investment allocation problem coupled to a market failure problem. I'll call this *old innovation economics* (it's also known as new growth theory, Arrow, Romer, Aghion et al). The other interpretation, coming from Austrian, Public Choice and New Institutional economics (Hayek, Buchanan, Ostrom, et al), and which I'll call *new innovation economics*, is that this is an entrepreneurial discovery problem coupled to a coordination problem.

The purpose of my talk/this paper is to elaborate on the ways in which Australian Agriculture industry and policy (and maybe Australian Agricultural economics!) is a product of old innovation economics, and to make the claim that it would be better served if instead it were based on new innovation economics.

*Old economics of innovation* was based around *market failure* in the production of new knowledge (Bush 1945, Arrow 1962). This was the innovation-push model of public science & technology to drive new industry and advance industrialization.

- Innovation problem: fixed costs under free appropriation & competition (P=MC<AC)
- Examples: chemicals, consumer electronics. Australian example: CSIRO
- Implication: social welfare maximization requires government intervention (i.e. innovation policy, incl.: IP, R&D subsidy, demand support, public science, etc)
- Presumption 1: governments can fix market failures
- Presumption 2: this applies to agriculture too

*New economics of innovation* based around *market process* theory (economics of entrepreneurship, economics of institutions). Basic idea is that the innovation problem is actually an *entrepreneurial discovery problem* combined with a *collective action problem* (solved with *institutions*).

- Innovation problem: rules to coordinate knowledge for discovery of value
- Examples: between new technology and emergence of industry (3D printing, blockchain, early wine industry in Australia)
- Implication: a new technology is not a new industry; new industry emergence requires governance (i.e. cooperation and rules, these eventually become industry groups/associations)

- Problem with Presumption 1 above: knowledge problem, rent-seeking/govt. failure, no recognition of the entrepreneurial problem
- Presumption 2: this applies to agriculture too

The practical difference comes down to: (1) a reassessment of the role of government versus the role of private governance; which (2) translates as different industry & innovation policy settings; which symmetrically implies (3) different understanding of the role of industry associations, and also relatedly (4) the institutional conditions from which new agricultural industries emerge.

In terms of economic theory, this means revisiting the nature of entrepreneurship as a discovery problem (Knight 1921, Kirzner 1973) (i.e. recognizing that a new technology is not equivalent to a market opportunity) and reassessing the role of private governance (Williamson 1985, Ostrom 1990) and the coordination of distributed knowledge in this discovery problem (Hayek 1945).

As a research program (agricultural innovation economics), this redirects attention to the institutional conditions that resolve collective action problems associated with distributed knowledge in the very early stages of new agricultural industries.

My theory: this institutional mechanism is the origin of comparative advantage in agricultural clusters.

## *2 Premise & diagnosis: [Innovation] Economics of Australian Agriculture*

Farmers and agricultural producers are often portrayed, and analysed from the perspective of economic policy, as traditional family farms, rather than as entrepreneur-led innovative businesses. [For the purposes of the competitive economic model] they are presumed to be small price-takers, producing an undifferentiated commodity-output, using known production inputs and technologies.

The implication for policy is that the way to help these people [struggling peasants/ agribusiness interests/ politically charismatic & organized voting bloc] is to artificially increase the price received for outputs, or subsidise the price of inputs.

By competitive economic logic (economics units are infinitely small, perfectly competitive, price takers, commodity output), *two things can never happen without government intervention*:

(1) creation and exploitation of market rents
(2) industry specific public goods (e.g. R&D)

The upshot is that growth of existing agricultural industries through productivity gains due to new knowledge and the development of new agricultural industries through

discovery of new knowledge or creation of regional or industry specific public goods that can drive comparative advantage require government intervention. This is the implicit diagnosis that follows from the premises of the model: *without government, no industry growth*.

These two observations and their consequence, derived from the economics of market failure and public goods, gave rise to the dominant agricultural policy models of market protectionism (via trade policy, regulation, factor market subsidy, preferential purchasing), support for single desk product marketing boards (competition policy), and the innovation economics of public funding of agricultural research (research and innovation policy).

All of this presumes that 'old innovation economics' is substantially correct. If it is, then our policy settings are where they should be, but we could gain from better resourcing of CSIRO and government-funded primary industry research associations.

But if there is anything to the case for *new innovation economics*, then we're currently doing things wrong. And that's probably harming the prospects of the Australian agricultural sector. That's why this 'academic question' matters.

## *3 Agricultural economic policy in Australia: history and consequences*

Economic policy affecting agriculture has historically been based around models of market protection, particularly commodity targeted trade barriers. This sought to intervene to artificially reduce competition (quotas, taxes or regulations), and thus increase price. Agricultural subsidy is mostly practiced in Australia as an input subsidy (e.g. insurance, infrastructure) or preferential public purchasing and promotion. Marketing boards to create monopoly in commodity supply through creation of mandatory single-desk selling were developed. Some still exist.

Since the 1950s or so, a new class of agricultural policy came in the form of science and technology policy, which treated R&D as an industry-level public good. This gave rise to the primary industry research and development associations (MLA, Australian Wool Innovation, Sugar Research Australia, etc) and to the federal government organizations, headed by the CSIRO.

The OECD (2011) reports that "at 3% of total farm income, government agricultural support to producers in Australia is now the second-lowest in the OECD, having been reduced from already relatively low levels in 1986-88. … Remaining producer support is dominated by the Exceptional Circumstances Program." They further observe:

- "Continued strong support to the farming community through General Services, particularly in research and development, provides opportunities for innovative approaches in the agriculture sector to reduce greenhouse gas emissions, better manage soils, and adapt to climate change.

- A new initiative to protect Australia's natural environment provides tools for communities, farmers and other land managers to meet the challenges of producing food and fibre in more sustainable ways."

The effect of these policy models has been to entrench a commodity market and an agri-business model, as the most effective avenue for business growth is scale. Evidence of this is difficult to formulate, but the relatively low level of complexity (Hidalgo et al 2007) of Australia's agricultural exports is one measure.[1] Furthermore, because General Services, Exceptional Circumstances, and Sustainability initiatives are all politically triggered support programs, this model tends toward cronyism and rent-seeking, and thus crowding-out innovation, because the returns to political connections and lobbying are either greater or more predictable than entrepreneurship (Baumol 1990, Holcombe and Castillo 2013).

Leave aside the industry support model that is intended to sustain non-viable industries, and therefore predictably negative effect on entrepreneurship and innovation, and consider only the policy model of publically funded agricultural research and development (whether directly, e.g. CSIRO (tax funded), and the 15 Rural Research and Development Corporations (levy funded), or indirectly, e.g. via research universities). Has this market failure model of agricultural innovation policy worked?

In theory it should, because we should see a transition from the theoretically expected zero levels of research to the industry-optimal level. In practice, however, it has been pretty disappointing. Much as it has in other countries and in other industries.

The difficulty is measurement and causality. These research units plainly do produce outputs, and it is always possible to point to a few high profile successes. It is also easy to point to overhead, and waste, both to be expected in production under uncertainty. The difficulty is connecting these outputs, which can be relatively pure science, e.g. publications, reports or patents, to market outcomes, such as new product lines or cost savings. There is also the international spillover problem: most agricultural research (e.g. on genetics, say) occurs outside Australia, upon which we can free-ride.

The disappointing results are entirely consistent with economic theory. Public choice theory predicts significant rent-capture (Tullock 1969), such that the main beneficiaries will be research institutes and scientists (Goolsbee 1998), or will be captured by lobbyists and activists (e.g. GMO, sustainability, climate science, etc).

General science tends to be difficult to translate into market value (i.e. to monetize). It is also difficult to protect, leading to a systematic preference for patentable outcomes. Principal-agent problems also abound in this space, as researchers will rationally tend to work on projects that benefit their own careers, rather than the industry. Because of fundamental uncertainty, asymmetric information and monitoring problems, research contracts are very difficult to efficiently specify (Pisano 1991, Aghion and Tirole 1994).

## *4 Problems with the theory*

### *4(I) – Where are the entrepreneurs?*

Take a step back. Something is missing. Observe that there are no entrepreneurs in the market failure/public innovation story. This is the Austrian critique: in essence, by failing to account for the role of entrepreneurial action, a normal *market discovery process* is misdiagnosed as a market failure.

What do entrepreneurs do? They conjecture and test (i.e. discover) opportunities to create value (Kirzner 1973, 1996; Shane 2000; Foss and Klein 2012). In the Schumpeterian variant they introduce new ideas – they are innovators, who have different knowledge to others. The point is that entrepreneurs reveal information, or generate new information.

So, why are entrepreneurs not in the standard model of innovation in agriculture? Because they are unnecessary: there are allegedly no such opportunities because there is no missing or unknown information. All technologies are known. There is perfect information. All prices are given. There is nothing for an entrepreneur to do. There are no strategic choices under uncertainty. The only economic agents are rational agents choosing on the production function to maximize profits. This is why only agent in the above story that can help by introducing new ideas and knowledge is the agricultural scientist.

### *4(II) – Where is the information/knowledge?*

The missing entrepreneurs are connected to a broader problem, namely the missing *local* information and knowledge. The standard presumption in the market failure model of innovation is that the relevant innovation information/knowledge is *general-purpose* new technologies (e.g. a new seed strain). This is the sort of new knowledge that is said to experience market failure, and for which the Rural Research & Development Corporations were built to rectify.

But following Hayek (1945), the other sort of information that exists in an economy is 'local information of time and place'. Hayek argued, in his famous article about the information carried by the price system, that the price system is a highly efficient distributed information and communication system because changes in prices convey information about changes in supply or demand conditions elsewhere in the economy, enabling people to adjust their individual behaviour in the direction that will result in general coordination (all without the need for central control).

Hayek's was an argument (based on the work of Mises) about the superior efficiency of price coordination over central planning, but he built his argument from the starting observation that there are two types of knowledge and information in an economy: scientific and technical information, and local information of time and place. This second type of information is just as important as the first, although tends to be ignored. Yet it is the sort of information that entrepreneurs seek to use and exploit.

The standard diagnosis of market failure and the innovation problem in agriculture also ignores the second type of information. The key point about this type of information is that it is *distributed*. It is very difficult to centralize. It is also only discovered through *experiment*. It is also very difficult to store or attach property rights.

*4(III) – Where are the institutions?*

The standard market-failure model of innovation policy is relatively institution free. There is the market, which fails, and there is government intervention that fixes the problem through redistribution and rent creation. As we saw, there are no entrepreneurial problems or opportunities, and nor are there any knowledge problems. There are also no institutional problems in this world.

There are three ways in which this oversight matters. First, this approach basically rules out the entire concept of private governance (Ostrom 1990). Which then rules out private orderings – in the form of commons, networks or clubs, for instance – that might serve as coordinating institutions to solve local or context specific problems associated with collective action, as for instance in the creation of a local public good. Instead, government is the solution because all other institutional mechanisms are ruled out.

Second, because institutions create incentives, an institutionally weak analysis will often gloss over complexities, including principal-agent problems and perverse incentives that are consequences of the particular institutional forms. This extends to understanding the nature of market failure itself, in respect of what institutional aspects of the market (for ideas) specifically failed (e.g. Gans and Stern 2010)

Third, innovation policies (e.g. intellectual property, tax credits, industry policy, public science, etc) are all institutions or interact with institutions. The standard model tends to ignore the various trade-offs that occur in tis space, presuming that institutions are in effect separate and additive. No account is provided of how these institutions interact, or of the social losses that each accrues and in what dimensions (Djankov et al 2003, Davidson and Potts 2015). What is missing is an analysis of the relative efficiency of different bundles of innovation institutions, under different contexts.

## *5 Modern innovation economics*

Entrepreneurship, knowledge, coordination, institutions, governance, evolution.

- *Entrepreneurial discovery problems*, not investment misallocation problems.
- *Collective action problems*, not market failure problems.
- *Governance solutions*, not government solutions.
- Hayek, Schumpeter and Ostrom, not Samuelson, Arrow and Romer.

### *5(I) – Opportunity discovery – entrepreneurs & the growth of knowledge*

Agents of change. Knowledge needs creating and processing. Opportunities need to be revealed. Market process theory. Evolutionary growth of knowledge.

- Schumpeter (1912) entrepreneur introduces new ideas (novelty)
- Kirzner (1973) entrepreneur as alertness to opportunity (arbitrage)
- Loasby (1999) entrepreneur as heuristic-guided action under uncertainty (Simon, Shackle) (entrepreneur as scientist)
- Sarasvathy (2003) entrepreneur discovers opportunities in the resource set (effectuation)
- Shane (2000) on prior knowledge and the discovery of entrepreneurial opportunity
- Foss and Klein (2012), building on Knight (1921), on entrepreneur as judgment under uncertainty

### *5(II) – Discovery of comparative advantage – a local public goods problem*

Haussman and Rodrik (2004). Comparative advantage of a region made up of local costs, institutions, resources, skills, etc. Not usually obvious and often changing at 6-digit SIC level. Hence needs to be experimentally discovered. Substantial pay-off to a region, but individually irrational for first *entrepreneur*, who bears cost of failure if

wrong, but provides valuable information to other entrepreneurs about local comparative advantage if correct.

Implies innovation policy should be to support experimental discovery and making experiments (positive and negative) public. This defines an entrepreneurial public goods problem (i.e. a *collective action problem*, not a market failure problem).

This is a theory of the origin of new industry. (e.g. Salmon farming in Chile, cut flowers in Columbia).

### *5(III) – Innovation Commons – efficient governance & innovation institutions*

Allen and Potts (2015). Beyond market-government axis, the commons as an institutional coordination solution (Ostrom 1990). Commons = private governance.

Why innovate in the commons (cf. markets or government)?
i.e. why create new knowledge in the institutional context of a common pool resource, rather than private property, or as a public good?

Answer: entrepreneurial uncertainty and distributed knowledge. The commons is a highly efficient institution for pooling distributed knowledge under conditions of uncertainty. The innovation commons solves the entrepreneur's problem. It is the phase from a prospective technology to the discovery and development of an entrepreneurial opportunity.

The innovation commons is thus the 'zero-th phase' of the innovation trajectory. This explains the origin of firms, the origin of new industries.

## *6 Innovation commons in Australian Agriculture*

Hypothesis: all new industries begin in an innovation commons. The innovation commons is the most efficient institutional form for entrepreneurial discovery of opportunities. From this new firms and industries can grow. [Which is of course the goal of innovation policy].

### *6(I) – Very early Australian wine industry*

Historical research supports the hypothesis of the importance of the innovation commons in the early Hunter Valley wine region (Australia's oldest continually producing wine region), based on historical records (McIntyre et al 2013).

Using detailed archival data, McIntyre et al (2013) create a business case history documenting an extensive culture of informal cooperation and knowledge sharing in the early days of the Hunter valley wine region in NSW, from 1788 plantings of experimental hobbyists to the true emergence of the Australian wine industry in the 1870s. The record a cooperative institutional culture that they argue continues to the present. They document sharing of plant stock and printed instructions, and of sharing practical advice in viticulture and viniculture when such knowledge was sparse and still experimental in the Australian climate.

They note in passing that the NSW government Department of Mines and Agriculture began publishing its *Gazette* and appointed its first viticultural expert in 1890. In other words, public science came after the entrepreneurial originators had developed the industry by collaborative experimentation and pooling knowledge. This pattern of private innovation commons leading to the development of new industry and then science coming after is actually widespread (see Kealey 1997, 2013). Nevertheless, this is not the standard dogma, which is the science-push model (Bush 1945).

Such early stage cooperation and knowledge sharing – in what I call an 'innovation commons' – is widely observed among hobbyists and enthusiasts of any new technology. It is easily observed in open source software development, and in the early days of the personal computer industry. It has been documented in the origin of new sports (Franke and Shah 2003, Shah 2005, Shah and Trippas 2007, Potts and Thomas 2015), an observation that dates from the work of von Hippel (1986, 1987) on user innovation and open innovation.

### *6(II) - What else?*

The hypothesis is that all /most new industries niches begin from within an innovation commons. (The alternative hypothesis is that they come from the results of public of industry association research). The claim, in effect, is that it is entrepreneurial experimental and distributed market knowledge that is far more important to early stage innovation than scientific technical knowledge.

- Wagu beef in QLD
- Tuna farming in SA
- Wine in Queensland
- Blockchains for direct sales and marketing

## *7 The life cycle of an Industry Association*

The standard model for the logic and function of an industry association is as a solution to a collective action problem, particularly in relation to: (1) political lobbying; (2) joint marketing, particularly regional; (3) other local public goods, e.g. research, standards, enforcement. But the problem is free-riding (i.e. a social dilemma); hence the need for compulsory joining or sales levy funding models. Industry associations thus politically supported.

Several economic models of industry associations.

- Forum for coordinating collusion/ cartels/ (competition policy) **Negative**
- Site for rent-seeking, principal-agent problems (board member perks) **Negative**
- Counterveiling power against labour or other factor market collusions (e.g. unions, consumer groups) **Positive**
- Private governance/ industry self-governance (better resolution of knowledge problems than public regulation, Shleifer and Vishny 1998) **Positive**

All of the above are defined in respect of a mature, static industry. But no dynamic account of industry associations. The innovation commons model suggests a lifecycle (developmental) model of an industry association.

Hypothesis: industry associations originate from a collapsed innovation commons (Potts 2015). An industry association is a phase in the lifecycle of an innovation commons that emerges as a switch in function from coordinating discovery and common pool resource access, to coordinating industrial *niche construction*.

We therefore add a further economic model to the role of industry associations:

- Industrial niche construction. **Positive**

Niche construction is a term from evolutionary ecology. In the evolutionary economic context niche construction means retrofitting and newly constructing the economic and institutional infrastructure of a n emerging and growing industry so that it is adapted to the business models, market imperatives and technological plans of the industry. It happens in conjunction with the entrepreneurial contestation unfolding in the creative destruction of industry development and in parallel with the evolving technological trajectory.

As an innovation commons, the collective action was inwardly focused, pooling and sharing distributed information to reduce entrepreneurial uncertainty. But as an industry association, it is outwardly focused on reshaping its institutional environment (niche construction). However, it is expected that many of the organization, cultural and social norms of the innovation commons will carry through to the industry association.

## *8 Conclusion*

*I – A New Research Program?*

Modern agricultural innovation economics is based on a combination of agricultural economics and (old) innovation economics. By replacing old innovation economics with new innovation economics, a new research program for agricultural innovation economics is created.

This replaces a presumed general public goods problem formulated as a market failure investment problem with, instead, an *entrepreneurial discovery problem* (i.e. dealing with uncertainty) diagnosed as a collective action problem in the knowledge commons (Allen 1983, Gächter et al 2010, Frischmann et al 2014, Allen and Potts 2015, Akcigit and Lui 2015).

This shifts research focus to seeking to understand the institutional conditions of the very early stages of the emergence of a new industry.

The basic analytic model is of an *innovation commons*. This is an institutionally guided space of cooperation of independent agents pooling distributed knowledge for the purposes of entrepreneurial discovery of opportunities.

*II – A New Policy Framework?*

Modern agricultural policy is based on the economic model diagnosis, and the implication of a re-diagnosis of the problem (from market failure to collective action) shifts the focus of policy from *government* solutions to *governance* solutions.

Innovation commons are the institutional structures from which new industries emerge. Policy frameworks should be focused on facilitating these largely private and emergent institutions.

Industry level science may not be a public good, but a club-like private good, or what Kealey and Ricketts (2014) call a contribution good.

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[1] See the Atlas of Economic Complexity developed by Cesar Hidalgo at MIT Media Lab.
http://atlas.media.mit.edu/en/profile/country/aus/
Australia is the 19th largest export economy in the world yet only the 71st most complex economy according to the Economic Complexity Index (ECI).