Political Aspects of Innovation in the Australian Dairy Industry

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Abstract

This paper explores the Australian dairy industry from the Political Aspects of Innovation (PAI) approach. It stresses the importance of innovation in the struggle for control over the distribution of profits over the period of the business cycle. The concepts of transformative innovation and evasive innovation are used in this approach to plot two distinct trajectories of the industry. Dairy as a case study is useful because it exhibits all the characteristics of a traditional industry with many small businesses and ease of entry – in other words, it is a “normal” industry. However, dairy has changed considerably with the globalisation process creating very large multinational enterprises. Through a historical account of the industry, the full spectre of the dairy innovation system unfolds and is applied to PAI is applied to the long period of expansion (1992-2007). The analysis examines implications for environmental problems that current evasive innovation is unable to address.

JEL Classification: O25; O32; P16; Q16

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Introduction and Theoretical Framework

This paper examines the political economy of dairy in Australia with a specific focus on the role and place of innovation. As such, it is one of the first two case studies using the Political Aspects of Innovation [PAI] framework to analyse the role of government in innovation policy.\(^{1}\) This framework, developed in Courvisanos (2009a) and based on work done by Kalecki (1943), explains why and how capitalists manipulate public innovation-based policy-making for their own profit-making interests, and how such manipulation varies over the period of a total business cycle – from boom to bust and back again to boom. Courvisanos (2009a) outlines the epistemology of PAI, its role in critiquing public innovation policies, and its disclosure of pragmatic and coherent innovation policies in the context of both the public and private (vested) interests.

There are a number of reasons for dairy being chosen to illustrate the application of the PAI framework. At the theoretical level, the industry exhibits all the characteristics of a traditional industry with many small businesses and ease of entry. Notably, owner-operated farms dominate the Australian dairy industry with only 2% classified as corporate (Senate Select Committee on Agricultural and Related Industries, 2009, p. 2). In such a world there is the potential for innovation as new entrants challenge established businesses with new ideas. This is the world of small firms that Schumpeter (1938) identified in his 1911 examination of innovation and economic development. Malerbo and Orsenigo (1997) call this Schumpeter Mark I type.

Market structure of the Australian dairy industry have changed considerably over the course of the past century, most markedly since the 1980s with globalisation deeply affecting the industry and prompting the creation of very large multinational enterprises (MNE) for the processing, marketing and distribution of dairy products. More generally, challenges are emerging with competitive pressures increasing in the dairy industry in the face of continued and accelerating globalisation, centralisation of distribution, ecological problems (like greenhouse emissions, water shortages and drought) and health and safety regulations. Inter alia, this has encouraged farm amalgamations (with numbers falling from a peak of 22 000 in 1980 to less than 8 000 in 2008 (Senate Select Committee on Agricultural and Related Industries, 2009, p. 2), more absentee ownership, and mergers at the processing and distribution levels. Such forces as these are increasingly institutionalising the innovation process in the hands of larger businesses with greater internal

\(^{1}\) This study compliments the PAI analysis of the New Zealand dairy industry by Kesting et al. (2010). Together, New Zealand and Australia account for more than 46% of the world export market in dairy products
research and development [R&D] capabilities and, thus, constructing significant barriers to entry. Arguably, dairy is becoming more like the Schumpeter Mark II type of Schumpeter (1942) that can be seen at its apogee in the pharmaceutical industry (Rojakkers and Hagedoorn, 2006).

At the cultural/institutional level, Australia accumulated its economic wealth from mining and agriculture. A cheap commodity producer to the world’s powerful growth economies (in chronological order they have been Great Britain, USA, Japan and (now) China), Australia has the “…largest national agricultural sector among the advanced economies that is essentially unburdened by the distortions of trade protection and competition-reducing regulation.” (Jolley, 2006, p. 98) With a long and consistent record of positive and consistent returns within this sector, and given its significance in the growth and viability of rural communities, the Australian dairy industry encapsulates the essence of successful innovation and government support that underpins its success.

From the political economy perspective, Australian agriculture historically has had a very strong research infrastructure, established by government in cooperation with the industry. Initially, this research strength was based around the CSIRO as the public R&D institution that deals with fundamental agriculture related science to improve productivity. More recently applied research has been strongly developed (again with the cooperation of industry players) by a broad range of Rural Research and Development Corporations [RDCs] and Cooperative Research Centres [CRCs]. There is, thus, strong encouragement for innovation in agriculture with government support for advances in areas like biotechnology and micro-technology, while nanotechnology and The Australian Synchrotron can be of major future significance (Productivity Commission, 2005).

In light of the above introduction to the Australian dairy industry, and by way of shaping the analysis that follows, two questions should be considered: One, in an economy characterised by private enterprise, neoliberalsm and deregulation, why does government still play a prominent and enduring role in dairy innovation, well after its viable establishment? Two, given the competitive and ecological challenges facing the industry, what type and level of innovation has emerged pursuant to addressing these challenges and what are the future innovation patterns? As stated above, the PAI framework is used to shape this analysis.

While familiarity with the previous PAI work is of value, signposts and explanations offered through the case study will enable the reader to appreciate the PAI perspective in operation. By way of introduction, PAI analysis is a dynamic tool that complements the static innovation systems framework (national, regional and sectoral) by focusing on innovation and public policies applying to the dairy industry over the boom and bust of business cycles. PAI identifies over the business cycles the changing nature of three capitalist fears in the context of innovation: loss of economic, policy and industrial control. Note, that the focus of ‘industrial control’ is not only on industrial relations with employees per se, but also on how innovation and its flexibility in labour processes affect the power balance between different factions of capital.

Insofar as innovation is concerned, PAI identifies two types, evasive and transformative. “Evasive innovation” is used to denote any innovation (either incremental or radical) where negative “spillovers” or side-effects are externalised in pursuit of a traditional trajectory of economic growth (Tidd et al., 2005, p. 170). “Transformative innovation”, by way of contrast, is radical innovation which redirects the trajectory of economic development by internalising negative spillovers (Lowe, 1976).²


³ During long periods of economic growth, governments in advanced developed economies have the policy tools and techniques to encourage and support transformative innovation. Yet this form of radical innovation is highly unlikely. Instead, during a period of strong economic growth (boom), marketing-based incremental innovation is far more likely. From a PAI perspective, this is identified as evasive innovation because the pursuit of a traditional economic development growth path externalises negative spillovers. Given the prominence of the environment in international and national policymaking such transformation could and should be a driver for ecologically sustainable development [ESD] (see Courvisanos, 2005). Strong profits and consumer demand in the private sector
The three fears vary over the course of the business cycle. Courvisanos (2009a, p. 1121) identifies that “[t]owards the top of the expansion phase” these fears intensify, limiting investment to the commercialisation of evasive innovation that supports current technological trajectory, with transformative innovation delayed. This limited investment in innovation continues through the contraction phase until (or if) the contraction is so deep and investment so long postponed that the potential of new entrants spurs investment in a large corpus of technical inventive knowledge that is the basis for transformative innovation. However, minor cycle downturns provide strong basis for only evasive innovation, with the cycle troughs not having the political economy power to usher in transformative innovation.

To set the context, section 2 of this paper provides a short overview of the Australian dairy industry and the relevance of PAI to an analysis of innovation policies while Section 3 offers a short history of relevant innovation. Through this historical account, the full spectrum of the national dairy innovation system is revealed. Section 4 then analyses dairy innovation policies over the long current period of expansion (1992-2009). All three sections are written with reference to the PAI framework. Section 5 examines the implications for environmental problems. Section 6 provides a concluding PAI analysis of innovation in the context of dairy industry stakeholders, and ending with a short conclusion.

**The Australian Dairy Industry**

The dairy industry accounts for nine per cent of Australian agricultural production, which in turn contributes around 3% of Australia’s GDP, some $37.3 billion per annum (Australian Bureau of Statistics, 2008). It is also the largest deregulated agricultural industry in the world (Jolley, 2006, p. 105). In 2009, although responsible for only around 2% of worldwide milk output, 45% of Australia’s dairy production was exported for $2.9 billion, 9% of the world’s dairy trade (Dairy Australia, 2010a). Value adding by a factor of three on to the farmgate milk output makes dairy, along with wine, the only significant off-farm agricultural contributors to GDP, generating a regional multiplier in the order of 2.5 for the local community. Yet, at an average of US$20-25 per 100kg of milk (c.f. Europe with US$30-35), Australian dairy farmers receive (along with New Zealand, see Kesting et al., 2010) the lowest world farmgate milk price. This situation is largely a function of deregulation and an open market (Dairy Australia, 2006a). This forces the farmers to be cost-efficient to survive, a crucial driver of innovation in the industry.

The role that innovation plays in Australian agriculture is broader than in any other sector of the Australian economy (Jolley, 2006). This is seen in the story of the dairy industry developed in this paper, as it faces pressures to reduce costs and develop new products (similar to other sectors), but with a much tighter focus on consumer needs (both in Australia and overseas) and the need for new farm management techniques in the context of severe natural resource constraints (including drought, loss of ecological diversity, animal rights, soil depletion, erosion and greenhouse emissions). This list means that the search for innovations for the industry is unique.

As demonstrated in the next section, from a political economy perspective, government policy has always significantly influenced the pattern of the dairy industry, from attracting and keeping farmers on the land, to increasing production for trade and consumption, regulating the quality on dairy products, and finally cost reductions and productivity increases. The PAI approach is therefore valuable to an understanding of the nature, context and outcomes of this history. As a preface to the analysis that follows (in the next section), offers an opportunity to promote this transformative innovation, thereby redirecting the trajectory of economic development towards ESD. Herein lies the dilemma for public policy. Economic prosperity brings with it strong profits and rising economic wealth that should support ecologically sustainable innovation (the Kuznets Curve argument), yet the political economy rationale explains why during a long economic boom a shift to transformative innovation is highly unlikely.

4 “The growing pressure for environmental reporting has hit Australia’s dairy industry, which is committed to developing a sustainability benchmark.” (Hopkins, 2007)
there is a need to recognise that dairy innovation is supported by two distinct groups of scientific knowledge. One is biology - bio-chemistry, physiology, agrostology (study of grasses) and genetics - that addresses on-farm dairy processes. The other group includes chemical engineering (heat transfer, crystallisation, evaporation and fermentation), bacteriology, chemistry and physics that make possible the manufacture of dairy products (Tucker, 1988, p. 2). It should also be emphasised that this scientific knowledge did not only drive technological innovation but also, at least indirectly, both enabled and required fundamental organisational change.

From these two knowledge bases, four chronological periods of innovation can be identified, albeit with significant overlap between each. The liberal political economy model that is strongly reliant on market-oriented rules and conventions provides the background to this analysis (Hall and Soskice, 2001).

The History of Dairy Innovation in Australia

Below are set out the four chronological periods of innovation. Each period is defined by reference to the major innovative theme pursued at the time. However, as is evident, all periods are characterised by a range of innovative practices and policies, with one initiative frequently propelling or requiring others. Each period with an innovation suite has impacts on subsequent periods which are discussed in the context of the period in which the innovation suite first evolved. The PAI framework is applied to identify the overall nature of innovation for each period.

**Embryonic innovation: 1820s to 1870s**

In 1788 Australia began its colonial existence as an extension of Great Britain’s public prison institutional structure. Seven cows and two bulls were imported with the first fleet in that year, later escaping from Parramatta into the bushland around Sydney Cove. The herd was rediscovered seven years later by which time there were 61 head. Those cows formed the first dairy herd in Australia. Dairy settlements began in the 1820s in New South Wales (NSW), followed in the 1830s in Victoria, Tasmania and South Australia. Innovation was restricted to clearing and creating dairy farms out of virgin bushland in an environment alien to the white settlers. A local regional based industry became established, supplying fresh milk and dairy products to newly established towns nearby. In a period of economic growth from a very low base, colonial governments encouraged the expansion of agriculture, including dairy, deeper into virgin territory (Muller, 1996). This being a form of competition in what Denoon (1983) calls “settler capitalism” for colonial dependent development.

Virgin land expansion continued after 1901 Federation in a push to legitimise the land claims of the new nation. This agricultural geographical expansion tapped marginal lands where soils were poor, water relatively scarce and rain unpredictable. Expansion was further accelerated through soldier-settler programs following both World Wars. Dairy soldier-settlements developed early in the 1920s around Northern Victoria under irrigation and in Western Australia (Muller, 1996). This form of government-supported innovation, following the initial expansion, was far from transformative and was merely an extension of British agricultural practices. As the ventures were premised largely on competition and economic growth, the PAI analysis argues that this expansion policy was evasive innovation after the initial embryonic period reached well past its efficiency level with the recession of the early 1870s. Governments did not have the wherewithal or expertise to assist dairy farmers in successfully balancing competition and innovation. 5 As is the case with many embryonic innovation processes that extended too far, most dairy entrepreneurs entering the competitive dairy industry were small, under-funded, poorly skilled and fighting

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5 O’Hara (2007, p. 15) explains the innovation-competition dialectic. The width of the boundaries within which this dialectic operates depends on the institutional context of the nation/region and industry in which firms are operating.
a losing battle with an inhospitable environment. Many failed to negotiate the fine and narrow line between successful accumulation and bankruptcy.

**Process innovation: 1880s to 1910s**

For those who survived, an uninterrupted expansion period of 21 years from cycle trough in 1870 to peak in 1891 enabled dairy to establish itself firmly as a cottage industry. After a deep recession in the early 1890s, three process innovations – refrigeration, the centrifugal cream separator (both in the 1880s) and the Babcock rapid fat test (in 1892) changed dairy in Australia completely. The separator was a major advance for butter making which also contributed to boosting the export butter market. The Babcock Test was the first reliable monitor of fat content in milk and exposed those producers who diluted their milk by adding water. To this add on improved transport infrastructure in ports, rail and road and the introduction of refrigeration that allowed dairy products to be transported outside their immediate local communities for national distribution and export (of butter) to Britain (Muller, 1996). These three process innovations, together with stock success in the development of the Illawarra breed (the outcome of several generations of crossbreeding between well-producing imported dairy cattle and local stock of the Illawarra area), and dairy was poised to become a major commercial operation. The process innovations redirected the trajectory of economic development in Australian dairy on to a much higher production level and thus, in terms of the period, could be considered transformative.

The three process innovations had a wider effect for the industry. “Early cream separators were large, expensive machines, out of financial reach for the average Australian dairy farmer.” (DAIRC, 2005) This led to the formation of cooperative ventures, where farmers would pool resources in order to set up butter and cheese factories. This in turn led to the development of small towns like Allansford, Stanhope and Tongala (in Victoria) and Bega, Bodalla and Kameruka (in NSW). By 1900, 82% of butter was factory-made, with the remainder still made on-farm (Muller, 1996, p.8). These factories were cooperatives with the same farmers both supplying the resources (milk and capital) and sharing any surpluses or deficits.

Process innovations introduced into Australia therefore formed the basis for a viable strong agricultural industry, which began to move away from the farm into manufacturing on a small scale cooperative level. The 1890s recession limited the industry’s growth temporarily, but it also provided the diffusion platform for its growth at the start of the 20th Century once the economy began to expand and Australia became federated. At this early cycle expansion stage, governments assisted the diffusion process with each colony/state appointing “Dairy Experts” to guide production efficiency improvements. Victoria, with its relative climate advantage, took the initiative first, appointing David Wilson in 1888. After visiting Europe in 1890, Wilson argued for the introduction of pasteurisation even though it was not made compulsory (following a very bitter debate) until after World War Two (WWII). The other colonies/states followed with Dairy Experts appointed in NSW (1896), Western Australia (1897), Queensland (1904) and South Australia (1905). As further indication of the important role played by governments in this early innovation, the Victorian Government pushed its strong comparative dairy advantage by providing a bonus for every pound of butter exported, leading to a twenty-fold increase in butter exports out of Victoria after five years (Muller, 1996, p. 8).

Four major recessions in a relatively short period from 1903 to 1920 delivered what PAI would designate as evasive innovation with only minor further improvements in comparison to the process innovation suite that

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6 The dating of Australian business cycles is based on Harding (2002, p. 6).

7 The whole basis of the dairy cooperative is that it is non-profit, with the financial surplus returned to the owner dairy farmers based on volume of milk provided. This structure has its strengths in the democratic process and enables the effective transmission of tacit knowledge (in the form of “knowledge clusters”). However, it also introduces many constraints on the venture in its ability to expand. Thus, mergers of cooperatives became the one viable option for growth, though it in itself becomes a most difficult complex process to negotiate (Anderson and Phillips, 1996, pp. 74-80).
emerged after the 1890s recession. The long-term prosperity of the industry was far from assured, threatened by fluctuations in the economic cycle. However, the threat posed by these market fluctuations remained masked – the cooperative system and government support lessened the impact of cyclical downturns, while strong effective demand accruing from government-encouraged population growth allowed the industry to prosper during the short expansions. No attempt was made to address the underlying threat facing the industry, one that would become prominent during the next period in its history (the Great Depression).

Organisational innovation: 1920s to 1960s

From a political economy perspective, federal government commitment to a strong public research infrastructure encouraged a strong organisational and institutional culture of innovation to develop, especially in agriculture. At the start of a strong cyclical expansion in 1921 came the first attempt to establish a national institute to undertake scientific research, review existing research, and disseminate scientific information. However, this attempt failed due to lack of both funds and organisational structure. In 1926, a second and this time successful attempt saw the creation of the Council for Scientific and Industrial Research (CSIR) which became one of the most comprehensive scientific organisations in the world. CSIR’s initial successes came in agriculture with control and prevention of bitter-pit in apples and liver fluke in sheep, and control of prickly pear cactus. A national approach to dairy manufacturing research began tentatively in 1929 with the formation of the Dairy Product Research Section within CSIR. However, with funding coming from state and federal governments in an uncoordinated way, little effective national dairy research was achieved (DRDC, 1996, p. 234).

Organisational innovation in production and marketing was also a feature during this expansion period. In 1922, the non-statutory Australian Dairy Council was set up to enforce pasteurisation of milk among local plants and research into butter and cheese production. In 1936 this body was merged with the Australian Dairy Produce Board (ADPB) a Board established in 1924 pursuant to the Dairy Produce Export Control Act of that year to provide some focus to marketing of dairy products that was then in a chaotic state. This Board controlled the export of all butter and cheese to Britain, thereby creating a very strong but narrow export base. State marketing boards had to harmonise their policy and approach with that of the ADPB. The strong 1920s consumer demand and growth in Australia and Britain stimulated the development of an organisational infrastructure around the many small independent dairy farmers and their cooperative factories. Such a structure was of importance given the increase in dairy head numbers with the post-war soldier settlement schemes. However, many of these sponsored farmers were on marginal land (Muller, 1996, p. 11), and this, along with drought and lack of mechanisation meant one major problem for the board – virtually no increase in average yield of milk production through the 1920s.

During the Great Depression, the prevailing characteristics of the dairy market encouraged farmers to hold on to their dairy cows and not to mechanise. There was a rapid rise from 1934 in dairy cow numbers stimulated by economic improvement, yet again milk yields increased only slowly. Technical change in this period was slow. Indicatively, milking machines (first patented in 1836) did not become widely accepted in Australia until 1938 with the arrival of electricity to remote farms; this despite the introduction, adaptation and patenting of the Lawrence-Kennedy design (running on steam) in 1900. Unpreparedness to handle the technical problems of steam power, neglect in cleaning the machines, and then the economic crisis of the Depression, all contributed to low mechanisation (DAIRC, 2005).

From the PAI perspective, the mood of government during the period of emergence from the Depression can be identified as predisposed to innovation-based stimulation as economists and industry leaders demanded action in the face of rising effective demand. The corporation, Commonwealth Dairy Produce Equalisation Committee Ltd. (owned and run by the State Dairy Produce Boards) was formed in 1934 to overcome low London export parity prices and to stimulate dairy production in Australia. Dairy subsidies began during WWII and continued afterwards. The commencement of pasture research by the CSIR
Division of Plant Industry in 1938 (Federal) and the establishment of the School of Dairy Technology at Werribee in 1939 (Victoria) were both evidence of concern for the lack of farm productivity at the time of rising demand. WWII channelled production priorities and innovation towards the military effort, first by redirecting production to cheese and (especially) condensed milk; then by innovation as the Queensland Butter Marketing Board and the CSIR’s Division of Food Preservation and Transport developed canned butter for use in the tropical war-zones (Muller, 1996, pp. 11-12).  

The combination of effective demand expansion, low productivity and the war effort is important from a PAI perspective as it led to major public infrastructure for dairy innovation that in turn was the impetus for a significant rise in on-farm productivity from its deep trough in 1945. Most notably, artificial insemination (AI) programmes to increase productivity were established at the state level by 1958. This impetus also led to subsidiary developments. One was the formation of interest groups, such as the Australian Society of Dairy Technology in 1944 (that from 1945 began publishing the Australian Journal of Dairy Technology, a journal that remains in publication to the present). The Australian Casein Manufacturers’ Association was founded in 1947 to advocate export stability and stimulate R&D. Cheese (1954) and butter (1961) manufacturer’s federations followed. Another development saw the amalgamation through the 1950s of small cooperative factories around motorised milk transport, a trend that provided cooperatives with the financial ability to support the installation of the latest technology and more effective marketing innovations. A strong organisational innovation path that supported the process innovations of the previous period was clearly established.

In 1949 the CSIR was restructured as the CSIRO to focus exclusively on civilian research, and with all the dairy organisational elements coming together in the 1950’s ‘golden age’, dairy innovation finally came to the fore in the 1960s. The CSIRO dairy research laboratory developed a method (internationally copied) of recombining skim milk powder (SMP), milk fat and sugar with water; thereby tailor-making SMP to suit a variety of Asian markets. During the 1960s, CSIRO’s Division of Food Preservation and Transport revolutionised cheese-making internationally when they developed mechanised alternatives for the four phases of cheese-making, providing rindless processed cheese for the established British market and the new developing niche Japanese market. From the PAI analysis it can be seen that these were, however, incremental innovations that followed the innovation path set earlier.

With those in the industry believing that growth would continue unabated, the 1970 XVIII International Dairy Congress was held at the Sydney Showground and attended by more than 4000 people. This was to prove the high-water mark of this organisational innovation period. In the same year Britain announced it was to join the European Economic Community (EEC) (Muller, 1996, p. 16). A series of crises then began to buffet the Australian dairy industry, requiring a completely different approach to innovation.

**Product innovation: 1970s to 2000s**

The early 1970s saw a perfect storm of events and developments impacting heavily on the dairy industry in Australia. With the rise in cost of industrial raw materials and the drop in international demand for agricultural commodities, stagflation (commonly but not universally blamed on the first oil price shock of 1972-74) hit the economy. Britain joined the EEC in February 1973 and the Australian preferential tariff arrangements with Britain ceased, virtually eliminating dairy’s export market. The Australian Agricultural Council approved an increase in margarine production, complemented with a huge marketing campaign promoting it as the healthy alternative bread spread. Large surpluses in dairy produce (milk and butter) began to mount in the EEC and the USA, reducing export prices. Butter, and to a lesser extent SMP, were the major export casualties. Consequently, as shown in Figure 1, milk production declined by 28% in the ten years to 1980, with registered dairy farms down by around 50% (Dairy Australia, n.d.).

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8 The R&D war effort by the CSIR is seen as “its finest hour” (CSIRO, 2006).
The only possible future for the industry lay in geographical and product diversification away from bulk milk, butter and cheese. However, this required significant changes. Growing the niche Asian market as a replacement for the British market would require a suitable product mix while growth and long-term prospects in the domestic market demanded to cater to consumers interested in a proliferation of different products. These product innovation based developments can be appreciated, and their impacts understood, from the PAI perceptive as set out in the section that follows.

Product innovation for the domestic market began with adoption of milk cartons in the early 1970s and plastic bottles in the late 1970s. But that was not all. The statutory Victorian Dairy Industry Authority [VDIA] (successor to the old Milk Board) regulated and controlled the flow, quantity, quality and marketing of Victorian milk from farm to final consumer. Mindful of its responsibility to stakeholder-farmers, the VDIA became proactive in this period of crises. In the summer of January 1977, the VDIA launched the “Big M” flavoured milk marketing and promotion campaign (with the mnemonic slogan “Mmmmmm…”). This very successful campaign was the forerunner and standard-bearer to the diverse range of dairy products marketed to the Australian consumer ever since. “Big M” has the first-mover advantage that continues to enjoy a large share of the flavoured milk market in Victoria with 60% and around 45% on Australia’s East Coast9 (Thoeming, 2002, p. 87). The ironic aspect is that this new product innovation approach was initiated by a state government authority on behalf of the Victorian dairy farmers it represented, yet thirty years later this approach is dominated by the retailers and processors, a long way from the farm. Big M, along with the company that owned the brand (National Foods), became in the 2000s part of Kirin Breweries, a multinational company based in Japan.

**Figure 1**

*Source: Dairy Australia (n.d.), Deregulaton, web page, p.1.*

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9 South Australia followed in the same year with the very successful Farmers Union Ice Coffee flavoured milk product (Thoeming, 2002, p. 87).
The success in marketing flavoured milk had two major effects in the 1980s, coinciding with expansion out of the 1980-82 economic trough. It changed the downstream product mix away from butter and SMP to whole milk and cheese. Upstream it encouraged more product differentiation and niche market building in milk and cheese that in turn enabled much more product innovation. In particular, while bulk cheese was exported to Japan, cheese marketing in general concentrated on developing and introducing a wide range of varieties. A range of different milks was introduced to cater to health conscious consumers concerned with milk fat content. This continued, with Dairy Australia (2006a) reporting only 53% of milk sales as regular (whole full cream), with the rest being reduced (23%), low/no fat (7%), flavoured (10%) and UHT (7%). Efforts during the 1990s extended to table cream, dairy desserts and yoghurt. Yoghurt sales climbed to nearly 7% of the Australian dairy product consumption supported by much product innovation in yakult (for drinking), flavours, packaging and use of probiotic cultures (Dairy Australia, 2006a, pp. 20, 25).

Underpinning this product innovation was a major reorientation of the dairy industry and its organisational structure. A deregulation process began slowly at the federal level and then spread to the states. The regulated structure that was intended to stabilise farm income, provide equalisation subsidies and control marketing was progressively dismantled in favour of market-oriented incentives. The federal government in 1986 began this process by converting the ADPB into the Australian Dairy Corporation (ADC) and by discontinuing price pooling arrangements on major dairy manufacturing products. A levy on all raw milk production was introduced to raise the price of exported manufacturing milk products above market levels.

Pursuant to the agreements reached during the Uruguay round of GATT, all market support programmes ceased in 2000. Post farmgate deregulation at state level began in Western Australia in 1990, with the other states quickly following with expansion out of the 1989-92 economic trough. Then, under the National Competition Policy, by 1st July 2000, deregulation was completed with milk being allowed to flow freely across state borders and farmgate prices no longer guaranteed (NCC, 2004). This last policy has made Australia one of the few countries in the world where farmgate prices are dictated by market forces rather than regulation (Senate Select Committee on Agricultural and Related Industries, 2009, p. 2).

At the same time as this deregulation has taken place, a heavily public-supported dairy innovation system emerged to harness technological change essentially for product innovation, but supported by evasive innovation in on-farm dairy process improvement10 and in off-farm processing. Reflecting this shift to product innovation, in 1972 the research functions of ADPB were split off into the Dairy Research Council (later the Australian and Development Corporation, ARDC). The new post-deregulation dairy marketing body together with ARDC formed Dairy Australia Limited in 2003. A dairy levy supports the organisation with matching R&D funds flowing from federal government. Then, there is the peak industry body (ADIC) and organisations with particular policy interests – farmers, manufacturers and milk processors and five knowledge intensive third parties that liaise with DA: Geoffrey Gardiner Foundation (GGF, funding Victorian dairy projects), University of Melbourne (R&D in dairy farming systems), National Centre for Dairy Education, Cooperative Research Centre for Innovative Dairy Products, Department of Primary Industry Victoria.

At the scientific edge, there is the Australian Dairy Herd Improvement Scheme (est. 1982) and Dairy Innovation Australia Ltd. (est. January 2007). The latter brought together five existing research centres into one innovation centre with four cross-disciplinary programs in biosciences, process technologies, product innovation and health/nutrition. This centre was set up by DA along with GGF, Food Science Australia and all the major dairy processors except the largest New Zealand-based global firm, Fonterra11 (Food Victoria, 2011).

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10 Such public-supported advice and support for on-farm improvement is called farm research, development and extension, or simply RD&E.

11 Fonterra entered the Australian dairy industry by taking over Bonlac, Bega and Tatura processors. Despite it not being named as a party to the centre, it is worth noting that it has indirect involvement since Bega and Tatura are both listed as assisting in the formation of the innovation centre.
2006). Coincidentally, Fonterra a year earlier (in October 2005) announced the building of its own “state-of-the-art” innovation centre in Melbourne to supplement its New Zealand centre. Despite Fonterra being a privately owned and operated cooperative (as well as being one of the largest multinational dairy processors and sellers in the world) and despite the focus of the research centre being market oriented product innovation, the Victorian Government (i.e. the Victorian taxpayer) is assisting Fonterra in the centre’s establishment.

In conclusion to this brief outline of the history of dairy innovation, the casual observer can appreciate that the dairy innovation system is very deep and complex with public support at the centre of all the activities within the system. This occurred despite the fact that some of those activities could be seen as giving the participant(s) potentially significant market advantage both domestically and globally. Within a deregulated environment where participants are expected to make decisions based on market forces, this position is interesting. Consequently it is worth examining the complex innovation system from the PAI perspective. This is the focus of the following section.
The PAI Perspective on Dairy and the Long (post-1992) Boom

The political economic history of dairy innovation outlined above places in context the long period of economic expansion (1992-2007) that resulted in safeguarding powerful dairy interests from the three fears arising through product innovation that began in the early 1970s. Each of these PAI fears is examined separately and then together:

Loss of economic control

Market power became highly concentrated through the product innovation period, as R&D and economies of scale led to great product diversification. The product diversification through incremental innovation began with public dairy authorities, but then dominated by powerful processors (with supporting public R&D subsidies and innovation infrastructure) and retailers (with minimal constraints by anti-trust authorities). This facilitated “...a noticeable increase in the extent of restructuring and investment at the factory level...[which] increase the incentives firms face to up-date their technology and increase their capacity.” (Doucouliagos and Hone, 2000, p. 153) The outcome of this concentration has been a battle for economic power between the large national/multinational processors (oligopolies) and the giant retailers (oligopsonists). Greenwood (1996, p. 19) describes deregulation as only “partial” because concentration of market power in supermarket chain retailers has led to them being able to dictate trading terms to processors. Their determination to act competitively in the retail market compelled processors to amalgamate as a means of clawing back some price power through realising economies of scale and product diversification, thus building demand inelasticities in consumers that are health, budget and time conscious.12

From their place at the start of the value chain, dairy farmers saw the lack of agreement on marketing arrangements between processors and retailers as hurting them the most (Godbold, 1989, p. 211), leaving them “…prostrate in the face of returns beneath production costs” (Jones, 2000).13 Research conducted and/or reported in Dairy Australia (2010a) showed that only 50% of Australia dairy farmers believed that they would earn a surplus for the first six months (p. 8). Findings by the Australian Bureau of Agricultural and Resource Economics (ABARE), which are also included in this Dairy Australia (2010a, p. 10) report, were more depressing, with average farm cash earnings dropping 43% and the percentage reporting negative earnings rising from 26% to 44% over the year.

Loss of Policy Control

The economic control fear inevitably dovetails into the policy control fear – a fear shaped by government policies of deregulation and restructuring. Innovation has always driven policy in this industry, from the government dairy experts in the 1880s to the company and public R&D research centres in the 2000s. With technological change making dairy (from farming to marketing) vastly capital-intensive and the continued depressing average dairy farmer returns, the pressure for restructuring has been inexorable. As a result,

12 The overwhelming majority of milk is processed by three huge overseas companies being Parmalat (Italy), Fonterra (New Zealand), and National Foods (subsidiary of San Miguel conglomerate based in The Philippines); two large national cooperatives being Dairy Farmers and Murray-Goulburn. There are then about 35 other milk processors varying from the large Swiss Nestlé (mainly for confectionary), one only local large public stock company Warrnambool Cheese & Butter, some private local companies (e.g. Burra Foods) and finally a large number of very small cooperatives (e.g. Hastings).

13 In 2009 there was a bitter dispute between a group of Tasmanian suppliers and National Foods (owned by Kirin Breweries out of Japan) around cuts in prices offered for their milk. With no option but to supply to National Foods (there being no other processor in the area) they maintained that the price was below the cost of production. The dispute remained unresolved until a public inquiry by the Senate Economics Committee that tabled its report in May 2010. Amongst its recommendations was that the Australia Competition and Consumer Commission immediately investigate milk prices and that steps be taken to amend the Trade Practices Act 1974 to address market inequities “…particularly those provisions relating to misuse of market power, predatory pricing, mergers and creeping acquisitions and …price discrimination” (Eckersley, 2010)
completion of the deregulation process in July 2000 required a structural adjustment program that entrenched economic control in a few large farmers and provided exit for failing farmers. The $1.7 billion Dairy Structural Adjustment Package was introduced and was slowly phased-out over eight years until 2008. As a result, there was a 12% effective rate of assistance (ERA) provided to dairy in 2003-04, compared to an overall rate of 4.1% for the agricultural sector (Productivity Commission, 2005, pp. 84).

Deregulation and assistance has had, and continues to have, impact on the industry. First, it delivers efficiencies from technological change to the whole industry and lower prices to the consumer. Secondly, it provides countervailing power to the dairy processors against the giant retailers by delivering control of the whole production process to five major milk processors and their contracted large farmers. Also public infrastructure, funding, and support continues to deepen the dairy innovation system, ameliorating susceptibility to private sector investment instability by the increasingly monopolised dairy private sector, even though this investment is for essentially impulsive consumer-based marketing product innovation; evasive innovation of the highest order.

**Loss of Industrial Control**

The Australian dairy industry began on the farm and through cooperatives and a wide retail distribution system; the dairy farmers were in control and this is reflected in many of the milk processor names that still attest to their farmer cooperative origins. However, technological change made existing employment and work practices irrelevant and uneconomic. Flexibility in dairy has become the aim with deregulation, a public policy tool that is based on the neoclassical economics assumption that markets will automatically and flexibly manifest clear demand and supply. The flexibility is, however, only one-sided and reduces the number of small farms and employees in processing. In dairy, this leads to longer work hours than other workers and having to rely on family labour, which impacts on the family’s ability to get away from the farm (Todd, 2006). With giant retailers flexing their monopsonistic muscles, processors have been forced to grow, both to challenge this power and to drive product innovation further to maintain some monopoly power themselves.

So, from a political economy perspective, the neoclassical assumptions do not work. In the history of Dairy Farmers Cooperative, Todd (2001, p. 260) succinctly concludes when reflecting on the emergence of deregulation and the loss of industrial control by the cooperatives:

…many of the classical assumptions about the structure of the perfect competitive market were still a long way from being met. For the farmers it was more important than ever that they owned their own co-operative and could still marshal their own market power. It was important that they too were more than just contract suppliers, and more than their milk.

This important economic issue has been lost in the market concentration of the dairy industry.
**PAI in dairy**

Overall then, the combined effect of deregulation of Australian dairy and market characteristics has directed the industry down an economic growth path determined and characterised by evasive innovation. The capitalists exercise power through innovations to their advantage both in market decisions (higher profits and lower costs) and in their dealings with policymakers (publicly funded support and research to achieve greater private benefits). Size matters. However, the history outlined above reveals that to pursue that growth path unchecked, exposes the industry to market volatility and innovation policies aimed at reducing this volatility without the critical risks of transformative innovation. Yet, a range of environmental problems linked to the dairy industry have failed to be appreciated in the dairy restructuring that has occurred. As will be discussed in the following section, it is vital for the long term prosperity of the industry that such emergent and significant environmental issues drive innovation into the future and spearhead its transformation.

**The Environmental Problems**

Innovation and the environmental issues facing the dairy industry have been closely interrelated as they charted a course together through the last century in an inhospitable physical ecosystem. However, in the interests of length and clarity, the discussion of environmental problems below relates to the post-1992 economic boom and is discussed under three headings - climate change, inputs (water, energy and foodstuffs) and outputs (liquid wastes and emissions).

**Climate Change**

Australia is acknowledged as being the most arid of all settled continents. In addition, it experiences some of the most extreme temperatures on the planet. Consequently, climate change is likely to impact hard and fast on Australia and in particular on its agricultural sector. Dairy can not escape, a point well recognised by the industry. This future reality was the focus of a Diary Australia strategy document (Dairy Australia, 2006b) that investigated industry capability and strategies to manage this risk and to demonstrate that commitment to the community. In this document, a two pronged approach was mooted – facilitating adaptation and mitigation of effects. Although specific details are lacking, many of the proposals for innovation put forward could be described as transformative rather than evasive, relying heavily on scientific research into adaption of pasture, improving water usage efficiency, plant breeding and rumen modification. The problem is that the economic growth path of dairy innovation identified in the previous section clearly is driving evasive innovation in the context of ameliorating the three fears of the entrenched dairy capitalist interests. This innovation path is a juggernaut that is well set on its course. The path is reinforced by the clear resistance in the agricultural farming community to change in the face of all the scientific and media information on the dangers of climate change (Fleming and Vanclay, 2009).

**Inputs - water, energy, foodstuffs**

With chronic drought conditions affecting much of Australia since the early 2000s, inevitably there has been much discussion and debate over the most efficient use of water, particularly in those regions where most foodstuffs are produced (especially, the Murray-Darling river basin that crosses the four eastern states of

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14 As Foucault (1980) argues, it is the combination of economic power and community resistance that are created by cultural, social and economic hegemony which need to be understood in order to find ways of addressing the need for change. The PAI perspective provides the innovation context to this understanding of resistance to economic transformation implied by climate change, while Fleming and Vanclay (2009) provide an understanding of the cultural disclosures in farming communities that lead to this same resistance.
Queensland, NSW, Victoria and South Australia). Significantly, of the producers of dairy in Australia, the two biggest are NSW and Victoria with 11.4% and 65.6% shares respectively of national production (Dairy Australia, 2010b). Water is essential for highly water-intensive dairy production. The average cow directly consumes four litres of water to produce one litre of milk, thus dairy farming used in 2004-05 19% of all agricultural water usage (Wescott, 2009, p. 34). Also, there are large amounts of water otherwise involved in milk production. Figures vary, but one estimate is 800 litres of water per one litre of milk (Blundell, 2007, p. 22). The drought conditions of the past decade have had many farmers exiting the industry in large numbers (Barr et al., 2005, p. 32), leading to farm amalgamations and increase in herd sizes (see Figure 1). As an indication of the impact of drought, in the year 2006-07, the average return for irrigated dairy farms in the Murray-Darling basin was -0.3% (Ashton and Oliver, 2008). More recently the implications of increasing the cost of water to farmers while reducing its quantity, has been highlighted. For example, the Victorian state government $1 billion foodbowl modernisation project (in the Goulburn Murray irrigation district)15 was “damned” by the Auditor-General who judged that the project “lacked transparency and rigour” with superficial analysis of costs and benefits (Bourne, 2010). “Access to water has become a political issue” between irrigators and environmentalists (Alston, 2009, p. 55), with farmers fearful that the rationalisation of the channels will leave them without access to water and spell the end of their livelihood and their communities (Bourne, 2010; Fyfe and Millar, 2010).

With water prices rising significantly and downward pressure on milk prices being exerted by processors and retailers alike, the short term survival strategy for farmers at this front end of the chain is to expand in an attempt to widen the absolute gap between cost and return – using sophisticated milking techniques, efficient water and pasture management, and high quality stock breeding. All this is evasive innovation as per PAI. However, those innovation techniques merely contribute more milk to a market where the price signals are generally negative. Add to that the growth in dairy in New Zealand – where Fonterra is the largest milk processor by far – and the conclusion is that this innovation approach is unlikely to lead to long term prosperity and stability and may well lead to Australian supply being replaced by imports.

A further issue is energy, which farming (especially dairy) is heavily dependent on. Dairy farms in particular are heavy users of electricity – estimate of around 40% of electricity usage on dairy farms for heating water, with the balance split between cooling milk, pumps and lighting (Dairying for tomorrow, n.d.). Diesel is also utilised in crop cultivation and pasture improvement. Milk is transported by tanker to the processing plants (using diesel) while the processing itself requires electricity. Refrigeration of the finished product is compulsory both in transportation to market and in the market itself prior to sale. Such “evasionary” innovation strategies as expansion and consolidation at all levels of the industry will lead to efficiencies in the use of energy but, ironically can also have negative effects such as idle or underused plants in a volatile industry like dairying. For example, a farmer may invest in large capacity milking and storage equipment yet underuse it when drought or feed shortages or price drops force a reduction in cows milked. Equally, a large processor may be forced to expend more energy collecting milk where it has pursued a strategy of geographical expansion into an extended area or on keeping milk chilled in higher ambient temperatures. Both such situations lead to higher total energy use even as the industry is reducing its output.

Foodstuffs is the third input analysed here. Traditionally, dairy has relied on pasture and some supplementary feeding to support herds (Dairy Australia, 2007). However, for a range of reasons such an approach is becoming less viable and attractive in certain areas. In particular with large dwelling expansion, farming generally and especially dairy, is forced into the hinterlands. The problem here is that the coastal and lowland areas taken for dwelling expansion are also those areas most fertile and with the most reliable

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15 This project involves upgrades to irrigation channels, replacement of water meters, reductions in the total kilometres of water channels and diversion of a proportion of the “saved” water to Melbourne town water storages. Irrigators contributed $100 million directly for the project but they will be paying more indirectly through increases in water bills and for new meters (Fyfe and Millar, 2010).
rainfall. In the traditional dairying area of Kiama in NSW for example, the very survival of dairying is under threat from property development (Murphy, 2006). Land in the hinterlands may be cheaper but is likely to require more irrigation (putting pressure on water supplies) and may have less pasture growth (forcing extra supplementary feeding and increased energy). With downward pressure on returns, such relocation may be the only viable option but also has the effect of increasing costs, thereby further reducing marginal returns. Climate change and its effect on water supplies and temperature can only add to the pressures. Evasive innovation in the form of relocation and expansion again is not an innovation strategy for long term prosperity.

**Outputs - emissions, pollution**

Insofar as outputs are concerned, the two that attract the most attention are emissions and pollution. There are several reasons why dairying comes under scrutiny in relation to emissions. First there is the cows themselves. As ruminants, cattle give off methane, one of those gases considered to contribute substantially to the broader agriculture sector’s contribution of around 16% to total Australian emissions (Australian Greenhouse Office, 2005), while dairy farming is estimated to contribute 11.6% of all agricultural emissions (Eckard et al., 2000). There is research underway into the reduction of emissions per litre of milk through intensification (as opposed to expansion of units), with findings in the region of 30% reductions in emissions (Farina and Garcia, 2009). More scientific and farm-management research is underway by way of collaboration between Dairy Australia and a range of partners (including Universities in Melbourne and Sydney and AgResearch) focusing on, *inter alia*, rumen modification, integration of climate risk into management modelling, fertiliser management, and energy efficiency. Although arguably such initiatives could be classified as cost management or savings focussed, they could also be considered examples of transformative innovation in accordance with the PAI framework as they address issues of environmental concern not to expand the industry but to “proof it” against an uncertain future.

The second reason for the ecological scrutiny is the energy usage in delivering the product to market. With the value of exports it is vital for the industry to address concerns from global markets. One of the important issues of potentially significant impact for Australia is food miles. The argument is that the further food must travel from farm to market, the higher the energy required getting it there and therefore the greater its contribution to its carbon footprint (Saunders and Barber, 2007; Burgess, 2007). Despite research showing that the carbon footprint of Australasian dairy products landed on the English market is still less than half of that of British produce (1423kg CO₂/t MS c.f. 2921kg CO₂/t MS) (Saunders and Barber, 2007, 20), it is inevitable that this and related concerns will remain significant to the future of the industry. In this context, Dairy Australia is presently participating in an international study to track the carbon footprint of dairy products (Dairy Australia, 2010b). The audit follows samples of product from farm to export port, arriving at a total for the industry and providing this measure to buyers in markets where information on the carbon footprint is a requirement (including Japan, Korea, France and Sweden through legislation; Walmart, Tesco, and Marks and Spencers by specification). This is merely evasive innovation in that it is a response to market pressures without necessarily leading to change.

Finally, pasture-based stock farming and processing produces several types of pollution, Dairy Australia has established the *Effluent and Manure Management Database* (Dairy Australia, 2008) in response to this concern. The database is essentially designed as a management and information tool for those in the industry and “…outlines the principles for effective effluent management, performance based design criteria for components of effluent containment and reuse systems, and appropriate management principles for optimal operation of each design.” (Dairy Australia, 2008, p. iii) With regular updates, this database is strongly supported by scientific research into aspects of such management and has the potential to involve significant aspects of transformative innovation if the industry takes the measure seriously and not merely a legitimating strategy.
Overall then, environmental pressures have had a range of effects on innovative approaches and strategies for the Australian dairy industry. Although most of them are short term evasive, there are elements of innovation with transformative potential. In light of the PAI analysis and the historical record, all the environmental pressures and challenges facing the industry, evasive innovation as a legitimating strategy is prevalent, with the long term ecological future of the industry under serious threat.

Industry Stakeholders and Innovation

The final part of the analysis synthesises the above discussion through a summary portrayal of how the players/participants (stakeholders) in the previous analysis operate in the industry in terms of the PAI framework, and of what the implications of this are for innovation in Australian dairy. Industry stakeholders’ respective short-term (+) and long-term (x) impacts on evasive and transformative innovation are set out in Table 1 below. A brief explanation/justification for this portrayal is provided together, inter alia, with implications for future dairy innovation.

Based on Table 1, as long as prices and terms of trade are rising, it would be expected that all of the industry stakeholders, except small cooperatives and environmentalists, would seek to maximise their short-term interests through an evasive innovation strategy – externalising environmental costs and following an economic growth path. This supports the PAI concept that so long as the economy is in boom, evasive innovation dominates.\(^\text{16}\)

Efforts to foster ecological sustainability through a transformative innovation strategy have been largely ignored by Australia’s dairy farmers. This is indicated in Table 1 with ecological consideration being symbolised as evasive innovation with a “+” in the first row/second column of Table 1. In the same row, the “x” relates to a limited number of ecologically concerned farmers willing to lead a “green” transformative initiative. The history and present innovation strategies of both the three global firms and two large domestic cooperatives show clear short term growth with evasive innovation and no evidence of any long term ecologically sustainable innovation. Medium sized dairy processors tend to follow the competitive strategies of the larger processors, with a few looking at longer term horizons. It is at the small cooperative dairy level that transformative sustainability is an issue, both for marketing reasons as a higher priced organically-based niche market is targeted, and also due to the different discourse from the farmers in this sector that reflects a different ecological perspective (Fleming and Vanclay, 2009). This supports the Schumpeterian idea that small firms are more inclined to radical (here transformative) innovation. Outside investors are keen to buy into a publicly owned stock of the major dairy companies due to their strong marketing, and thus reflect the same pattern in Table 1 as the large dairy firms. Marketing success of the large dairy firms, with only the small niche markets for organic sustainable dairy, form the basis for the “+” and “x” in the row related to dairy consumers.

Table 1: Australian dairy PAI analysis of two types of innovation

<table>
<thead>
<tr>
<th>Industry Stakeholders</th>
<th>Evasive Innovation</th>
<th>Transformative Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy farmers</td>
<td>+</td>
<td>x (limited extent)</td>
</tr>
<tr>
<td>Three global enterprises</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Two large Aust. co-ops</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Medium-sized processors</td>
<td>+</td>
<td>x (limited extent)</td>
</tr>
<tr>
<td>Smaller cooperatives</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Outside investors</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

\(^{16}\) Due to space limitations, the analysis in this paper ceases with the end of the long economic boom in 2007. The Global Financial Crisis with the accompanying economic downturn and its impact on innovation arising from this crisis needs a separate study of its own, after the crisis has produced whatever economic path transpires.
Major retailers | +
Dairy consumers | + | x (limited extent)
Government | + | x
Environmentalists | x

+ = short term support, x = long term interest

The federal and state governments have conflicting interests represented by different departments and ministries. Economically oriented government departments, for example Treasury and Trade, have a short term interest in economic growth and positive trade balance, which indicate an emphasis on short term economic goals and reluctance to use the price mechanism to support transformative innovation both at the state level (e.g. water use; see McEachern, 2009) and federal level (e.g. carbon price; see Parkinson, 2010). Yet, the Federal Departments of Agriculture and Climate Change have been pushing the ecological sustainability innovation long term strategy (Parkinson, 2009). From this can be deduced that mixed messages are coming from governments, generally resulting in confusion and little long term action. In this political conflict, environmentalists have been leading the way in demanding transformative innovation, because of their concern with the large total cumulative ecological footprint of dairy production (Benyon et al., 2002) emerging not only from the actual farming techniques, but also from production of feed and downstream dairy processing (Gerber et al., 2010, p. 124). These environmental interests are included in the last row of Table 1 as “x” in the third column.

During the long economic boom, dairy has been able to ride a wave of prosperity with evasive innovation fostering economic growth, including strong marketing and diversification benefits. This can be seen in Table 1 by the strong power bias towards the evasive innovation column. Considering the weight of interests behind evasive innovation in this PAI conflict scenario, a paradigm shift towards transformative innovation is unlikely in the near future. That is unless there is the political will by government(s) directly to address the unwilling through encouraging social learning and adaptation towards eco-sustainability (as outlined by Courvisanos, 2009b).

Conclusion

Innovation is not simply technological (in process) and economic (in outcome). The political dimension casts a strong shadow over both process and outcome. The class-based PAI approach of Courvisanos (2009a) is applied in this paper to analyse the Australian dairy industry and identify the specific dairy capitalist elements that drive innovation from within its own dairy reproduction system and the public support that ensures economic growth while ameliorating susceptibility to future risk. All this occurs within the context of the boom and bust of business cycles, for it is these short term economic forces that influence the shape and form of innovation, whether evasive or transformative. Forces aimed at ameliorating the three fears of capitalists are important for the basic dynamic of the innovation process. Kalecki’s political economy as applied to dairy innovation within a conjectural history of Australia’s dairy industry illustrates that the PAI approach has potential for understanding innovation from a broader heterodox perspective which can lead to a coherent agenda for eco-sustainable dairy innovation.

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