

The Knowledge Gap: A Perspective on Trade, Industry, Technology and Policy from Pre-war Australian Music Technology Manufacturing (1903-30)

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Australia struggles to achieve economic competitiveness, prevent expansion of the trade deficit and develop value-added production despite applications of policy strategies from protectionism to trade liberalisation. This article argues that these problems were emerging at the turn of the century, and that an investigation of music technology manufacturing in the first two decades of this century reveals fundamental problems in the conduct of relevant policy analysis. Analysis has focused on the trade or technology gap which is only symptomatic of an underlying knowledge gap. The article calls for a knowledge policy approach which can allow protection without the negative effects of isolation from global markets and without having to resort to unworkable utopian free-trade dogma. A shift of focus from a 'goods traded' view to a knowledge transaction (or diffusion) perspective is advocated.

Australian attitudes to protectionism and foreign trade were important elements in shaping the industrial climate from Federation up to 1930. Moreover, this period can be seen as a critical phase in establishing enduring patterns of public policy directions and resulting industrial performance for the whole of this century (Anderson 1987; Hill 1988; White 1992). Therefore, a focused examination of the role of public policy in relation to, for example, music technology manufacturing during that time can help in establishing what the genesis of these patterns has been, and to begin generalising about policy-making processes with a view to placing them in a more realistic socioeconomic context. The music technology industry is of particular interest because it rode on the cusp of the long transition of manufacturing from the production of mechanical technology such as the acoustic piano and pianola, to electric goods like the wireless and electric gramophone, and later on to the electronic and digital consumer goods such as compact disc players (Rooney 1996).

Conservative management, risk aversion, poor marketing skills, expensive manufacturing processes, a lack of ability to produce sophisticated products, and inadequate engineering know-how are all problems that can be shown to have existed at the turn of the century in Australian industries, but became more evident by the 1970s (Butlin 1986). Debate about Australia's industrial problems since the mid-1970s has tended to focus on arguing that an over-reliance on protectionist policies and restrictions to the freedom of trade was the direct cause of problems such as those just mentioned. However, more recent argument has swung back in the direction of an activist role for government. It has been pointed out that Japan, South Korea and Taiwan, for instance, have successfully promoted their industries through government initiatives; namely protectionist policies which have been sensibly linked to industrial performance incentives (Stewart 1991, 1994; Bell 1997; Hughes 1998). In looking at performance, though, there is a need to consider a key

element of postindustrial economies—knowledge. If government is to intervene, it needs to be able to include a knowledge perspective and apply knowledge-based analyses in its policy formulation process. To date, however, there has been little development of thought about knowledge and public policy (Rooney and Mandeville 1998).

Knowledge and Policy

Economists have long held the belief that knowledge and information are important elements in economic activity, even if neoclassical economists have largely failed to adequately deal with them. However, some such as Boulding (1956), Maclup (1962), Arrow (1974) and Lamberton (1994) have held knowledge and information to be of fundamental importance. Indeed, these ‘information economists’ and others have built a sound theoretical and empirical base in relation to the economic dimension of knowledge. This, in turn, has provided a set of analytical tools which can be used by policy-makers.

In a more focused analysis I argue that knowledge is fundamental to manufactured goods and the manufacturing process. If we accept that technology can be defined to include tangible artefacts and intellectual technologies (Rooney 1997), then it is not a great distance to move to see manufactured goods, at least in part, as the embodiment of knowledge or know-how. I am suggesting here that any manufactured good is in fact a combination of both physical and intellectual/conceptual properties.¹ This being the case, then knowledge must be treated as a factor of production in the same way that land, labour and capital are (Drucker 1991; Mandeville 1996; Arthur 1996). Furthermore, technology transfer and international trade in manufactured goods can now be seen in large part as a knowledge transfer process in something akin to a globalised knowledge market. This ‘market’ is critical to industrial and economic performance, and is one in which Australia under performs (Engelbrecht 1997). To run a knowledge current account deficit, so to speak, is therefore to have a knowledge gap. That is, there is a gap between Australia and the rest of the world in industrial and commercial know-how, which results in an unfavourable differential between what Australia can produce and sell compared to other industrialised nations.

I argue that some of the failures of industry and trade policy have their roots in a failure of both government and industry to sufficiently grasp the role of knowledge in economic activity. By simply seeing protectionism or trade liberalisation in terms of goods traded or balances of trade, we miss the essence of the problem. What we should be certain to bring to the centre of analysis are the flows and stocks of knowledge which are required to develop products, manufacture them, trade them and use them. Knowing how to develop and make products with sufficient market appeal, and knowing how to participate in knowledge transfer within industries and internationally are areas that need more policy attention.

In short, with a knowledge perspective an added dimension has emerged; trade can be viewed as involving knowledge transactions (or flows) as well as financial transactions.

¹ Stewart (1997) estimates that an aluminium beer can, for example, embodies scientific and engineering knowledge and that 25 percent of such a can’s market value is attributable to that knowledge. We are also able to estimate the value of marketing knowledge, business process knowledge etc. to a finished product. Therefore, it can be said that the aluminium can is to a considerable extent the embodiment of knowledge.

The point to be driven home here is that whatever Australia's industry and trade failures have been, they are not usefully seen only in terms of the relative freedom (or otherwise) of trade. These failures must also be seen as failures to learn; failures in bridging the knowledge gap. What I will clearly show is that in the period in question protectionism had many palpable benefits for Australia despite its problems. These benefits cannot simply be consigned to the dust bin because later generations failed to capitalise on them, or because inflexible and unrealistic neoliberal orthodoxies were unable to adequately perceive and account for knowledge concerns. After all, an economic reality in the twentieth century is the emergent knowledge economy; an economy where tangible economic artefacts like money and goods have become less relevant to analysis and the intangible artefacts of knowledge more relevant (Arthur 1996).

A New Nation

It was not surprising that a nation being exposed (or feeling it were) to the world on its own for the first time, would seek to buffer any shocks to its economic system by reducing the threat from outside. Import tariff barriers were the buffers of choice to both Australian music technology manufacturers and the federal government. It is important to keep in mind that these trade barriers formalised a realistic view of Australian manufactures at the time as primarily import replacers rather than as full participants in an international market as exporters. Concurrent with this outlook was the fostering of management practices which tended to remain, as they had in pre-federation Australia, focused on British management models rather than learning and adapting something of the new American models, to the long-term cost of Australians. As a consequence, the Australian industrial attitude was rather parochial and, therefore, not well engaged with the wider world. On the other hand, the feeling of security provided by tariff protection was an incentive to Australian musical instrument makers and wireless manufacturers to enter into, or continue in, their chosen lines of business with the knowledge that they had a reasonable chance of success without being swamped by large American, German and British manufacturers. Yet as I will show below, despite protectionism, from Federation until 1930, Australian music enthusiasts favoured foreign producers, particularly Germany and the United States, for the satisfaction of their demand for both traditional musical instruments and new technologies like the gramophone and wireless. The task of turning the focus of local consumers to local products was going to be both a necessary one, if Australian manufacturing was to grow, and a difficult one, because of trenchant prejudices against Australian products.

Using the 1903 Commonwealth Bureau of Census and Statistics trade figures to provide us with a snapshot of conditions, what can be seen is a heavy dependency on imports to satisfy local demand and a remarkable dependence on German music technology over American and British products (Figure 1).

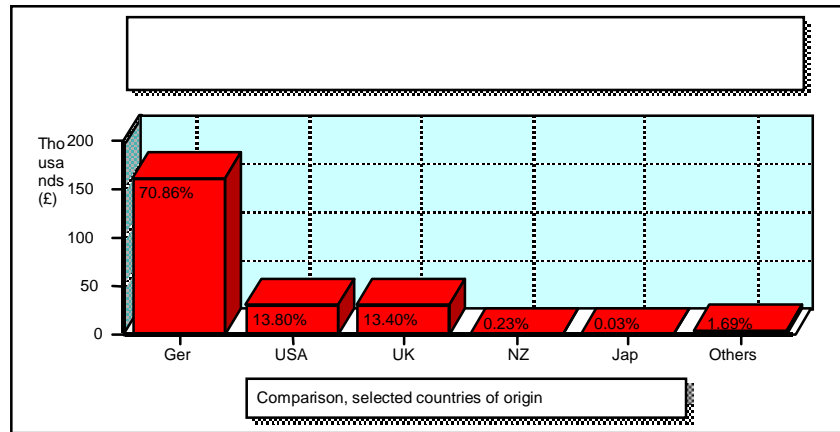


Figure 1. Imports: Musical instruments and parts, 1903

Source: Commonwealth Bureau of Census and Statistics, *Annual Statement of Trade of the Commonwealth of Australia, 1905*

In the medium term, the dependency on Germany was most notable, but in the long term it was the poor export performance by the local manufacturers that is important to note. The lack of exporting activity has been a feature of music technology manufacturing in Australia throughout this century and dramatically highlights the inward-looking nature of an industry which developed as an import replacer and not as an exporter. In 1903 the value of music technology imports was £228,000 compared to exports of only £95. This is an issue which Stewart (1991) has identified as a long-term problem in Australian industry policy, but which other small protectionist nations were able to overcome in the second half of this century. These nations have had protected industries and excellent export performances.

By 1921 the geo-political focus of Australian music technology trade had narrowed with Britain and the USA dominating imports (at the expense of Germany) and the export focus had further concentrated on New Zealand (Figures 2–5). Furthermore, the balance of trade was still worrying, with imports valued at £1.1 million and exports at a mere £22,500 of a total local production value of £555,000.

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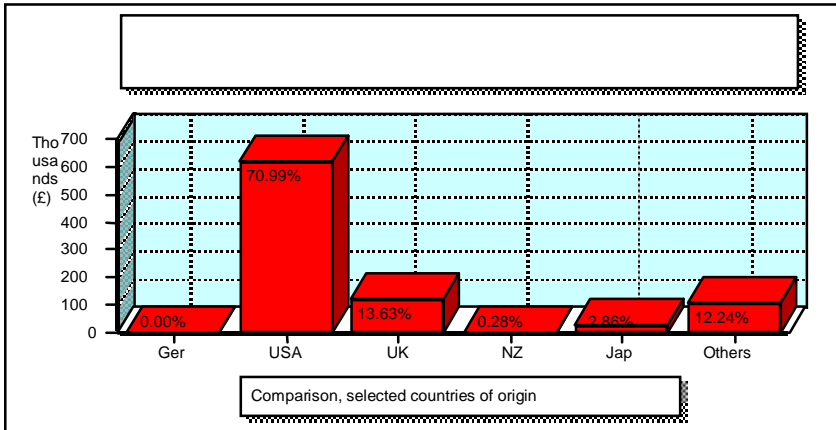


Figure 2. Imports: Musical instruments and parts, 1921

Source: Commonwealth Bureau of Census and Statistics, Overseas Trade Bulletins, 1921

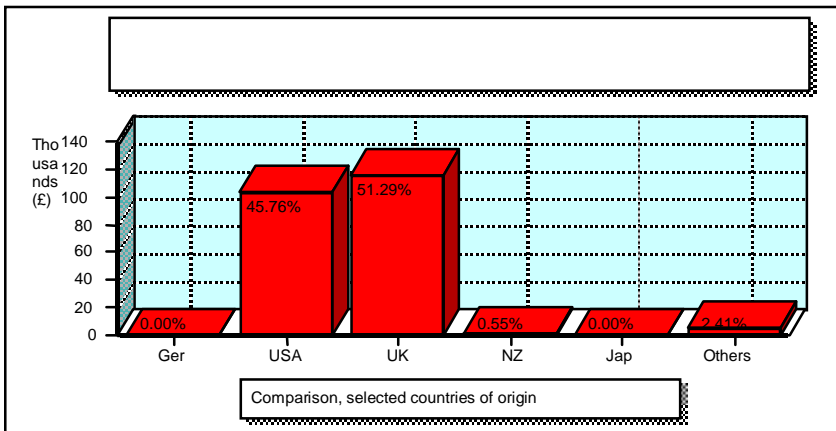


Figure 3. Imports: Gramophones and accessories, 1921

Source: Commonwealth Bureau of Census and Statistics, Overseas Trade Bulletins, 1921

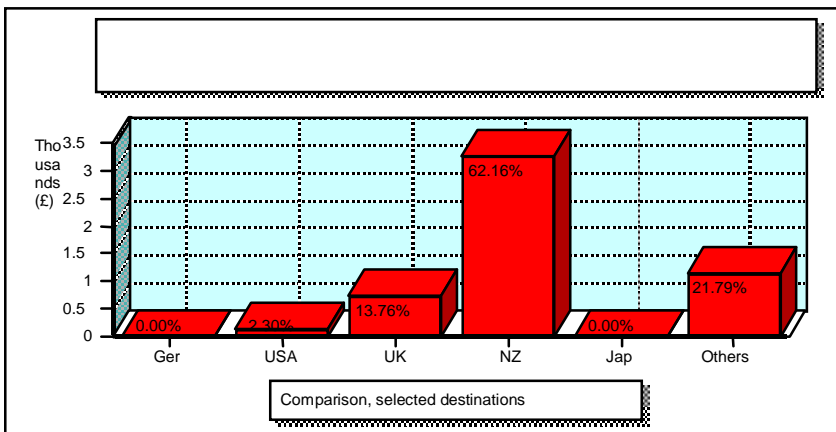


Figure 4. Exports: Musical instruments and parts, 1921

Source: Commonwealth Bureau of Census and Statistics, Overseas Trade Bulletins, 1921

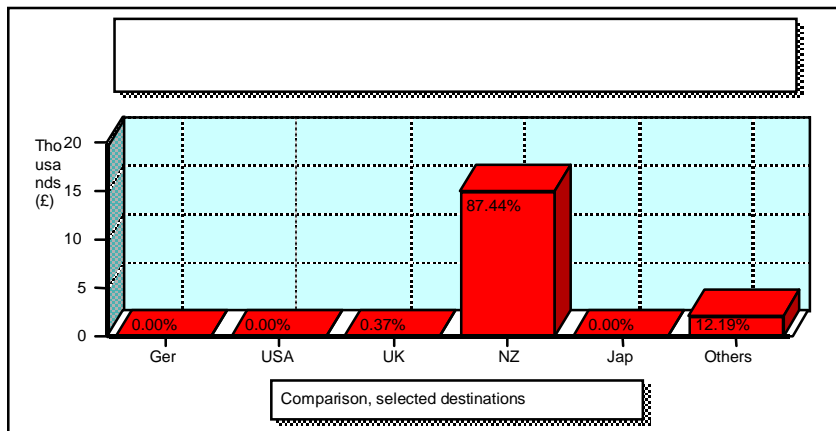


Figure 5. Exports, gramophone and accessories, 1921

Source: Commonwealth Bureau of Census and Statistics, Overseas Trade Bulletins, 1921

We can say, on the basis of data presented in Figures 1–5, that the capacity of domestic producers to act successfully as import replacers was limited, despite it being their main role. This situation meant that there was room for the industry to expand while still maintaining its import replacement role, because Australian manufacturers could only increase their relatively small share of the domestic market as protection levels increased. However, a question arises about the success of the policy of increasing market share through increased protection alone. Although a tariff increase in 1907 boosted import duties by an average of 33 percent (Anderson 1987), affording substantial protection, Australian manufacturers still had difficulty in attracting customers. Considering the high standards of manufacturing that were achieved in Australian musical instrument manufacturing at the time (Game 1976, 212), and the high level of protection, it seems that the most likely reason for this poor performance was a lack of marketing skill combined with consumer prejudice in favour of European, British and American music technology. An advertisement placed by Allan's in the *Age* 20 January 1913 suggests conservatism in retailing too. The advertisement announces that Allan's sells Bechstein, Lipp, Ecke, Feurich, Vincent and Thurmer pianos because; 'Every piano that we feature has a reputation of over 50 years behind it'. Allen's focus, as revealed through their advertising, was firmly set on European—but especially German—instrument makers and almost totally excluded Australian makers.

I conjecture that a form of cultural cringe was at work which helped musicians do the seemingly irrational thing of spurning perfectly good Australian instruments. This conjecture can be taken a step further by arguing that the attitude may have been overcome if local makers proved themselves in European markets. Such a step could have been an emphatic demonstration of the worth of Australian know-how in a market of highly knowledgeable consumers and changed the negative perceptions held by the local consumers. The national mythology may have admitted to clever bushmen and agriculturalists but was not ready to admit world-class and seemingly esoteric violin and piano makers in the unglamorous spaces of city factories without an emphatic display of their *bona fides*. I do not wish simply to suggest that a clever marketing ploy might have been used but rather that the encouragement of business to adopt an outward-looking

stance is a plausible, indeed necessary, policy consideration in a protectionist setting if we are focusing on knowledge instead of goods traded. What this implies is that the knowledge flow between Australian and the world, and between manufacturer and consumer is a complex and multidimensional process which operates below the level of simple financial measures and easy calls for free-trade.

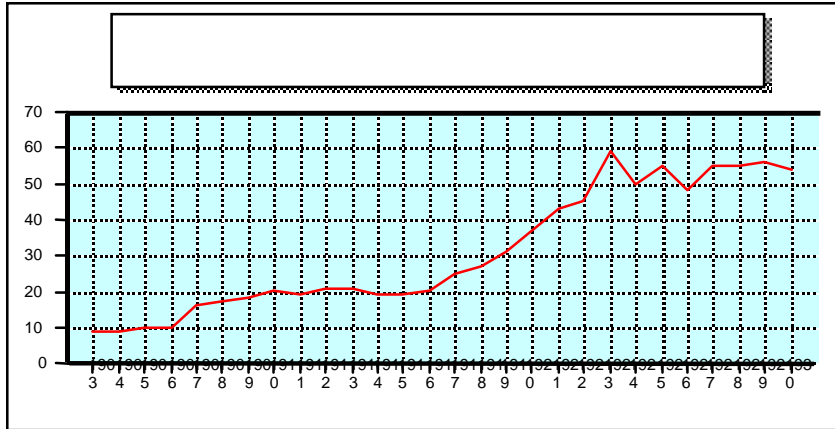


Figure 6. Number of Australian instrument factories, 1903–30

Source: Commonwealth Bureau of Census and Statistics, *Production Bulletins, 1903-1930*

Despite the prevailing attitudes of retailers and consumers the number of musical instrument manufacturers in Australia had increased from 9 in 1903 to 37 in 1920, which represents significant growth (Figure 6). Initially, the growth in factories was still not matched by a similarly healthy growth in their total production value. The total value of production in 1911 was just over £190,000 which averaged about £10,000 of production value per factory per annum, compared to a total of £385,223 in 1920 or about £10,400 per factory, a modest increase. By the early 1920s, the domestic market for music technology had greatly expanded and through the middle part of the decade, local manufacturers made progress in gaining market share. The number of local factories averaged 52 through the 1920s with an average output per factory of around £19,200 per year, an 85 percent increase on the 1920 average. This increase was, however, probably more attributable to shipping restrictions (which limited the amount of imports that could be received—an unplanned trade barrier) after the first world war and to tariff increases mid-decade than better marketing or other skills (Forster 1964, 3–4; Johnston et al 1995, 228).

Figure 6 about here

Protectionism, although creating jobs for instrument makers in the new factories and, indeed, encouraging factories to be set up, did not necessarily encourage significant increases either in productivity or in marketing finesse because manufacturers were insulated from what Stewart (1991) sees as the positive effects of international competition and a concomitant outward-looking industrial posture (Rooney and Mandeville 1998). Stewart’s argument *is that* the benefits of learning about international management skills, production process benchmarks, consumer tastes, technological change and so on *can only be acquired* by engaging in international trade. **[I’m not sure I follow: you’ve given a list of measures to be learnt, but is that an ‘argument’? or**

maybe my problem is with the word ‘restated’??] Therefore, Australia’s protectionist policies were only partially effective while serious limitations were placed on the capacity to learn about and develop sophisticated manufacturing processes or industrial research and development programs, which would help minimise their manufacturing and business process costs, and improve their ability to develop new products with which to service changes in demand. These are important points because, for example, high labour costs are often cited as an impediment to Australia’s poor international competitiveness. Likewise, the argument that manufacturing was a relatively minor contributor to wealth creation and employment in Australia during the pre-war years, a *situation* [?result?] which has been attributed to its low productivity, has also been frequently put forward (White 1992; Forster 1970). The logical analysis of these points is not only that labour cost and domestic market size barriers existed but more importantly that management deficiencies, or rather, management and industrial knowledge deficiencies were central problems.

A major reason for the critical place of management and industrial knowledge deficiencies is that there were two general competitive strategies music technology manufacturers could adopt: 1) competition based on price which emphasises cost-cutting and low price; or 2) competition using the non-price attributes of products such as better quality, more functionality and more user-friendliness. Australian manufacturers were confounded by a paradox; they were unable to engage in price-based competition and unable to engage in non-price competition. The cause was to be found in a lack of appropriate knowledge to do either.

To begin examining this paradox it is useful to begin in 1906. 1906 saw the introduction of the *Industry Preservation Act*, the product of lobbying by the busy and successful protectionist movement in Australian industry. Instrument manufacturers were active in the lobbying to increase import duties as a way of protecting the local instrument making industry. As I have already shown, Australian instrument manufacturers were struggling to compete with imported instruments (after two decades of increasing protection). A letter from organ manufacturer, Fincham’s, to the Royal Commission into import tariffs in 1906 illustrates the position that local industry took on the issue of tariffs and an enduring deficiency in the vision of the industrial process:

We beg to point out the injury being done to the industry of organ building in the Commonwealth. In the states of Victoria and New South Wales alone the industry has suffered during the past two years to the extent of more than £10,000. The tariff as at present practically admits all [organ] parts free. All parts can be made in the Commonwealth, and when made will stand our climate better than the imported article. During the forty-five years our business has been established we have not found it necessary to import other than raw material. In view of the recent developments the industry will be ruined unless full protection is granted for all parts without exception (Matthews 1969, 102).

This argument helped persuade the Royal Commission of the value of import tariffs to protect the local industry, which in turn led to the 1907 tariff increase. What is also important is Fincham’s recognition of the threat to the ability to make parts; or what was only implied, the ability to retain the knowledge to do it. Sustaining the ability and skill to make these products, and others, might have been more comprehensively contextualised than simply a tariff concern though. If the manufacturer has such superior

technical skills, or know-how, it may be equally beneficial to learn how to make the same parts more cost effectively and to make quality part of the marketing of Australian-made products. But no indication is given about how Fincham's or their local competitors were going to act in these regards to prevent their further injury and ruin. Fincham's argument, as stated above, has no other dimension than tariffs. This point leads us to confront the underlying and uncriticised assumption in Australia's trade and industry policy, based on tariff protection, that competition is mostly based on price. But non-price competition is equally valid and rather too easily swept aside with such a one-dimensional policy approach. Non-price competitiveness cannot be achieved with protectionism unless protection is only part of a larger strategy.

A fundamental problem for Australian manufacturing was the modelling of Australian industry and technology development on British practices (Hill 1988; Moyal 1986). Hill has argued that the British commitment to iron technology and steam power meant that Britain did not move quickly enough to adopt electric power for its industries, and this put it at a disadvantage compared to American manufacturers who were in the vanguard of electric technology. This situation was significant for Australia not only because Australian industry had also failed sufficiently to see the advantages of electricity, but because the models for engineering education in Australia were British too (White 1992, 249). Australia did not have the intellectual resources (technical and scientific knowledge) to make the change when it became apparent that Australia was at a disadvantage and there was no significant policy push for the required changes. Once again, a knowledge-related failure emerges. A knowledge framework was needed that could pull the various branches of policy-making together and deal with acquiring knowledge from external sources, nationally and for individual Australians (Rooney and Mandeville 1998).

Furthermore, as American businesses grew through mergers and acquisitions to develop control over markets and prices (a strategy used to avoid prosecution under the *Sherman Anti Trust Act* for forming cartels), they also discovered increasing returns to scale. In Britain on the other hand, the concern was for marginal economics and small family-based businesses and so increasing returns to scale were not found (Ormerod 1994, 52–6). The American's ability to develop increasing returns to scale from 1919 was also dependent on the coordination of finance and investment in manufacturing by the government under the direction of President Wilson. Wilson saw that a strong national radio corporation was vital to America's economic objectives but what was more important from about this triad of government, finance and manufacturing (apart from the fact that it challenges the myth of *laissez-faire* government in America) was the process in which they learnt to work together (Sobel 1986, 26). They were able to learn what each needed and did not need from each other. This level of coordination and knowledge creation was missing in the British industrial model. Therefore, as Britain lost its position in the industrialised world—although it still had great industrial capacity; Australia was fated to follow suit, but from a lower starting point, unless it could adopt more appropriate models. These fundamental weaknesses in Australia's capacity to manufacture and utilise technological know-how necessarily put Australian music technology manufacturers at a disadvantage. Nobody seemed to ask the question: 'what can we learn from the American successes that will help us bridge the knowledge gap?' Indeed, it is as if no knowledge gap existed.

One Bridge Across the Knowledge Gap

By the 1920s electricity was important in new music technology. Radio broadcasting and electric gramophone recordings were beginning to change music technology manufacturing. It is necessary to appreciate some of the commercial implications of radio and gramophone. Between 1920 and 1921, radio receiver sales in America rose from zero to annual sales of \$12.2 million; by 1926 they had reached \$206.7 million. In addition, by 1920 gramophone sales were at \$105 million a year, indicating that at least in America gramophones were still a good business to be in (Sobel 1986, 49; Lubar 1993, 174). Clearly, the commercial potential for the new technologies in Australia was good too. In 1913 Amalgamated Wireless Australasia (AWA) was set up, with a board of directors made up of equal numbers of federal government officials and representatives of commercial interests. Similarly, Standard Telephones and Cables (Australasia) (STC) opened for business and sought to capitalise on the potential of the electrical goods industry in Australia (Potts 1989, 15; Muscio 1984, 231–2). The productive capacity of AWA was protected by the acquisition of a bundle of patent licences from Marconi and Telefunken who were major investors in AWA. The vitality of the Australian electrical goods manufacturing industry in the 1920s was such that virtually every piece of broadcasting equipment could be designed and manufactured in Australia—mostly by AWA, a manufacturer which showed a commitment to research and development, even if it was only a modest commitment by American standards. Geeves (1993, 7 and 51) notes that AWA had set up the Marconi School of Wireless to train technical staff and in the 1920s had successfully conducted collaborative research programs with government and other commercial partners. When Brisbane's 4QG was built by AWA in the early 1920s, all but about £1,000 of the construction budget of £33,552 was spent in Australia (Walker 1973, 4; Benson 1990, 20) and the 1928 Tariff Board estimates showed that Australian radio manufacturers had a 60 percent share of the domestic market (Forster 1964, 110). The benefits of government intervention and coordination with industry are clearly demonstrated here even if such outcomes have not normally been the result of Australian industry policy. It is also clear that the importation of the tacit knowledge of the Marconi and Telefunken representatives on AWA's board and the codified knowledge of the Marconi and Telefunken patents, and education along with their training programs were critical to the success of AWA in its early years.

What is more interesting than cataloguing these details is the broader contextual framework in which AWA had been placed. It was a multidimensional framework which saw protection as more than just tariffs and shutting out foreign competitors. Indeed, special concern was shown for the radio technology patents held by AWA beyond the fact that they had been acquired from Europe. A Royal Commission was set up in 1926 to investigate AWA's patent monopoly—a quasi knowledge monopoly—and its restraint on free-trade. The Royal Commission, in the final analysis, had little effect on AWA which maintained its patent monopolies and was able to negotiate with the government to receive 3s per year from each listener's licence as a patent royalty, but agreed to waive the royalty claims on valve receivers for five years (Geeves 1993, 53). However, because copyright and patent laws are about creating monopolies, it is important that the AWA investigation raised the complicated issue of the inherent conflict between the benefits of

patent monopolies and free-trade. The spotlighting of the patent conflict showed the benefits of close ties between government and industry, and the development of more sophisticated attitudes to intellectual property which AWA's European investors had. More importantly though, it showed that the negative effects of protection could be overcome if international knowledge transfers, or knowledge transactions, were encouraged. In other words, protectionism did not have to mean isolationism and neither did its weaknesses demand inflexible advocacy of a utopian vision of free-trade.

When One Bridge Is Not Enough

But such a combination of sophistication and success was rare in Australia. In 1926 George Taylor, president of the Association for the Development of Wireless in Australia, New Zealand and Fiji, argued at the Commonwealth Radio Conference for the establishment of the AWA Royal Commission saying that 'Australia which has led the world in some of the primal discoveries of radio, was one of the most backward nations in the use of radio [patents]' (Geeves 1993, 46). If Australians were capable of ground-breaking industrial research and development, then it was sensible to capitalise on it through the execution of patent rights. But were most Australian manufacturers really able to compete with the new, more sophisticated, or knowledge intensive, products coming from overseas?

With foreign companies like Philips and STC ready to contest AWA's position in the Australian market, the legitimate use of intellectual property law to foster Australian industry needed to be integrated into the Australian music industry as a rational extension of existing protectionist regimes. Moreover, a broader application of the mix of intellectual property monopolies, aligned with tariffs, favourable exchange rates and import quotas, along with a concern for the acquisition and application of other knowledge should have been central elements to industry and trade policy-making much earlier. This is so because it may have helped stimulate more concern and capacity for the generation of commercially valuable patents in Australia while radio technology and markets were still immature.

It is worth keeping in mind that for Australian high-technology manufacturers in the 1990s the problem is that they are frozen out of international and local markets dominated by the likes of Microsoft, Philips and Sony. Arthur (1996), and Pandit, Swann and Watts (1997), among others, argue that a technology life-cycle exists and that for a firm to stand a good chance of rising to prominence in a particular product's market, it is best to enter while the technology and market are still immature. Indeed, the lack of this patent-generating ability early in the cycle has been a major obstacle to music technology manufacturing in Australia since the end of the second world war. The 1920s was the critical time for Australia to enter the technological arena from which the contemporary consumer electronics industry emerged. AWA certainly made their entry but the push was not sustainable on a national level because of a lack of knowledge including a general lack of intellectual capital in the form of, for example, engineers and educational capacity, intellectual property, and global market intelligence. More importantly, the capacity was lacking to create knowledge, which could keep the Australian industry moving forward at a pace that would guarantee leading-edge products and businesses, and to absorb technological advances made overseas. Again, a multidimensional

approach to the knowledge problem was missing and that was the root cause of the unsustainability.

Only a Mirage

As noted, tariff increases in the mid-1920s were contributing to strong growth in the value of Australian production of music technology and the lack of shipping meant that more goods had to be manufactured in Australia. In addition, White (1992, 235) has argued that in the 1920s the ratio of population size and average income allowed many Australian consumer goods manufacturers to go 'beyond the minimum threshold of efficient technology and therefore [achieve] significant factor-productivity increases', thus making possible increased economies of scale, and some form of mass production and, therefore, mass marketing in the domestic market.

In this climate the total value of production from the local music technology factories peaked at about £1.5 million per annum in 1927 (more than double the average output per factory in 1911), and began to fall leading into the Depression. It looked at face value, the Depression notwithstanding, as if the local manufacturers had made some significant gains. Although a welcome situation, which was attributable to the benefits of protection, it would ultimately prove unsustainable without a recognition of the unimproved knowledge deficiency.

Gains by local manufacturers look even less impressive when it is recognised that imports of music technology rose sharply after 1922, which indicates a sharp rise in demand, consistent with or greater than the rise in imports across the whole economy and the rise in local instrument production at the same time. The demand for upright pianos more than doubled in 1924 compared to a year earlier and so did demand for player pianos. Although demand continued to be strong for most of the next five years, it was demand for wireless, gramophones and records that sustained the most consistent growth during the whole of the 1920s, especially from 1926 to 1930, after which demand fell off. In 1921 gramophones made up 20 percent of imports but by 1931 had risen to 23 percent which along with wireless (52%) collectively took 75 percent of music technology imports. This could be seen, in part, as a response to the improved sound quality achieved by the electric recording process, which meant that electric technology could begin to compete with traditional instruments in terms of sound fidelity. *Yes, I have cut the sentence [tech imprv that produced better qual prod. were in prod. based on > kn. than less successful prod.: I don't follow, nearly goes full circle? esp. after the previous sentence, which pinpoints why the quality improved, this sentence seems unnec.; suggest delete]* But in the long-term the Australian music technology manufacturing industry would be unable to transfer enough of its capacity from the traditional (mechanical) instruments to the new electric ones, which were embedded with new forms of knowledge. The gains made in the 1920s were a mirage because the intellectual foundations which were needed to underpin continued development were missing. Before returning to this important point, I would like to briefly address some additional issues relating to consumers.

Consumer credit, or hire purchase, was an important stimulant to demand for music technology when it became common in the 1920s. The *Sydney Morning Herald* in 1927 clearly captured its significance:

Of late there has been tremendous growth in...the time-payment system of buying... Today the operations of the system are not confined to any one class or section of the people, they are widespread. It is no longer popularly regarded as pernicious; few are ashamed to admit that they take advantage of the facilities it offers;... and the great proportion of the purchases made by its means are not clothing, nor furniture, nor general household goods, but motor cars, player pianos, wireless sets, electric carpet sweepers, and jewellery (Forster 1964, 9).

Credit facilities, which had been available to middle-class Australians for some time, were now more widely available and that boosted spending. Indeed, between 1920 and 1927 personal consumption in Australia increased by 75 percent (Shergold 1987, 226). Money was easier to spend, and could be spent before it was earned, and a growing array of attractive consumer goods was available for purchase. This unleashing of consumer spending can be seen as empowering consumers as a group, even if it was ultimately a financial disaster for some individual debtors. Lack-lustre manufacturers and their lack-lustre products could not maintain the attention of empowered customers eager for 'better and brighter' things. In the 1920s, Australian consumers were more than ready to begin learning the patterns of global consumerism characteristic of the post-World War II era, but local manufacturers appeared not to be ready to learn with them.

Some companies involved in the manufacture of instruments in Australia were prepared to diversify, building pianos, gramophones and wireless sets for example. However, not all of these diversifications were successful. For example, the World Record Company (WoCord), the first Australian company to record, press and retail its own records, began operations in Brighton, Victoria in 1925. They produced shellac on cardboard acoustic records, gramophones, wireless sets and had their own radio station, 3PB. Unfortunately, WoCord closed in 1926 (Bisset 1979, 30).

Tellingly, there were at least six record companies operating in Australia during the 1920s. Four of them—HMV, The Gramophone Company, Columbia and Parlophone—were British; and one—D. Davis and Co.—was American (Bisset 1979, 30; Murray 1978, 182). As if to further underline the preparedness of foreign companies to exploit Australian markets, in 1926 HMV opened a recording studio in Sydney (Murray 1978, 182). These foreign companies were ready and able to take advantage of the arrival of electric recordings in Australia and to fund the beginnings of the Australian recording industry as the technology became too expensive and sophisticated for small entrepreneurs to easily enter the industry. The new exciting products, which were clearly most in demand by the newly empowered consumers, looked like being supplied by foreign manufacturers. This is made more important because some of these products, namely radio and records, were destined to become central to popular cultures which would exert a strong hold over what many people would spend their incomes on.

WoCord can be seen as an early indicator of the troubles which would increasingly hamper Australian music technology manufacturers as the levels of sophistication of products and manufacturing techniques increased. Perhaps WoCord's attempt to enter the increasingly complex music industry was scuttled by its dependence on the soon-to-be

superseded acoustic recording process and through an inability to re-equip for the electrical process. The increase in technical sophistication of products indicates that the levels of knowledge which underpin their development and production had also increased. This growth in the levels of knowledge intensiveness in foreign industry was not being matched by Australian producers and the knowledge gap widened significantly. The chance to grow with a still relatively immature industry was being squandered by this industrial and policy stance.

Such was the expansion of knowledge dependence in the music industry (in a little more than a decade) that backroom recordings like those done in the 1910s at Allan's were no longer possible in a commercial sense. Allan's illustrates the simplicity of the acoustic recording process relative to electric recording. When Allan's ran out of a particular record they would send one of their staff, who was a good singer, to a backroom to record the song with piano accompaniment performed by another member of the staff onto a blank wax cylinder, while the customer waited: 'The results achieved, while most satisfactory at the time, were ludicrous in comparison with modern electric recording', according to a former employee, George Sutherland (Game 1976, 143). But the Australian capacity for industrial learning was not able to progress quickly from this relatively unsophisticated music technology and industrial or business process at the time when electric recording and radio were beginning to move into large-scale industrialisation with its increasing returns to scale, mass production and so on. New technology did not just embody new technical knowledge but also organisational or managerial knowledge. Organisational and technical knowledge were evolving together, making the task of keeping up with global trends even more difficult, and the need for a multidimensional knowledge policy perspective to assist essential.

Conclusion

I have shown that the development of what were to become chronic problems in the Australian music technology manufacturing industry, such as poor marketing skills, an inability to produce sophisticated products and lack of appropriate engineering know-how, were all manifest during the early decades of the century. Although some of these weaknesses appear to have been overcome to some degree in the 1920s, the high levels of protection masked them. In reality, there was still a gap developing between that which Australian manufacturers of music technology could do, or wanted to do, and that which was state-of-the-art and which some of Australia's major competitors were able to do. This gap, though, was not a trade gap, or a technology gap, but a knowledge gap. A general failure to take measures not to impede knowledge transfers and knowledge creation—which could have negated the undesirable effects of protection while not diminishing most of the positive effects—by giving manufacturers the knowledge to lower manufacturing cost, improve quality and better meet consumer demand is the essence of the problem.

Adopting a goods traded view of local industry problems masks the underlying reality of what is moving between nations: knowledge. Knowledge is the essence of manufactured goods. Every good embodies knowledge—the knowledge needed to design, develop, manufacture and sell it. Furthermore, the more sophisticated the good the more knowledge can be assumed to be embedded in it. Australia's problems were and are to do

with knowledge transfer, knowledge creation, and industrial and commercial know-how—intellectual trade barriers. To be effective for the long-term health of the Australian economy, industry, technology and trade policy had to address the knowledge gap which was already growing in the first three decades of this century. It did not and still has not done this properly, and the price to be paid for a continuing failure in this regard will continue to grow.

It can be concluded that protection was partially successful during the period of this study. There was consistent growth in the number of manufacturers entering the music technology business, the average revenue earning capability of manufacturers gradually increased and at least some manufacturers were able to lay claim to being at or near the technical proficiency of imported music technology. The problems were clear too. Lack of penetration into local markets, lack of export activity, a general inability (with the exception of AWA) to generate commercially successful patents, high production costs, a narrow geo-political international trade focus, failure to embrace non-price-based competition, and slowness to move from mechanical to electric music recording were all identified. However, responding to these undesirable circumstances by narrowly focusing on the manipulation of tariff barriers was an inadequate and partial measure. This is not to suggest that the opposite of protectionism, a free-trade utopia, was the solution. Instead, the negative effects of protection could be overcome if international knowledge transfers were encouraged. The flaws were not in protection but in only treating the symptoms of the central problem, which was one of knowledge rather than commerce.

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