R&D Incentives and their Economic Outcomes in the Australian Context

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ABSTRACT *Research and development (R&D) is presented not as a primary source of local economic activity but as secondary to fundamental factors influencing corporate survival in small economies. The increasing difficulties of demonstrating causality between levels of Industrial R&D (IRD) expenditure and local economic activity are discussed. It is argued that industry specific, selective support schemes are more likely than generic tax concessions to be effective in periods of rapid trans-national restructuring. Such support appears of limited value unless aligned with a broader policy to assist local enterprises to adapt to competitive forces.*

Keywords: R&D Incentives, Industry R&D, Globalisation, National Identity, Product Innovation, Venture Capital, Australia.

Introduction

Within Australia, during the last two Labour governments, government support schemes for IRD were centred around a generic scheme—150% corporate tax deductibility for approved expenditure—and selective schemes including project specific grants and tax loss funded syndications.

The effectiveness of the government IRD support programs has in each case been subjected to review. Objectivity in evaluation is made difficult, since review design and assessment is undertaken in a political environment of continuous lobbying for funds by researchers, tax concessions by industry and special help for inventors and new business creators. The syndication scheme performed excellently in the eyes of two of its beneficiaries; it gave value to corporate tax losses and it enabled researchers to continue their work. Its creative effect on new products or manufacturing processes of national economic value is moot. Broad reviews have been requested from time to time by government, of which the Industry Commission review of 1996[1] was the most recent example. This paper does not seek to criticise the conclusions of any of those reviews or reports, but attempts to stimulate discussion into the evolving economic, social and commercial environment which may diminish their relevance to national economic development. It challenges the fixture relevance of the criteria against which measurement has historically been made, in the light of the rapid changes in the structure of global industries and of declining national influence over their evolution. The main assumptions as to the mechanisms by which enterprises convert intellectual capital to profit, and hence to survival, have been subject to significant change since the decisions were made to create the existing programs.

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Some alternative, but more complex, models are proposed which put IRD support in a context of achieving outcomes for improving enterprise wealth creation but in which access to product and process design are not the primary critical constraints.

The main drivers that now influence the causality relationship of national economic benefit and locally derived technology are postulated as:

- The changing relative importance of product innovation in corporate creation and survival strategies.
- The 'Winner takes All structural characteristic of technology based industries. The globalisation of the development, manufacturing and marketing functions. The scale economies of manufacture favouring high capital: low labour investments in logistically favourable locations.
- The global nature of scientific research exchange and of technological dissemination.
- The benefits to speedy and relevant product innovation that come from the proximity of markets and development activity.
- The freeing up of global capital flows leading to the decoupling of country risk in the benchmarking of available equity returns.
- The changes in corporate process and business methodology, accelerated by a self reinforcing uncertainty in business environment, which have a short time constant as compared with the government support program design and implementation process.

The dominant underlying forces are those of globalisation—ownership and deployment of corporate assets and the unifying of consumer buying preferences.

Product Innovation in Corporate Creation and Survival Strategies

The assumption appears to have been made that product innovation or even technology research is a driver of a wealth creation process and this is an important component of the argument from researchers in favour of support. The contemporary behaviour of technology based business enterprises suggests otherwise. Product innovation appears to be an enabler for only certain types of enterprise and even within them, it requires a number of other competencies and positioning criteria to be present to create a sustainable outcome. The measurement of the effect of R&D alone in such a complex system is difficult and may not be separable from the effects of other (and in many cases, dominant) factors.

In the case of business start ups driven by a technological advance, the determining risk component is that of market capture. In interviews with US based co-investors negotiating such investment decisions, the author experiences the question 'How do you intend to occupy the space?' as the dominant discussion focus. The space refers to the time and space window in the market which might be occupied by the business exploiting the technological opportunity. The assumption that the technology will work is quickly substantiated, as are the financial implications of a business development strategy. In the industries which are the heartland of US venture capital—Information Technology (IT) and Medical Products, the issues are similar. How may product and operational forces be marshalled to capture the market window, before competitors occupy the space and what alliances are needed to provide the control to hold the niche open?

This component of the business creation cycle holds the most risk of failure through interference by external and uncontrolled factors. It also, because of the costs of creating a brand and product awareness, tends to demand funds dwarfing those used in the R&D process, which then determine the rate of return for the risk capital.[2] The market

analyses submitted in these industries typically show the USA providing 50–60% of the world market. The market capture process invariably depends primarily on a USA presence. The alliances of leading edge customers, Original Equipment Manufacturer (OEM) customers and technological platform definers depend on a shrinking number of major market players. For example, there are four US, one UK and one Swiss based pharmaceutical companies who largely control market access for products into the Organization for Economic Cooperation and Development (OECD) health care systems. Similarly with telecommunication innovations, the major US and European carriers determine the viability of any new technology platform and its associated supply structure. This skews the odds of success for a technology start up heavily in favour of those located in or near to the US. The outcome of commercial success is also more easily recognised in the US, as its equity markets recognise the future cash flow potential of a captured technology market space and respond with high valuations.

Within Australia, the proportion of corporate funded R&D within Gross Expenditure on R&D (GERD) has been rising over the last 5 years—for which a variety of causes may be postulated. A reduction in government R&D spending skews the ratio. Tax concessions based on volume of R&D undertaken may cause an increase in economically useful R&D, but they certainly encourage an increase in the reported level of R&D. A compelling argument is that companies only spend discretionary cash flows when they need to, i.e. when they might result in a consistent improvement in return to shareholders. Most Australian manufacturing industry, supported by protectionism policy, existed to supply Australian needs only. It was more cost effective and involved lower risk for them to use product design and process technology already proven in larger markets overseas. The best management practice was to avoid spending on R&D and concentrate on the constraints on manufacturing efficiency, inherent in low volumes of production. Now that protection, regulatory and logistic, is disappearing for many manufacturing enterprises, alternative strategies are more appropriate. Some businesses are abandoning manufacturing at the component level and are marketing imported products made with more efficient scales of production elsewhere or are limiting added value to final product customisation.

Other manufacturers have concluded that their best strategy lies in becoming a sustainable product supplier against global competition. They are then choosing to undertake product innovation as an intrinsic and critical part of corporate strategy. They are not so much encouraged to do economically marginal R&D through tax incentives as to use the incentive to ease the pain on working capital and shareholders during the transition to global competitor and subsequent growth phases. It can be argued that their R&D expenditure is driven by commercial survival considerations and not by government incentive.

A typical example of the two behaviour patterns can be seen in the Australian white goods market. Email, who efficiently manufactured whitegoods under licence, are now being challenged by Fisher and Peykel, who have adopted a product innovation market penetration strategy.[3] It is arguable that this was the only way Fisher and Peykel as a small newcomer could capture market share and so they had a commitment to R&D in New Zealand only loosely coupled to government encouragement.

Some have decided that the global competitive battle cannot be won from their existing business position. Thus operations, such as Pacific Foods are being sold to global corporations that already have the advantages of brand ownership and distribution. Such firms may well choose to increase the amount of IRD they do in Australia to increase the sophistication of products moving to more complex and demanding markets. Capturing that activity locally may contribute to the enhancement of local product value.

Influence by tax incentives is likely to be marginal. Encouraging the use of local IRD competencies calls for a combined demonstration of the benefits both by government, with specific targeted incentives, and by IRD organisations, with the recognised and commercially relevant competencies.

'Winner takes All'

Management theory in the early 1980s[4] contrasted the risks and benefits of first mover positioning and early and powerful followers. Contemporary observation suggests that the odds have moved heavily in favour of first, fast and powerful movers.[5]

A 'winner takes all' environment is flourishing in global technological innovation. This is a situation which did not exist 20 years ago when IBM, Apple, Lotus and Microsoft could arm wrestle for market share. The microeconomic forces driving this have become apparent as the economies from multiple sales of the same technology have demonstrated positive feedback effects As an example, the computer networking industry illustrates clearly a simple causal relationship between IRD and economic benefit, albeit accruing to a very few enterprises. The industry, US based, became delineated in the early 1980s as a number of venture-capital start-ups emerged, to meet the needs of PC based networking. As these businesses commenced, some 90% of their capital and early revenues were spent on R&D.[7] Those that captured markets early, such as Cisco Inc. could sustain their product innovation while reducing the percentage of overall costs spent on it to a level which balanced market prices for their products with an acceptable shareholder's return. This is an industry where technology and customer needs are moving fast in parallel with falling technology costs, some of them highly volume sensitive. The outcome is few survivors, arguably three and all US based, who now have multi-billion-dollar annual sales. Cisco now need only spend 10% of sales on R&D and with US$400 million per annum to spend, can manage the continuous regeneration of its product range and a significant expansion capacity.[7] Technology spawned the corporate vehicles, but positive feedback created the economic growth and determined who was the beneficiary. These effects may be summarised as follows:

- The US, representing an homogenous 60% of world markets, offered the easiest opportunity for growth of sales and disadvantaged competitors from other countries only able to address smaller local segments.
- Growing sales allowed growth in IRD, widening product range and so accelerating sales growth.
- Early movers established a technology platform and de facto industry standards with high switching costs, which disadvantaged small or late innovators.
- Volume related component and manufacturing costs were reflected in control of market pricing, reducing profit for smaller competitors.

It would not, therefore, have been likely that government IRD support in other countries than the US would have produced a viable competitor and this has been evidenced by the rapid demise or absorption of both the smaller US and the offshore industry participants.

In trying to model this form of industry evolution (which in 15 years only represents 2–3 investment cycles and 3–4 governments), a new approach is advocated, to separate the kick start effect of the IRD from the accelerative and competitive destruction effects of other inputs. Contemporary analysis of business proposals indicates that the time window during which the positive feedback factors must be invoked, is shortening generally. In some extreme cases such as Internet based sales modalities, the window is

reduced to months. It is a challenge for government policy formulators to recognise and influence such trends, and one which may be beyond the response times of their processes and organisation.

The Globalisation of the Development, Manufacturing and Marketing Functions

Historically, when markets were closely related to ethnic or cultural buying patterns, they were generally also congruent with national identity. This association was reinforced in cases where isolation was caused by communications and transport limitations. With these limitations, products were designed, built and sold in the same community and included culturally relevant characteristics. Tariffs and other forms of protection were used to prevent the import of products of low differentiation, such as commodities, interfering with the national self sufficiency that was engendered. Local preferences, and design input to tailor products to influence those preferences were therefore relevant to both R&D and marketing executives.

This century has seen falling costs and an increased capacity for both for transporting goods and communicating information. The trends continue and in the case of communications the trend is accelerating. Global brands emerged but were slow to take hold until the 1970s. As a result, the protective mechanism of local market preferences is increasingly being eroded.[8] Few counter pressures exist—language and cultural protection, technical standards, innate conservatism, differentiated standards of living are all becoming weaker as forces for local market protection. Differences engendered by climate or geography remain, but many product designers prefer to design to meet worst case environmental conditions and trade off the costs against volume economies.

The communications revolution still underway enables brands to be created and maintained by entering global markets at the earliest opportunity. Advertising media as varied as television, video, print, sports spectaculars and now the Internet all provide marketing weapons available to attempt to over-ride local preferences with the desirability of a global product. The motor car industry recognised this more than a decade ago and is the provider of the second largest consumer asset, after housing (which is by its nature, local). However, early attempts by General Motors, for example, to develop a world car were unsuccessful. Today such developments are standard industry practice. Only a thin disguise is needed on a Holden to incorporate General Motors' US engine designs and General Motors' Opel German body designs—and to claim an Australian identity.[9]

Products which, as new concepts, have appeared since the mid 1970s have, on launch, been able to establish global positioning as they had no local preferences to displace. Examples include the Walkman, fax machines, personal computers and all their peripherals, pharmaceuticals, VCRs Video Cameras, and SLR cameras. As a result, it is increasingly difficult for start-ups to compete effectively with firms which have access to global marketing and distribution systems. This forces technology driven start-ups, described by McKinsey and Company as 'Born Global',[10] to be immediately immersed in the risk/reward constraints of creating such a distribution resource or forming an alliance. Both approaches bring risk considerations which are large compared with most commercially accepted levels of technology risk, and dilute the linkage between IRD input and commercial outcome.

Electronic commerce (E-commerce), has the ability to deliver a sales message through the telephone, television and Internet and may make the geographical positioning of much of the marketing and sales process irrelevant. It may even be to the advantage of some product and service providers operating out of small, remote countries. But it may

also be strongly to their disadvantage, because when the search-light probing new incremental sales beams from the US or Europe on to small markets like Australia's, they can be satisfied on an incremental cost and marginal pricing basis.

The geographical location of enterprise activities is also shifting and the proximity of IRD activity to markets may be more important (an industry specific factor) than proximity to manufacture or component sourcing. Other factors, unrelated to IRD may dominate the choice of where to perform it—labour and capital costs, transport, communications and supply logistics, cost of infrastructure, and availability of management cadres, for example.

In modelling the potential effects of IRD policy, the complex motivational matrix that affinity groups engender need also to be acknowledged. Within each of those affinity groups nationality, industrial enterprise, scientific disciplines, ethnic and community groups there is a measure of power over members as a consequence of their membership. Such affinity groups also have an element of influence over their external environment. In earlier models made for simpler times, the government's group power extended strongly to all of those industrial and commercial enterprises within its national borders. That is no longer true and is consistently trending to lower levels of relevance. Decisions about the deployment of wealth creating activities now lie largely in the hands of corporate power brokers and not those of government. Government can no longer direct, it can only encourage and foster.

Japan at one extreme on a scale, has had a high level of differentiation as a nation and an internal congruence between national, ethnic and language affinity groups. This has helped to maintain local buying preferences, which in a market of 100 million, has facilitated a local, protected economic self sufficiency in consumer products. Japan's history as a successful builder on scale economies to capture global markets is well demonstrated by its global brand identities. Intriguingly, these identities did not spread by imposing Japanese consumer tastes on their export markets. By contrast the US, particularly in technology and associated culture-related products such as music, film, video and Internet offerings, has marketed its culture as an integral part of influencing consumer preference. Australia, at the other extreme, is a much more diverse grouping, unable or unwilling to link the interests of business closely with national goals. Its cultural openness has facilitated the opposite consumer trends—those of quickly absorbing new products and technologies from elsewhere. It should therefore not be expected that the mechanisms for transforming commercial enterprise in Australia should follow the same pattern or priorities as in larger, more differentiated economies. Such mechanisms, of course, included taking IRD through product innovation into market capture.

The proponents of 'new' growth theory[11] and supporters of the Porter view of the competitive advantage of nations[12] continue to view macroeconomics as a national economic aggregation of a number of national enterprise based economies. The Ohmae[13] view suggests that global corporations have a macroeconomy of their own, often loosely coupled to the nations in which they operate but an aggregation of the microeconomies of their subsidiaries, supplier and client relationships. Both models need to be used, as they coexist, albeit uneasily. It will be argued that the latter model is the one relevant, at least through the next 10-year investment cycle, to contemporary product investment decisions. The process of turning ideas into wealth is executed by corporations, rarely now by government, and the control of industries is passing from national government to corporate empires.[14] The economic model which describes two factor sets, those endogenous to a national economy and those exogenous, now has to become a matrix on which factors endogenous to a particular industry player may have

to be overlaid if the significance of IRD, to any one country in that industry, is to be evaluated.

The Global Nature of Scientific Research Exchange and of Technological Dissimilation

Science is a globally shared activity. Scientists isolated from contemporary knowledge may produce some valued insights but a more managed application of limited resources comes from carrying out new work in the context of old. With contemporary communications and travel facilities, participating in a full global sense is determined by costs and budgets. Australian scientists are disadvantaged now to a diminishing extent by the cost structures associated with distance and by limited competition in the supply of communication services.

The long established practice in Australia has been to introduce and implement programs providing a incentives and support mechanisms to stimulate investment in and the application of R&D. In addition, separate programs have flourished to finance research and development in government and mandated industry research bodies. Australia has had, by OECD standards, a high percentage of R&D activity carried out by the public sector, but its conversion to economic benefits via Australian commercial activity has been questioned. The outcomes have been constraints on the funds available to public sector R&D and the encouragement of transfer mechanisms to the private sector. A typical example was the drive to force the Commonwealth Scientific and Industrial Research Organization (CSIRO) to seek 30% of its funding from non-government sources. The Commonwealth Scientific and Industrial Research Organization offers many examples of how the preferred means of commercialising public sector research have been influenced by a narrow definition of benefits to Australia. Much of CSIRO's work, for example, has been done on behalf of major Australian industries such as primary production, resource exploitation and manufacturing. The commercialisation focus has been on setting up or supporting small Australian companies to commercialise the research outcome, be it pharmaceutical, a manufacturing process or a machine to aid production. In practice, these small businesses have proved inadequate to fully exploit the benefits of the research and as such have failed to bring the benefits to Australia that wide scale and more timely access to the product might have offered. It is now appreciated that the production of an agent which enhances productivity is more likely to be cost effective if provided by an organisation of scale, geographical and market positioning determined by global market forces. The challenge is then to the Australian industry applying research outcomes to differentially capture the benefits.

Intellectual property (IP) protection is seen as a method of giving enhanced value to local technology for which programs exist to support policy and implementation. There are difficulties in creating an IP protection environment much weaker or stronger than the US—determined world practice. Some industries gain little benefit. Information Technology for example, with its transient product life, finds the patent system too slow for its needs. Conversely, health care and agricultural biotechnology products with their long gestation cycle rely heavily on patents for protection. Local capture of returns on IP by these means may only give rise to licensing revenue streams of modest economic benefit, unless the industrial enterprises exist locally, or can be created, to exploit its value. This is yet another example of IRD support not realising its full benefit, as a result of other, more dominant factor conditions not optimised in Australia, and with the viability of such enterprises depending on issues other than product design or sourcing.

The purpose of providing IRD and other industry assistance programs is essentially to stimulate the economic well-being of the country. This pre-supposes an environment

in which the research and development and the subsequent industrial activities are contained within the country. That environment exists for a number of IRD and technology activities based within the United States and perhaps Japan. It is no longer true or becoming less true in other nations, especially the developed OECD countries. In nations such as Australia, research and development in any particular technology is a local contribution to the global pool of scientific knowledge, if pre-commercial. The ambitions of the professional researchers involved in such work may not necessarily coincide with those of their national community. Industrial activities utilising technological innovation are increasingly global in scope and their ownership and control may well not rest in Australia, implying the existence of divergent motivations.

The core distributor of wealth to a community used to be the labour employed in manufacturing. As manufacturing becomes more capital intensive, manufacturing sector employment is becoming less significant than the labour deployed in product distribution and the servicing of markets. These activities are naturally performed within markets themselves and therefore a player in an industry of global scope will trend towards an Australian component of perhaps only 2% of its total activity and hence wealth creation.

Barriers to Analysing Impacts of IRD Policy

There are significant barriers to accurate research on the effectiveness of incentives to business.

Reviews are normally conducted by the extensive use of questionnaires and interviews. The limitation of this approach is that the responses given may be shaped by the questions posed and therefore rarely encourage busy respondents to step back and look at the holistic environment in which a program is being undertaken. It is more likely, therefore, with the natural pressures to demonstrate the value of work already done, that the conclusions of such reviews are more positive than is warranted. Moreover, these social experiments lack a laboratory in which a parallel experiment can be carried out with a placebo and even greater limitations exist because the research cannot be done on a double blind basis.

Product and process innovations are key sources of competitive advantage. A company is unlikely to signal its competence or commitment in this area for other than tactical marketing reasons. It will naturally present itself in the light it believes appropriate to maximise external sources of cash flow to improve shareholder returns. Support may reduce the risk level of new product innovation but is just as likely to be used to improve cash flows at the level of business risk that the managers have already deemed prudent. The tools available to researchers to probe motivations are limited and easily blunted by corporate confidentiality, presentation and reporting skills.

The issues raised by external reviews are often at the core of the firm's competitive strategy and, as with all academic research in this sensitive area, are subject to pressures to keep corporate strategy from the public gaze. Without trying to penetrate that diffusing screen, it may be possible to deduce motivation by examining the factors affecting industrial change and postulating logical responses. Against that anticipated behaviour, one may make assumptions as to the response and hence value of market distortion mechanisms such as R&D support programs.

Just as the Europeans are pondering the end of their car industry[9] so researchers in the US are reviewing their future as a base for automotive manufacture and their dependency on R&D.[15] The US report cited illustrates the difficulties facing econometric modellers of the effects on the US economy of R&D in this industry. The statistics show that the automotive industry is the most important manufacturing industry in the US and

yet it runs a trade deficit of US$45 billion per annum in motor vehicles. Research and Development by Ford, GM and Chrysler at US$13.6 billion in 1994 represented 4.5% of sales (several times total vehicle sales in Australia). Their share of world production has dropped from 45.9% to 24.7% between 1965 and 1994. What is the correlation between their contribution to the US economy and their R&D expenditure? To model it, it is necessary to factor in the data that GM and Ford make around half of their profits from manufacturing activities outside the US, presumably working off that R&D effort. In addition, a significant and rising proportion of the manufacture of automobiles in the US is carried out in factories owned by European and Japanese based corporations. Overseas owned car companies had in 1996 at least 50 R&D centres of their own in the US. The Japanese have sited or placed contracts with styling houses in California, arguing that the culture of that region of the US is the one that dominates global product promotion.

Clearly the industry depends on R&D for its survival, or it would not carry the costs at a time when serious excess capacity exists and profits are slim. It is possible to infer that R&D is seen as an important component of competitive behaviour between global corporations and is managed to optimise its contribution in that context. Its effect on national issues is secondary and not optimised by the corporate management who control the expenditure. In this particular industry, government intervention has diverted some of the local R&D expenditure, not to improve economic goals but for environmental and safety objectives enshrined in regulatory controls.

The Freeing up of Global Capital Flows

One factor of particular importance to the choice of location of manufacturing is the effective cost of capital. Australia has been presented as a low-risk country in which to carry out IRD and other activities, which arguably offsets its higher interest rates, lower price earning ratios on stock market values of technology enterprises and its relatively harsh capital gains treatment of high growth enterprises. A more efficient way of quantifying country risk is the size or rate of decline of the risk premium on investment returns, and more and more emerging economies, once considered high risk, are now comparable in stability to Australia.[16] To encourage IRD to be carried out in Australia, there is a need to demonstrate superior quality and access to the intellectual capital of the country to compete with the increasing competence of education establishments in the region. While demonstrating competence in R&D in the university and government research sector is a factor, exploitation of the R&D will still take place overseas unless an industry is one in which production is knowledge-intensive and has to be close to R&D, or is insensitive to net employment costs or the cost of capital.

Policy Processes and Corporate Evolution: A Mismatch in the Rates of Change?

The use of negative feedback to stabilise a system requires sensitivity to change and a process for adapting and compensating which is faster than the changes it is attempting to control. There appear to be increases in the rate of change of the Socio-economic environment and, in particular in the nature of employment and wealth creation activities. The process of canvassing the community to identify their aspirations, creating processes for solutions, overcoming objections, and implementing and measuring the outcomes is probably in excess of one government term. A process to produce programs of value should probably have an anticipatory component which can predict the operational climate 5 to 10 years beyond the point when the program was conceived.

That may well have been practical until the mid-1980s. It now appears that the time

constraint of implementation of the government process is too long to match the rate of change of the broader global industrial scene. This mismatch is compounded by the limitations of research tools that are available for anticipating the forces that lead to those changes. A dangerous short cut is to copy successful programs from the US or Europe. If there is a confirmation that they have been successful then they would have been conceived a decade ago, to allow the implementation time for outcomes to be assessed. The question has to be posed as to whether the conditions will be sufficiently comparable, in 2007, for similar outcomes to be available.

This paper is based on the premise that the competitive edge produced by continuous product innovation is in the community interest and that policy issues solely relate to improving the process. Within the time scale of introducing a new program, it may not, however, be possible to achieve much. To take a contemporary example, downscaling in middle class employment is a feature of the changing social environment.[17] People are being encouraged to reduce consumption as being socially desirable, even if not economically a necessity. The follow-on effects may be an emerging demand for longer lasting products and a desensitisation of the consumer to promotion of incremental design improvements which stimulate replacement. In this scenario, IRD is directed towards product price and longevity factors and a high rate of product obsolescence through innovation is considered undesirable—an argument attractive to those active in promoting conservation of natural resources and pollution minimisation.

To deal with changing social mores such as these, methods of evaluating programs in their design phase would ideally need to include foresight techniques incorporating at least a decade in projection of changing values.

The Effect of Scale and Scope Economies in Manufacturing

Businesses driven by technology products are the major source of enterprise growth in the US. In other OECD economies (including Australia) such trends are less apparent. One of the changing features in the technology of the industrial landscape has been the rising cost of capturing markets relative to the cost of carrying out product development. The risk profile of business growth has shifted the peak of risk away from technological innovation through the processes of gaining market acceptance and penetration. Associated to and compounding that risk, however, is the tendency for continuous economies of scale to apply to most commercial implementation processes. The IRD costs are largely fixed relative to sales volumes, so that amortisation is accelerated as volume increases. Production economies of major technologies including IT hardware and software, bio-pharmaceuticals, and mechanical engineering, favour large volumes since they permit capital intensive manufacture which reduces unit price. The observed effect is a consolidation of global manufacture to smaller numbers of sites, each one concentrating on narrow product ranges. The trend carries the inherent risk that if sales volumes decrease through market saturation or economic downturn, then the economic justification for such concentration collapses, but the plants cannot readily downsize without losses in the capital value of the enterprises controlling them.

The importance of brand identity is now accelerating in a similar way as global marketing gives an economy of scope by generating sales from a global brand identity. The outcome is that speed of market capture is critical to gain volume, and once the volume is attained, price ascendancy over competitors is achieved and there is no further room for later entrants.

Implications for Social Policy

The OECD countries, in particular those of Europe and Australia, have used their wealth creation in the post-second world war era in a socially generous manner. Wealth has been transferred across the community and across generations to provide social welfare and retirement comfort. The contemporary effect of this is that these countries need a certain level of economic activity to provide their taxation system with the cash flows to recycle. That is proving difficult to sustain with their falling population ratios of productive workers to others.

The emerging economies have started from a different base. They traditionally depended upon self help and family welfare mechanisms and they, therefore, have relatively low taxation rates and government enforced wealth transfer is at relatively modest levels. As those economies have developed, the more economically enlightened have encouraged or enforced personal savings to solve the intergenerational wealth transfer problem. Rapidly growing economies have provided new work opportunities throughout the community, thus reducing the need for other forms of welfare. Health care and education, so important in those developing economies, have been encouraged on a 'user pays' principle. As a result, although their wages are rising towards European, US and Japanese levels, their cost burden remains lower, giving them a competitive advantage. We are now in a period in which we have nearby economies containing skill bases as effective as ours but whose true cost of carrying out wealth creation activities, manufacturing and distribution, is lower than ours.

While this situation prevails there are strong pressures to undertake manufacturing elsewhere, until a plateau is reached. Those countries like the US, which can maintain the IRD resources for products manufactured in lower cost locations, will be better able to return to local manufacture when costs equalise. Programs which encourage IRD in Australia may have merit in positioning business for future changes in comparative costs given that major exploitation currently occurs in emerging economies.

Adapting Policy to Accommodate Globalisation

Generic IRD support is unlikely to optimise use of resources since industries are at widely different evolutionary stages in respect of globalisation and their dependence on IRD for individual corporate survival.[18] In the Australian context, the main survival threat for firms in a variety of industries arises from the need to participate in their industry as a global competitor. Their Australian location can be an impediment which the community could help to redress. More valuable than generic support to IRD might be improvements in the development of competent international managers, making special demands on the education system in respect of language skills, international network formation and a global perspective on law, accounting and management practice. Partnerships with government to raise profile overseas may also be useful. Market capture poses common challenges across industries. If the government perceives its role as addressing market failures, its assistance might be better directed to compensating for local businesses' remoteness from the markets in which battles for survival battle will be fought.

Different industries have different evolutionary patterns. They have different rates of consolidation and globalisation and, as a result, they have differential potential in terms of the growth of small and medium enterprises. They also have different dynamics in terms of optimal location, and will have different weightings on the value of an

Australian location. This suggests that a generic policy supporting product innovation will have a widely distributed range of outcomes, related purely to industry dynamics.

The Approach of the Venture Capital Industry

The venture capital industry does not, as is generally supposed, function by backing winners. The best analytical techniques are still not able to produce a high probability of success from those businesses chosen for support. It does however, produce acceptable outcomes at least within the US. Such outcomes depend upon two key factors: one is the value of successful outcomes, relative to the cost of failures, the other is the screening process which eliminates the large number of investment possibilities considered to have a high potential for failure. It functions, not as a process of backing winners, but as a process of removing losers. This model may have value in designing more selective IRD and other enterprise support.

Although difficult, it would perhaps be more appropriate to target government policies to specific industries rather than retaining a generic approach. Avoiding those industries likely to desert Australia through unstoppable global forces could be the first filter. The costs of identifying and tracking such industry evolution requires a deep knowledge of industry and may not be justifiable without government making use of industry resources.

It is also important to analyse, within an industry, the number of activities in Australia which might be part of an economic growth initiative on a global scale. In most industries, globally significant activities are likely to be counted in single figures so that in practice, the incentives most likely to yield positive results become focused on the individual enterprise. This invokes all of the political issues related to differentially supporting single enterprises exposed by the Labor governments support for Kodak. It is then a question of whether checks and balances can be devised to ensure that such support is seen to be fairly applied. If this approach is not followed, and support is open to all under a generic scheme, then it could be argued that the effect of support on any one enterprise is unlikely to be sufficient to materially affect its survival chances in a changing industrial landscape.

Targeting individual firms also has difficulties in public perception, because such a scheme is not designed to back winners, but to avoid supporting potential losers; the losers being players in an industry identified as being unlikely to effectively sustain an Australian enterprise development flow. Amongst those supported, there will still be a number of failures because of our admitted inability to predict winners. The thinking behind such an approach is to breed winners but leave private enterprise to race them. Consequently, such a scheme is open to criticism by those who failed to get support on industry grounds, but who will be able to point to those that did and still failed.

Not all industries derive their main innovative thrust from product innovation, the normal outcome of R&D. It could be argued that the reason why expenditure on corporate IRD has been relatively low in Australia is that Australian businesses do not need it as a profit generator. When servicing a small market for technologically complex products, the easiest route to profit is by importing products proven elsewhere. The second route, which has become less attractive because of the economies of scale in manufacturing, is to manufacture products locally under licence. Only if both of these fail, would it make commercial sense to develop products here to capture market share.

Those businesses, for example BHP, that require process innovation in order to maximise their profitability adopt much the same set of business priorities. Their first and easiest route to profit is to buy existing, proven process technology and to innovate

perhaps only in the way in which they apply it to their Australian situation. Only if process innovation is not available in the market and differential advantage in process is vital to profits, is it appropriate to spend corporately on IRD. Such organisations can be expected to make those decisions whether or not there is a government subsidy arising out of carrying out the R&D. If the R&D is a necessary condition for generating profit, then the return is likely to far exceed the taxation benefits. It has been argued that generic support therefore only stimulates R&D projects on the margins, i.e. those, which on internal analysis, have an expected IRR less than the company's hurdle rate and rely on the subsidy to lift them over corporate hurdle rates of return. As the R&D costs are usually much lower than the capital costs to implement them, these projects tend to be even more marginalised.

If a company is going to have to do the R&D anyway, then the subsidy may actually benefit the company's development and survival characteristics in other ways. If it is just viewed as an improvement to cash flows then that cash liberated may result in a dividend flow, which in turn improves the capital raising capacity of the company.

Alternatively, it may be deployed in other growth activities within the organisation. These may well include the marketing expenses necessary to improve market capture. That said, it seems an inefficient way of encouraging business growth to focus on one narrow sector of the total wealth creation process within the enterprise and subsidise that, particularly as it can be argued that is not the major process within the organisation for creating new wealth and employment growth.

An important feature of innovation in recent years has been the displacement and substitution effects it has induced in consumer decision-making. While incomes were rising rapidly, innovations offering consumers new choice met a rapid buying response. As a result, products like personal computers were able to gain quick penetration into family spending patterns. More recently, as personal income growth rates have declined, total consumption has levelled. Recent innovations like Internet are having significant displacement effects. It is becoming apparent that spending on such items as clothing is dropping to provide the household with cash flows needed for more technology rich equipment and to support a shift towards the consumption of services. From the point of view of the enterprise, such effects reduce the leverage of product innovation as a source of profit. They superimpose on the cost structure of introducing the product a significant additional element associated with encouraging purchaser to switch their buying behaviour. While consumers are being induced to switch in some sectors, this is being achieved at a cost and involves a business risk larger than that related to the new technology alone. Innovations like the Apple Newton, a Personal Digital Assistant (PDA) have failed, in spite of substantial product innovation and marketing investment, to create the spending switch. The fact that they offered a range of new user benefits was not enough to guarantee their widespread adoption.

Conclusions

In the context of support for IRD, the relationship between investment and corporate outcomes should be analysed from a global industry perspective. Further, it is possible to illustrate the leverage Australian based companies can exert on an industry's competitive structure. A rationale for targeted support might be found in government sharing with a company or companies the mission of achieving improved competitiveness.

The political aspects of differential support are sensitive within Australia, an issue which deserves future study. Such differential corporate support has been used in Japan, Korea, US, France and Germany among others to lift local corporations, large and

small, into a global positioning. If businesses can see how to manage the risks of a corporate strategy to compete globally, they will be easily encouraged to seek out or perform the IRD necessary for their new objectives. Then, the linkages between IRD and economic activity in Australia will be easier to identify and use as a basis for future policy formulation.

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