Industrial Capabilities and Productivity in Victoria : Part I The Company Survey*

Anne Leahy, Joanne Loundes, Elizabeth Webster and Jongsay Yong
Melbourne Institute of Applied Economic and Social Research
The University of Melbourne

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Melbourne Institute of Applied Economic and Social Research
The University of Melbourne
Victoria 3010 Australia
Telephone **(03) 8344 3701**
Fax **(03) 8344 5630**
Email **melb-inst@unimelb.edu.au**
WWW Address **http://www.melbourneinstitute.com**

Abstract

This paper presents the main findings from a study of six industrial capabilities in leading Victorian sectors. The capabilities included manufacturing, design, information and communications technology (ICT), biotechnology, environment technologies and business services. Eighty-eight companies and organisations were interviewed for the study. We found that the main requirements for the successful creation of a capability was the ability of the company to recruit and retain the best graduates from universities and technical schools, the ability to offer training to these graduates and the ability to financially support high and consistent levels of R&D over time. The main requirement for the successful use of a capability was effective company networking, conducive work cultures, supportive government regulations and the provision of complementary specialised training.

1. Introduction

Industrial capabilities are important sources of absolute advantage for an economy, and, accordingly, knowing the factors that underpin their creation and use is a prerequisite for developing policies to augment economic growth. Since existing empirical information on capabilities are scarce, the research team gathered primary data from a series of semi-structured interviews of companies and industry organisations across Victoria. A total of 78 companies and 10 industry organisations were interviewed over the period October to December 2002. The interviews concentrated on capabilities arising from domestic R&D – especially in the fields of biotechnology, information and communications technology (ICT), manufacturing, design, environmental technologies and business services.

Part two of this paper further explores the theoretical relationship between industrial capabilities and international competitiveness. The third section overviews the company survey and part four provides a summary of the most significant findings. The fifth section presents policy implications.

2. The role of capabilities in achieving international competitiveness

For developed regions, high productivity growth can only be sustained if the economy nurtures and sustains companies which are internationally competitive. Raising the efficiency of sectors which are below world standards, while of benefit to local consumers, will not uphold an economy's position among the developed economies of the world.

Countries and regions achieve international standards of competency when they excel at most, if not all, aspects of a production process. Such processes may include one of several segments of a full value added chain which extends from extraction or farming through to

manufacture and service provision and the distribution and sale of products. Increasingly, this chain is being extended to include controlling and minimising the level of emissions and the disposal of ‘consumed’ products.

Normally, a region will excel in a defined number of segments across different value added chains rather than having an unbroken advantage along a complete chain. Within each segment, best practice behaviours from all the component factors of production are usually required to sustain high productivity. These factors typically embrace either a region's natural endowment of resources or its workforce. More specifically, they would embrace the price and quality (including speed of delivery and flexibility in use) of supplies, the calibre of unskilled or basic and general labour, the calibre of skilled or advanced and specialised labour, business infrastructure, marketing and distribution, management attitudes towards new ideas and innovation, and the extension of markets for their products.

There is an a *priori* expectation that the scope for variation in performance of some of these factors will be larger than others and, accordingly, the potential advantages from improving some of those factors will be more extensive. In this sense, it can be said that some factors, at the high quality end, can be leveraged and are more critical to the absolute advantage of the industry, even though all factors are complements and are thus necessary for the complete production process.

Advanced skilled labour is one factor whose scope of performance and potential for leveraging is great. Advanced skilled labour is distinguished from basic or general labour in that first, it requires long and specialised formal education; secondly, it requires complementary long and specialised forms of work experience (informal training) and thirdly; it commonly requires certain personal characteristics relating to temperament and

dedication. A critical mass in a market or industry area of certain types of complementary advanced specialised labour is the normal source of industrial capabilities. In common parlance, these specialist labour types include scientists, engineers, technicians and specialised managers.

3. The company survey

The survey was conducted during October and December 2002. The primary data were assembled from one-hour face-to-face interviews (except five telephone interviews) with either the Chief Executive Officer (CEO) or senior manager of 78 companies and organisations that produce or use these capabilities and 10 industry associations related to those companies. In every Small and Medium Enterprise (SME) but three, the CEO was interviewed. For large companies, senior managers were interviewed. Five non-metropolitan interviews were done by telephone given the difficulties of access. Companies in the survey were selected from approximately nine industry groups or clusters, as detailed in Table 1. The interview success rates were 100 per cent for industry associations and training bodies, 57.1 per cent for companies.

The advantage of selection by clusters is that it permits more than one view of how a particular capability operates in a given market. Industries that were interrelated, and potentially part of the same value added chain, were specifically chosen. There is, for example, a link running from biotechnology and food R&D through to vineyards, dairy and horticulture, to packaging.

While the interview method has the benefit of being an open approach, it has several limitations compared with a randomised structured survey. First, the limited number of interviews makes it difficult to generalise to the whole economy. Secondly, the clustering of

the survey population further reduces the randomness of the data and weakens our ability to generalise outside the clusters. Thirdly, about two-thirds of the survey population was chosen from government contact lists and this may result in a bias towards companies which have an interest and penchant for networking and information sharing.

Table 2 shows the size of the companies interviewed, as measured by the number of full-time equivalent employees. Most companies are SMEs, with only eight companies with a workforce of more than a thousand employees. It is therefore no surprise that many of the concerns expressed in the survey are typically those of SMEs. The relationship between clusters and capabilities is shown in Table 3. It should be noted that we rely on some degree of subjective judgement to arrive at the relationship.

Table 1: Companies interviewed by industry cluster

Cluster	Name	Number of interviews
Rail manufacture and services	Rail	10
Automotive components manufacture and related training institutions	Automotive	10
Dairy R&D and manufacture	Dairy	6
Horticulture R&D, farming and processing	Horticulture	8
Packaging R&D and manufacture	Packaging	8
Software development companies	Software	8
Biotechnology R&D start-up companies and their financiers	Biotechnology	9
Wineries and vintners	Wine	10
Miscellaneous professional services	Professional services	6
Training providers		3
Industry Associations (related to above clusters)		10
TOTAL		88

Table 2: Companies interviewed by employment size

Number of employees (FTE)	Freq.	Percent
10 & under	9	12.3
10-50	22	30.1
51-100	9	12.3
101-500	22	30.1
501-1000	3	4.1
Over 1000	8	11
TOTAL	73	100

Table 3: Companies interviewed by creation and use of designated capabilities

Cluster	Creates capabilities	Uses capabilities
Rail	AMT, design, professional services, environmental technologies	AMT, design, ICT, professional services
Automotive	AMT, design, professional services	AMT, design, ICT, professional services
Dairy		AMT, Biotechnology, environmental technologies, ICT, professional services
Horticulture		Biotechnology, environmental technologies, ICT, professional services
Packaging	Design, environmental technologies	AMT, biotechnology, environmental technologies, ICT, professional services
Software	ICT, design	ICT, professional services
Biotechnology	Biotechnology, environmental technologies	ICT, professional services
Wine		Biotechnology, design, environmental technologies, ICT, professional services
Professional services	Professional services	ICT, professional services

4. Survey findings

The survey is divided into two parts, the first part consists of non-structured, open-ended questions. The answers to these questions had several recurring themes, among them are the dominant motive for creating capabilities, the conditions for the successful creation of capabilities, and the typical behaviour of companies that used the capabilities.

4.1. Motives for creating and using capabilities

Companies were found to pursue the creation of new capabilities with differing levels of vigour. Competition, especially from lower levels of protection (tariffs, preferential government purchasing), was a major factor affecting this dynamism.

The creation of most of the capabilities, in almost every company we interviewed, depended on the company's ability to:

recruit the best graduates from the relevant university courses;

offer substantial training to these highly skilled graduates;

retain a sufficient number of skilled staff over time to provide corporate memory, technology transfer and the correct mix of experienced and inexperienced R&D workers; and

finance and support high and consistent levels of R&D over time.

For the successful use of capabilities, there were four factors that were consistently mentioned as necessary. They are:

Effective networking, formal and informal, to discover the broad nature of changes in capabilities;

Specialised training for relevant workers to gain post-qualification skills in using a new capability. However, for companies to benefit from such training, low staff turnover is needed;

Supportive government regulation, especially for the use of environmental capabilities, was an important incentive. Apprehension of future government regulation and pressure from consumer groups and downstream companies have encouraged many companies, from farming to packaging, to adopt more environmentally sensitive practices; and

Conducive work cultures that will facilitate the adoption of a new capability. For physical technologies, e.g., ICT, using a capability can involve regularly adopting a new invention. For the soft or human technologies, to change the work culture in itself is using the capability (for example many environmental technologies are changing work practices).

4.2. Specific problem areas

In addition to the above general ways of operating, there were re-occurring problems in some industries and across some types of company. These included the problems of variable demand for output, small domestic markets, SMEs, suboptimal incentives within the training system, rigidity within the trades, skill gaps for professional engineers and specialist biotechnology managers.

Problem of variable demand

R&D is a highly path-dependent activity. Skills, both technical and commercial, which accumulate over time are embodied in individual workers and the organisational culture. The best way to maximise the effective use of these accumulated skills and to reap external benefits for the broader economy is to have a steady level of funding. Unfortunately, this has

been difficult to achieve for most of our capability areas. Either highly variable product demand (such as in the rail industry), or, chronic funding shortages (for example in biotechnology), has led to uneven levels of retained earnings and variable R&D budgets. When the funding horizon is short or uncertain, skilled R&D workers leave their industry. At a later time, when demand resumes, companies subsequently find it hard to find experienced people. Often, but not always, it is the most flexible and energetic people who leave the industry as their opportunities are greater elsewhere. Essentially, a variable approach to R&D funding is not efficient from the perspective of the whole economy.

Small domestic market

Many medium to large companies already dominate the domestic market and are forced to go international through export or foreign direct investment (FDI) in order to expand and reap economies of scale. This need for expansion provides an excellent opportunity for the further use of locally created capabilities. Problems of the small domestic market are compounded when State Governments give preference to local suppliers and, some companies, especially in rail, indicated that this practise still exists despite its inconsistency with the Australian and New Zealand Government Procurement Agreement and national competition policies.

Particular problems of SMEs

Almost regardless of industry, many of the challenges facing companies can be attributed to their size and inability to reap economies of scale, not so much with respect to operating unit costs, but as to overhead investments. The latter includes training programs, the collection and sorting of information, networking, companies' ability to affect government policy, companies' influence on education and training providers, and their (cost-efficient) access to government grants and subsidies. This does not imply that SMEs are an inefficient mode of

production. SMEs are the genesis of large companies and often provide the critical innovative margin in a market that sets the pace for other companies. Innovation is often accredited to the energy, insight and flexibility of SME managers, senior managers and specialised workers. It is possible that current institutional arrangements within governments and the education sectors with respect to overhead infrastructure capabilities and costs favour large organisations. There may be ways of accessing government grants or tax concessions or training other than through existing arrangements. An example follows:

A voluntary training payment scheme similar to the university Higher Education Contribution Scheme (HECS) could apply for employees who undertake training at an accredited provider. Repayments would be paid off over time by the employer after the training had been completed. If the employee quits the company, he or she, or possibly his or her new employer, would be liable for the remainder of the training repayments. Additional wages should not be paid to the worker during the repayment period. Repayments should be designed to run in parallel with the productivity benefits to the company arising from the training. In this scheme, the employer would be partially insulated from the risk many SMEs have that the employee will leave their employment before the employer has reaped the benefit from the investment. This HECS-style training scheme is a policy that will stop SMEs being caught in a low skill equilibrium. Changes in employer willingness to train has been attributed to changing attitudes to broader learning, reduction in the practice of labour hoarding and permanent employment and increased emphasis on short-term shareholder value versus longer term investment (see Buchanan et al 2002)

The compliance requirements on SMEs for applying for tax concessions and receiving government grants could be further streamlined to show a greater awareness by government organisations of the considerable costs of the paper work involved.

SMEs appear to benefit disproportionately from industry promotions (overseas and local) and many companies requested that further government effort be made in this area. Where it existed, the supportive role of the governments through the Victorian Industrial Supplies Office and selected trade missions and industry exhibitions was frequently mentioned in a favourable light. The major exception was software companies who felt that they did not receive this form of government support.

Industries dominated by SMEs need an active and well resourced body that will look after the business and environmental interests of its affiliates. The horticulture industry, for example, appears to have a need for an entity that can effectively garner companies' requirements for training needs, R&D issues, marketing problems and offer general networking in a way that does not impact significantly on SMEs resources. It is easy for farms and companies to be unaware of what they do not know and not have the time to keep up with changing institutions and government structures. Personal contact and relationships are required for this role.

Incentives within the training system

There did not appear to be strong pecuniary incentives within the Tertiary and Further Education (TAFE) sector for institutes to devise new courses to meet emerging skill requirements relevant to their jurisdiction. It was indicated that even if accreditation was achieved, new funds were not provided and redundant staff were still the financial responsibility of the institutes. The supply of places for courses does not appear to be demand determined (demand that is by potential trainees) and this has been claimed to impact on pre-apprenticeship training. Since the latter is considered a more efficient way to deliver Australian Qualifications Framework (AQF) III level training, this inflexibility is detrimental

to the economy. However, there was hope that recent reforms to address these issues would ameliorate this problem. Monitoring should be undertaken to ensure incentive structures are simple and easy to use, do not burden institutes with processes and have substantial outcomes.

Rigidity within the proclaimed trades (training and work)

Demarcation rigidity among the proclaimed trades, for both training and work practices, is legendary.[1] While many companies agreed that it improved during the 1990s, demarcation rigidity remains an issue for efficient work operations. Since many capabilities require multi-skilled workers, demarcation issues are a notable impediment to their creation and efficient use. There appears to be an emerging trend for companies to circumvent trade level training and seek their technical skill training at the diploma and advanced certificate level instead. From the companies' point of view, this seems to be the most logical action, but if successful, this could lead to the demise of manufacturing based apprenticeships. Solving the training inflexibility does not however solve work-based demarcation conflicts. One company suggested that this issue would be improved if single rather than multiple unions existed at workplaces.

Training for professional designers and engineers.

One of the most consistent problems companies and professional bodies raised was the lack of work experience skills among graduates from industrial designers and other engineers. Pre-employment practical experience was considered important to acquaint the new worker with the latest technologies, familiarise them with the shop floor and initiate awareness of

commercial realities. Successful examples of cadetships exist in Brisbane and Germany. The informal cadetship scheme, arranged through the Melbourne Development Board, was well regarded by one company that used it. The success of such as scheme would however depend on the details of the placements.

Shortage of experienced leading edge technology managers.

The emerging industries of biotechnology, Venture Capital (VC) funds management and multi-media IT product development identified severe and chronic shortages of technically competent people who had (successful) experience in managing a commercial organisation. Mentoring schemes, whereby the mentoree shadows an experienced manager, for a substantial period, may be one way this experience gap can be compressed. Formal training and education courses cannot substitute for accumulated work experience skills in this area. Local experienced managers may agree to cooperate with such schemes so long as the mentoree is not employed by a rival company. Given the international focus of the biotechnology, VC fund and multi-media development companies, this should be possible in Victoria. Measures would need to be taken to ensure the mentoree returns to his or her original company for a pay-back period.

4.3. Ancillary issues

The second part of the survey consists of several structured questions that are related, albeit indirectly, to the creation and/or use of the capabilities. These questions ask companies to assess the importance of (i) factors affecting their decisions to locate in Victoria, (ii) factors most critical for the growth of the industry, (iii) avenues through which companies learn

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[1] Demarcation issues are industrial relations issues and do not refer to government regulations and processes.

about new technologies, and (iv) types of government support that can assist their industry and their competitiveness. The level of importance was ranked using a 7-point Likert scale, with the anchor points – 1 denoting `Not at all important,' and 7 `Very important.' The tables below present an unweighted average of these responses by the selected clusters.

Reasons for locating in Victoria

Companies were asked to rate the importance of a number of selected reasons for locating in Victoria. Companies which had been established here for many years were asked to assess the importance of these reasons for remaining in Victoria. Table 4 which summarizes the scores, shows that most companies chose to locate in Victoria, or chose to remain in Victoria, because it was the home to both the original entrepreneur and subsequent managers. Most managers believed that Victoria's excellence as a place to live was a major attraction and this was true for all industries except horticulture and packaging. The rail industry was most influenced by the Victorian Government's approach to business, while automotive component manufacturers were heavily influenced by proximity to major customers. Dairy manufacture was influenced by proximity to suppliers (dairy farms), and the packaging industry was influenced by both the location of major customers (food and beverage manufactures) and efficient transport routes.

Table 4: Reasons for locating in Victoria by industry cluster

Cluster	Rail	Auto motive	Dairy	Horticulture	Packaging	Software	Biotechnology	Wineries	Bus. services	Total
Proximity to your suppliers	3.1	3.3	6.0	2.9	2.8	1.8	2.0	2.5	3.4	2.8
Availability of skilled or scarce labour	3.2	4.5	4.0	2.9	5.0	5.0	1.9	2.8	5.2	3.7
Proximity to your major customers	4.0	6.8	3.0	4.1	5.1	3.3	2.8	3.7	5.4	4.4
Proximity to efficient transport routes	3.4	4.1	3.7	6.0	5.1	3.0	1.6	4.2	2.2	3.8
High standard utilities, communications infrastructure	4.3	3.1	4.7	5.0	3.9	4.4	1.5	4.0	4.8	3.8
Proximity to research organisations	3.0	3.3	3.0	2.6	2.5	2.6	3.5	2.1	4.4	2.9
Good place for managers to live	5.4	4.8	6.0	3.5	3.6	5.4	5.5	5.1	6.4	5.0
Proximity to good business support services	4.0	3.1	5.7	3.8	3.0	4.1	2.4	3.1	5.8	3.6
State government's approach to business	5.3	3.7	4.0	4.3	3.3	3.9	4.0	2.9	3.4	3.9
No. of companies	10	10	6	8	8	8	9	10	6	88

Factors important for future growth

Companies were also asked to rate the importance of factors likely to be relevant for their industry's future growth. The average scores are presented in Table 5. As expected, most companies believed that an increase in consumer demand was the most important factor.[2] The second most important factor was the development of export markets. Many companies are currently dominating a mature domestic market and export or FDI remain almost the only sources of further leveraging their comparative advantage. Industry networking and the

availability of (suitable) skilled labour were rated the next most important factors and these ratings held almost uniformly across clusters. Not surprisingly, given the dominance of many companies in relation to the small domestic market, only companies in the biotechnology area wanted to see more firms in their industry.

Table 5 shows that the four factors, specifically related to the strategic capabilities, were not given particularly high ratings. For example, expenditure on information technologies (IT) or advanced manufacturing technologies (AMT) were rated around 4 on average, compared to increased demand (6.1), development of export markets (5.5), availability of skilled labour, or industry networking (5.3 each). One interpretation of this is that such expenditures were regarded as necessary for companies to remain viable, but were not sufficient for companies to gain an edge in their markets. Another interpretation is perhaps it is not so much the individual capabilities themselves that are important, but rather their interactions with other factors. In this view, the interaction between the capabilities is what allows companies to establish their markets more effectively (thus increasing both domestic and overseas demand), attract and retain skilled employees, and establish vital linkages within their industry.

Yet another possibility is that investment in these capabilities was perhaps near the optimal levels for these companies. Thus, the marginal benefit of, say, increased IT expenditure may be quite low. If the company's computer system were to crash, it may not be able to function at all. However, it does not follow that having twice as many computers or IT staff would make the company twice as productive. Table 5 also shows that automotive, dairy, horticulture, software and the professional service companies all believed that the availability

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[2] The main exception was the biotechnology-related companies.

of skilled labour is important for the future growth in their industries. Innovations from suppliers were not ranked as very important by all industries. The development of export markets was considered of high importance for all industries except automotive and packaging. For the latter, FDI was preferred given the weight and bulk to value ratio of their products. The IR climate was mainly an issue for dairy manufacture. Regulatory reforms were not rated highly by any industry and better use of relevant R&D was only rated as important by the automotive industry. Rail, horticulture, software, biotechnology and the wineries believed that their industries could benefit from more industry networking and more joint promotion efforts. Only business service companies considered Victorian Government charges, relative to other States, an issue.

Types of government support needed

Table 6 shows companies' assessments of the importance of different types of government support for their industry. R&D support was cited as the most important type of support, followed closely by support for training, and assistance with the development of export markets. Few companies wanted the government to coordinate marketing exercises, but as our qualitative results indicate, some industry sectors were keen for government to help promote their industry overseas. Relatively little importance was placed on the role of government in intellectual property (IP) protection, but this varied by industry. For the biotechnology companies, this issue was paramount, it was moderately important for the engineering-based companies. Several SMEs commented that they did not have faith in the IP legal system. Government assistance with the development of export markets was considered the most important form of support for rail and wineries. Assistance with the training of specialised labour was a priority for automotive, dairy and packaging companies -- although the latter companies tended to place low importance on government support generally.

R&D support was most highly valued by horticultural, software and biotechnology companies.

Table 5: Factors important for future growth by industry cluster

Cluster	Rail	Automotive	Dairy	Horticulture	Packaging	Software	Biotechnology	Wineries	Bus. services	Total
Increase in customer demand	6.1	6.5	6.7	6.5	6.3	5.6	5.1	6.2	6.4	6.1
Innovations from suppliers	4.1	4.8	5.3	4.0	5.3	4.9	3.5	4.5	4.0	4.5
Availability of skilled labour	5.0	5.5	6.0	5.5	4.0	5.9	5.6	4.9	6.4	5.3
IR climate in the industry	4.6	4.8	5.7	2.9	5.1	2.0	2.5	3.9	5.2	4.0
Development of export markets	5.6	3.8	6.7	6.1	3.5	6.8	5.8	6.7	5.8	5.5
Deregulations or regulatory reforms	3.8	3.3	2.7	3.4	3.8	4.1	5.1	5.4	5.4	4.1
Better use of relevant R & D	4.2	4.7	5.7	5.1	4.9	5.3	4.6	4.8	4.4	4.8
Industry networking	5.4	4.7	4.3	6.4	3.9	5.9	5.4	6.0	5.4	5.3
Joint industry marketing efforts	5.4	4.3	3.7	4.0	2.3	5.1	4.8	5.9	5.8	4.6
Increase in number of firms to attain critical mass	2.2	1.8	2.3	3.0	1.3	3.9	4.4	3.4	2.2	2.7
More expenditure on product design	4.2	4.8	5.0	4.6	3.9	4.8	3.6	4.5	3.8	4.4
More expenditure on IT	3.8	3.2	4.3	3.3	4.5	4.6	3.3	4.8	4.4	4.0
More expenditure on advanced manufacturing technologies	4.7	4.2	5.0	4.9	4.4	1.8	4.6	4.6	1.0	4.1
Better use of business consultants such as accountants, lawyers, financial advisors	3.3	2.5	3.3	3.3	2.9	4.0	3.3	4.1	3.2	3.3
Victorian Government charges overall relative to other states	4.6	4.3	4.7	4.9	3	3.6	3	4.3	6.3	4.2
Number of companies	10	10	6	8	8	8	9	10	6	88

Table 6: Types of government support needed by industry cluster

Cluster	Rail	Automotive	Dairy	Horticulture	Packaging	Software	Biotechnology	Wineries	Bus. services	Total
Training of specialist workers	4.4	5.8	5.0	6.1	4.9	5.5	5.9	5.0	4.5	5.3
Coordinating marketing exercises	5.6	3.4	3.0	4.3	2.4	5.1	3.4	5.2	3.5	4.1
R&D support	5.6	5.5	4.7	6.6	4.6	6.1	6.7	4.7	3.5	5.5
Developing export markets	5.9	5.4	4.3	5.6	3.4	5.8	4.9	6.2	4.0	5.3
Protection of your inventions	5.2	4.6	2.7	4.7	4.8	4.9	5.1	5.0	4.0	4.8
Number of companies	10	10	6	8	8	8	9	10	6	88

Learning of new technologies

Companies were also asked to rate the importance of different avenues for learning about new ideas and technologies. Table 7 shows that informal networks were rated as the most important way companies learn about new technologies, processes and products. The second most important avenue was publications and technical meetings closely followed by formal cooperation and networking with other companies. Licensing patents or designs, reverse engineering, and external consultants were the least common avenues. These general patterns were fairly consistent across the groups. Licensing of technologies was however important for dairy and packaging manufacturers. Publications and technical meetings were important for automotive, wineries and professional services. R&D was important for dairy and software companies and trade fairs, and joint promotion events were valued by wineries.

Table 7: Learning of new technologies by industry cluster

Cluster	Rail	Auto motive	Dairy	Horti culture	Packaging	Software	Biotechnology	Wineries	Bus. services	Total
Licensing technologies	3.9	2.9	5.3	3.4	5.0	3.9	3.7	2.1	4.0	3.6
Publications or technical meetings	4.8	5.2	5.0	5.1	3.6	5.4	5.1	6.4	6.5	5.2
Informal networks with other firms	5.3	4.9	5.0	5.9	4.5	5.1	5.6	6.2	7.0	5.4
Formal cooperation or networks with others	4.6	4.9	5.0	5.3	4.3	4.3	5.4	5.6	6.0	5.0
Hiring skilled employees from other firms in industry	4.3	4.5	3.7	3.9	3.1	3.9	3.9	4.4	5.5	4.1
Reverse engineering	4.4	3.5	3.0	1.5	3.3	1.6	2.4	2.5	1.0	2.8
Independent R&D (in house or external)	5.0	4.5	5.3	5.7	3.5	5.5	4.6	4.4	4.5	4.8
Hired consultants	3.8	2.5	3.7	2.3	4.0	2.4	3.6	3.9	5.0	3.3
Trade fairs and joint marketing events	4.8	4.6	4.0	5.4	4.8	4.9	4.3	5.6	2.5	4.8
Government agencies (e.g., CSIRO)	4.7	3.6	4.3	4.3	2.3	2.5	3.7	4.8	2.0	3.7
Number of companies	10	10	6	8	8	8	9	10	6	88

5. Policy implications

Specific policy concerns that flow directly from the survey findings are summarized below.

5.1. Training, skill upgrading, and labour related issues

Long term industry retention of skilled workers

The leading edge development of many capabilities is a highly path-dependent activity. Vital to this development are skilled staff who persevere within their field and accumulate relevant sets of tacit skills. These workers provide corporate memory and enable the transfer of

technology between experienced and inexperienced workers.

Retention of these workers is most likely when demand for output or external funding is relatively stable. Unfortunately, this has been difficult to achieve for most of the defined capability areas. Either highly variable product demand (such as in the rail industry) or, chronic funding shortages (biotechnology), has led to uneven levels of retained earnings and variable R&D budgets. When the funding horizon is short or uncertain, skilled workers leave their industry. At a later time, when demand resumes, companies subsequently find it hard to find experienced people.

Governments can assist the retention of key workers through policies to smooth demand for products and by offering greater training and R&D incentives during times of downturn. It could particularly encourage export programs during economic slow downs.

Scheme for financing workplace training

Companies can be caught in a low skill equilibrium when a low level of training hinders their ability to attract good workers and a lack of good workers affects their incentive to offer training. Low skill equilibria are partly attributable to inefficiencies in the system for financing enterprise training. Governments could consider introducing a voluntary training payment loan scheme, similar to the university HECS scheme, for employees who undertake training at an accredited provider. Employers would progressively pay back the cost of training after the course had been completed and the worker was providing a return to the company. If the employee quits the company, he or she, or possibly his or her new employer, would be liable for the remainder of the training repayments. This would insure the investing employer against the loss incurred through losing the trainee before he or she had repaid the cost of the investment.

Incentive structures for TAFE colleges

Pecuniary incentives within the TAFE sector for colleges to devise new courses to meet emerging skill requirements relevant to their jurisdiction should continue to be strengthened and monitored. The supply of places for courses does not appear to be demand determined (that is, by potential trainees) and this has been claimed to impact on pre-apprenticeship training.

Promotion of school-based technical courses

There appears to be a growing demand for technical workers with multi-trade skills. The apprenticeship system in not a suitable training vehicle for this new demand. Despite several decades of 'reform', it has not shown the degree of flexibility required to keep pace with the market in many areas. Furthermore, and perhaps as a consequence, factory-based apprenticeship appears to suffer from an image problem among youth. A study by Martino and Holden (2001) found that secondary school students in western Melbourne perceived apprenticeships as a last resort option. This will make it difficult for firms to obtain talented people from the technical training system. New school-based multi-disciplinary technical courses are being established in the AQF VI and V areas and these should be monitored to see if this form of training is successful. If they are successful, this style of course should be encouraged.

Cadetships for professional designers and engineers

There was considerable interest in the introduction of work experience modules for university educated industrial designers and other engineers. Practical experience was considered important to acquaint the new worker with the latest technologies, familiarise them with the shop floor and initiate awareness of commercial realities. Successful examples exist in

Brisbane and Germany. The Government could consider taking the initiative to establish these cadetships.

Mentoring for specialised managers in the biotechnology fields

A mentoring scheme, whereby the mentoree shadows an experienced manager for some months, may be one way the gap in the market for research scientists with some commercialisation experience can be narrowed. Local experienced managers may agree to cooperate with such a scheme so long as the mentoree is not employed by a rival company and they also gain through informal knowledge spillovers. Measures would need to be taken to ensure the mentoree returns to his or her original company for a pay-back period. The mentoree's salary would be the major cost of this scheme and the Government could consider using some funds currently earmarked for the biotechnology industry for this purpose.

5.2. Work organization and resource allocation

Changing work cultures

Changing work cultures is an important complementary step for many workplace innovations. However, considerable resources are often needed to change managers' and workers' views over the 'way things are done around here'. People learn and respond most easily to personal approaches. Programs wishing to make specific change in industries, from the adaptation of new technologies to participation in specific training or R&D programs, could benefit from the use of liaison officers who make personal visits to workplaces. Gaining the attention of business is difficult and any approaches should always have clear, concrete objectives.

Coordinate fragmented industries

Industries dominated by SMEs need an active and well resourced body which will look after the business and environmental interests of its affiliates. The horticulture industry, for example, appears to have a need for an entity that can effectively garner companies' requirements for training needs, R&D issues, marketing problems and offer general networking in a way that does not impact significantly on its resources. It is easy for farms and companies not to know what they do not know and not have the time to keep up with changing institutions and government structures. Personal contact and relationships are required for this role.

Reduction in skill based demarcation disputes through IR incentives

Skill based demarcation rigidities, while less prevalent than a decade ago, still detract from workplace productivity. The Government should continue to use its existing employment related programs to discourage these practices through penalties and incentives.

5.3. Government programs and regulation

Streamline Government compliance requirements

A systematic attempt by the Government should be made to simplify the application and reporting requirements imposed on companies who wish to participate in government programs and grant schemes. Existing requirements are too onerous for SMEs and for programs with uncertain outcomes.

Industry promotions by the Government

Many companies, from a variety of industries, were appreciative of industry promotions run on their behalf and requested that further government effort be made in this area. Many companies believed that representations by either the Government or industry promotion bodies did have an impact.

Environmental incentives

There is reasonable evidence that further creation and use of environmental capabilities in Victoria depends on the existence or expectation of rising environmental standards. The State Government can, first, devise forward environmental industry plans which define time-tables for future regulations and laws so industry has a lead time to adapt in the most cost-efficient manner; second, use pecuniary incentives to change company and householder behaviours; and third, enhance the operations of environmentally beneficial industries, such as public transport.

6. Conclusion

The issue of a selected set of capabilities should be cast within a wider perspective of the overall environment facing firms. In trying to isolate the effects of these capabilities on productivity, it is easy to obscure the multitude of interconnected factors contributing to the performance of firms and ultimately the economy. Even if certain selected capabilities can be shown to have a great impact on productivity growth, the contributions of complementary investments in organization, human capital, and managerial quality cannot be understated. In this regard, the role of governments should first and foremost be removing impediments to accessing and developing all productivity-enhancing capabilities. In promoting selected

capabilities, one should perhaps concentrate on capabilities that have wide applicability and large spillover effects across the economy. A combination of investments in technologies and changes in organizations and work practices facilitated by these technologies should most likely contribute to productivity growth and improved economic performance.

Reference

Martino, J. and Holden, S. (2001) Unlocking the barriers: A regional perspective of apprenticeships and traineeships, In *Australian Apprenticeships: Research Readings*(Ed, Smart, N.) Australian National Training Authority, Leabrook, SA, pp. 111-126.