

**USING TECHNICIAN LEVEL SKILLS TO OVERCOME SKILLS SHORTAGES
IN LEADING EDGE EXPORTERS**

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Abstract

Skill shortages are seen by leading exporter firms as a major constraint to growth. This paper discusses one aspect of the findings of a study of the skill formation practices of small to medium-sized firms that are significant exporters and/or users of knowledge workers (Curtain 1995). The purpose of the study, based on twelve case studies, was to identify the skills-related constraints faced by these enterprises.

The case studies of small, high tech enterprises show evidence of the use of young graduate engineers in relatively low skilled jobs. Few technicians are employed by the firms studied. Complaints by enterprises of skill shortages, therefore, cannot, at least in some cases, be taken at face value. Concern by management about skill shortages may in some cases reflect an inappropriate deployment of skill.

The reasons for an over reliance by small, high tech exporters on higher level skills are explored in the paper. These include the relative cost of graduate engineers and the lack of links between educational institutions supplying technician level skills and small, leading edge exporters. The challenge facing the providers of para professional technical skills and full-time students undertaking technician level studies is to establish close working relationships with leading edge workplaces. Ways to do this are suggested in the paper.

Introduction

The McKinsey study of "Emerging Exporters" for the Australian Manufacturing Council in 1993 first highlighted the contribution made by some 700 small and medium sized enterprises to the marked improvement since 1986/87 in Australia's export of "elaborately transformed manufactures". A further study by the LEK Partnership in 1995 entitled "Intelligent Exports and the Silent Revolution in Services" highlighted a 14 per cent growth in service exports between 1963 and 1993.

These studies have suggested a considerable potential exists for improving Australia's trade performance and standard of living if the constraints on these companies' capacity to export are eased. One major constraint identified by the enterprises themselves are skill shortages. This is confirmed by a 1991 ABS survey of manufacturing firms using advanced technology. Some 30 per cent of establishments reported having difficulty recruiting staff with the required skill for the normal operation, maintenance or programming associated with the technology (ABS 1991:27).

Purpose

The study of skill formation in small, leading edge enterprises was commissioned by the Dusseldorp Skills Forum. The project brief was to use case study methodology to investigate and report on the skill formation methods used in two types of firms: small to medium sized, leading edge manufacturing firms that have captured significant export markets and small to medium size firms that need to employ significant numbers of knowledge workers.

Case studies profile

The key features of the 12 case studies are outlined below. The summary points below are drawn from a more extensive description in Curtain 1995.

- all of the enterprises were founded in the last 25 years, with half only existing since 1980
- all enterprises studied have passed beyond the start-up phase with its heavy reliance on the founding entrepreneur to a stage where usually they are seeking to consolidate their early rapid growth
- the size of the firms varies from four to 176 employees with most between fifty and 120 employees
- the industries in which the case study enterprises are located vary from metal and plastics manufacturing, textiles to graphic design and publishing
- the range of products vary from computer and graphic design services to machine tools, scientific instruments and early warning fire detection equipment, software programs, ultrafine wool garments and multimedia games

- the focus of most exporters is on serving a small number of customers in niche markets. Only the multimedia and related products are produced for a mass market
- all the case study enterprises, except the smallest firm, are involved in exporting. The proportion of sales exported vary from sixty to 98 per cent for all but one exporter. All the enterprises that are exporters fit the McKinsey study definition of exporters that are born global by starting to export soon after start up. Most of the case study firms that are exporting did so within the first five years of start up.

Key workforce characteristics points are:

- trades-qualified and technician-level workers in most cases are not involved in research and development. Where they are present, they are confined to the production of standard products.
- more important in the export-based firms in terms of their value-added contribution are knowledge workers with tertiary qualifications. The proportion of managerial & professional workers varies from 8 per cent to 100 per cent. Within this group, professionals represent from 4 to 75 per cent of the workforce. Typically, engineers are the major group of professionals
- the high proportion of tertiary qualified workers in most of the firms reflects the strong emphasis given to research and development. The proportion of sales spent on R & D for the six firms for which information is available varies from 5 to 40 per cent.

A closer look at the major activities and technologies of the firms studied suggests a grouping of enterprises into either high-tech or medium level technology. The high-tech enterprises are so defined because of their focus on sophisticated and complex value-added products. In seven cases, the high value-added activity is software development (Farley Cutting Systems, Lochard Environmental systems, GBC Scientific Equipment, Beam Software, IEI, ANA Software and Moldflow). All these enterprises use leading-edge technology to place them at the forefront of their competitors in world markets. In six cases, these firms are serving niche markets with only a small number of significant competitors. Only Beam Software with its focus on interactive multi media products is aiming at a mass market. All these high-tech firms are significant exporters except one (ANA Software).

Medium-level technology is the basis of production in three cases: Merino Gold, Travel Guide Publisher and Thermal Paper Products. The products of these firms can compete well on overseas markets but there are significant competitors.

Engineers in place of technicians

Evidence from three case studies suggests that engineers are used for work more appropriate to technicians. There was evidence that young graduate engineers are used in

relatively low skilled jobs. Few technicians were employed. The enterprises studied preferred instead to engage graduate engineers because they are seen, in international terms, as relatively inexpensive.

Purported skill shortages, therefore, may be, at least partly, a reflection of the inappropriate use of scarcer or more costly higher level skills. Skill shortages may also be caused by an unwillingness of graduate engineers to offer themselves for work that is seen to have more limited career prospects.

The case studies show that exporters of high value-added products and services in their start up stage have to use the external labour market to obtain the skills that they require. High level skills are often needed to produce a prototype and conduct further research and development. However, once beyond the startup stage, there is evidence that these high tech firms may continue to use higher level skills (such as graduate engineers) when in many cases middle level technician level skills would be more suitable.

A substantial surplus of professional engineers in Australia in most disciplines has been evident since the mid 1980's (Halton 1992:18). It has been estimated that there are 2,500 professional engineer migrants arriving each year against an estimated demand of between 140 to 570 per year (Birrell, Healy and Smith 1992, cited in Halton 1992:18).

Evidence of the ready availability of overseas-born engineers is confirmed by three of the case studies. Most of the software engineers at Farley Cutting Systems, Lochard Environmental Systems and Moldflow were born overseas but were recruited domestically. A wide range of countries is represented although there was a concentration of Chinese-born engineers in two companies. Only one company (GBC Scientific Equipment) reported difficulties in recruiting engineers but this was addressed by lifting salary levels.

Explaining the over reliance on high level skills

The low cost of high tech skills

The relatively low starting salary for engineers in Australia has created an incentive for some employers to substitute more highly qualified workers for less qualified workers. The starting salary of a software engineer at \$A30,000 is considerably below the starting salary of \$US40,000, common in the United States in the early 1990's (Gomez-Mejia & Welbourne 1990). In addition to the high starting salaries for new graduates in the US, generous benefits are also provided such as relocation allowances, front-end paid vacations, settling in allowances at time of hire, post graduate education tuition reimbursement and parallel promotion ladders leading to challenging and high status projects.

Australia is now regarded as a low-cost centre for high-quality R & D (Roberts 1994: 751). One key factor in the low cost structure is the relatively low wages for specialists such as engineers. It has been estimated by one multinational operating an R & D facility in Australia that product engineering and development costs in Australia are about two-thirds of the cost of developing similar systems in the US (Roberts 1994:751).

Given these lower costs, employers may be consciously or unconsciously employing engineering graduates in place of technicians. The advantages of a greater use of

professional staff may be a higher level of flexibility in responding to problems and versatility in how they are deployed. The onus, however, is on the employer to ensure that the more highly qualified workers are utilised to full advantage. Problems may result, however, if they are to substitute for technicians' work because they only cost a small premium extra.

The difficulty with this strategy is that tertiary graduates may soon become frustrated with their job. If graduate engineers with high expectations, for example, are given work that is limited in scope and with little opportunity for training, they are likely to become dissatisfied with their work roles. This, in turn, is likely to lead to a move to another employer offering better work prospects and skills enhancement opportunities.

High level skills focus as a legacy of the start up stage of high-tech enterprises

The founders of many high tech enterprises are engineers or research scientists. This was the case with all but one high tech enterprise studied. Their concern during the start-up stage to tap higher level skills to develop and perfect a prototype. This often means that many high tech firms are from their beginning are top heavy with highly skilled personnel. Continued expenditure on research and development helps to entrench the position of highly skilled personnel within the enterprise. Their pre eminent position within the firm is often reinforced by the philosophy and predisposition of the founder.

The problem faced by many small, high tech companies is how to make the transition beyond the start up stage (see Curtain 1996 for a more detailed analysis of this issue). This involves developing operating systems and patterns of skills deployment that reflect cost effective ways of producing more standardised products.

Part of the transition process requires moving from the central focus on research and development with the high level skills this requires to a balanced approach to the allocation of resources within the enterprise. The initial reliance on the external labour market for high level skills needs to be replaced with a human resource strategy to foster the development of skills in-house. This strategy needs to be based on a reappraisal of the work allocation away from an over dependence on tertiary graduates and recruiting high cost experienced personnel to fill vacancies.

The consequences of an over dependence on high level skills

The case studies show that an over reliance on tertiary-qualified, technical expertise has in several cases resulted in high salary cost structures. Employees with higher level skills command higher salaries over time, resulting from internal progression or external salary pressures due to high levels of mobility. In one high tech enterprise, cost pressures had caused the company to reduce the size of its R & D function from twenty to eight employees and to rely more on technician level skills for testing and validating equipment.

Recruitment of well-qualified, experienced employees on the open market to replace experienced may also have longer term detrimental results for the employer. Meeting the market price can be costly and is likely to distort the basis for paying existing employees. Reliance on the external labour market to recruit the right mix of skills needed may result in considerable delays in finding the right person. Extensive use of the external labour

market also means that the enterprise is subject to poaching offers and is required to make a counter offer if the employee's skills are undervalued. This again is likely to distort the remuneration system.

Hyper mobility of high-tech labour

The "hyper mobility of high-tech labour" has been criticised by Florida and Kenny (1990) in their analysis of small "break through" companies in the USA. The high turnover of high level expertise is seen as disrupting R & D projects, making it difficult for enterprises to develop institutional memory based on the cumulative expertise and knowledge of the workforce working together over an extended time. The high turnover of skilled staff also makes it difficult for high-tech enterprises to engage in long-term planning (Florida and Kenny 1990:92-95).

In addition, firms are likely to be reluctant to invest in further opportunities for skills upgrading if there is a likelihood that employees may leave. A rational, short-term response of management to under-invest in training may be condemning that enterprise to a stunted growth, particularly in the face of competition from Japanese enterprises that operate on a long-term calculus of the benefits of investing in training.

The high turnover of skilled workers can impede an enterprise's ability to innovate and stay ahead of its rivals. The absence of internal mechanisms for retaining, enhancing and renewing skills could create an invisible barrier beyond which new high-tech enterprises are unable to expand. Reliance on new graduates and high cost specialists with their high levels of turnover may produce "niche companies." This refers to small firms that are unable to grow into larger enterprises with stable, integrated high-technology capabilities. It is argued, based on the Japanese enterprise model, that only larger enterprises are able to sustain long-term R & D efforts or to follow through on innovations (Florida and Kenny 1990:97).

How technician level training can meet the skill needs of high tech firms

Many universities of technology (Swinburne, RMIT, UTS) already have cooperative education programs in several disciplines that provide for work placements for students as part of their course. Several enterprises (Beam Software, IEI, GBC, and Lochard) expressed an interest in providing structured work placements for students during their courses, provided the arrangements were beneficial to both parties.

Considerable scope exists for TAFE and other providers of technician level skills to establish close links with small exporting enterprises by arranging structured work placements for their full-time students.

In the case of the Swinburne University Cooperative Education program, the benefits of the work placements to the employer are seen to be, in the short term, an additional resource to carry out a useful engineering activity such as laboratory work, design, measurements, quality assurance or testing. In the second placement, students are regarded as more "results oriented" and can be given problem-solving tasks and assigned individual projects.

Benefits to employers, students and teachers

The longer-term benefits to the employer are seen to be the opportunity to evaluate a potential graduate's suitability to the organisation. The cooperative education or industry-based learning placement model offers a range of benefits to employers, students and teachers. These benefits are similar to the benefits gained from the close association Japanese enterprises have with particular high schools and universities.

In the Japanese case, three sets of benefits have been identified (Rosenbaum 1994). These are, first, fostering value for academic skills by employers so that they are prepared to make some effort to obtain graduates with these skills. Second, students are likely to exert more effort because their academic performance is highly relevant to their future careers. And third, teaching staff accrue additional authority based on their close association with employers and ability to offer dependable evaluations of students (Rosenbaum 1994: 3-8).

The application of this model of cooperative education on a broader scale in Australia to the TAFE sector is likely to meet the needs of most parties concerned with the education to work transition process. The model appears to function well in a number of university of technology settings. There is, however, no reason it could not be extended to include other disciplines with a strong vocational orientation both within the universities of technologies, the older universities and to technician -level training in TAFE.

Conclusion

The case studies have highlighted the role technician level workers might and should play in high-tech workplaces. The opportunity to do this could be provided through work placements for students undertaking the Associate Diploma level courses in TAFE. Many TAFE students at Associate Diploma level are already full time employees but a significant proportion are not. In Victoria in 1993, for example, of the 41,454 students undertaking courses at the associate diploma level, just over a third (35.4 per cent) were full-time students. The proportion was 52 per cent for science and 38 per cent for engineering/surveying students. These figures suggest that there is considerable potential for lifting the status of and expanding the opportunities for the employment in leading edge enterprises of workers with technician level skills by arranging structured work placements for full time students during their course.

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