

Training needs of emerging
industries: Case studies –
Support document

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This document was produced by the authors based on their research for the report *Training needs of emerging industries* and is an added resource for further information. The report is available on NCVET's website:

<<http://www.ncver.edu.au/research/core/cp0001.pdf>>

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About the company

AeroEngCo began in the early 1980s as a maintenance facility for general aviation aircraft. In the late 80s and early 90s, the company became involved in research, development, and modifications to existing agricultural aircraft. This culminated in the development and type certification of the company's own agricultural aeroplane (issue of a type certificate indicates an aircraft is manufactured to recognised aviation industry standards). During the latter part of this period the company commenced research and development of another aircraft, an eight seater single engined passenger plane. The passenger plane received its type certificate in December 2000. At the time of this study, it had type certification for Australia and was undergoing type certification in South Africa and USA. Receipt of type certification for USA is widely recognised as being of international standard. The passenger plane is already operating in some overseas countries where an Australian type certification register is established.

About the workforce

AeroEngCo currently employs 80 people, a significant increase from a figure of 32 employees just 12 months earlier. This rapid increase in its workforce is an outcome of the successful type certification of its aircraft. Once certification has been achieved the company has a saleable product and can move from research and development into commercial manufacture. The long term prospects for manufacture and sale of the company's products look extremely promising.

Our business is very much a long term enterprise. Market research tells us the number of units we will be manufacturing and selling over the next 10 to 15 years will hardly scratch the surface of what the real demand out there is internationally.

A five year projection developed by AeroEngCo suggests that its workforce by the end of the five year period will be of the order of 400 employees. Already into the second year of this projection the company is approaching its anticipated figure of 100 employees. The current payroll listed 80 employees, and another seven apprentices were due to start in the week following the interview for this study. A further 100 to 150 employees are expected to be taken on in the third year of the projected period. The relative proportions of employees in the various employment categories (described next) are expected to remain much the same over the projected five year period. If the apprenticeships that were about to commence are judged to be successful in their first year the company anticipates taking on a further 10 apprentices in each of the ensuing years. Prior to the apprentices about to be taken on, AeroEngCo had trained two other apprentices, both in aircraft maintenance. However, as the company moves further into production, the majority of apprentices are likely to be involved in manufacture rather than maintenance of aircraft.

AeroEngCo employees can be classified into six broad occupational categories:

- Managers, who, apart from standard training and experience in various aspects of management are not required to have any specific formal qualifications. Standard management training programs already available meet the company's needs.
- Administrative staff, who have standard training and experience in office protocols and procedures. Training needs for administrative employees are adequately met by existing training programs on offer.

- **Engineers:** AeroEngCo currently employs five professional aeronautical engineers. However, three of these employees had only been hired in the three months preceding this study. Prior to that, the company relied on the services of the existing two engineers plus a consultant. Of the three new recruits, two were freshly trained graduates and one came from industry. Because of the specialised nature of their work and the small size of the industry, the availability of training for aeronautical engineers is quite restricted.

We have just employed a couple of new [aeronautical engineering] graduates and are already finding that, for the skills we require, there is an enormous amount of on-the-job training necessary to bring them up to a realistic level of proficiency. There is not a wide choice of tertiary institutions providing training in aeronautical engineering, RMIT in Melbourne and the University of Sydney are the only two that offer degree courses.

- **Draughtspersons:** The draughtspersons AeroEngCo employs do not have university degrees, however two have diplomas. The company has found that draughtspersons who do not come from an aeronautical background require a substantial amount of in-house training and experience to bring them up to scratch.

I don't believe there is a recognised course available for aircraft draughtspersons. Essentially you find someone who can draw, and if they haven't worked in the aircraft industry, you have to train them. We have just put on a young fellow as a trainee draughtsman who is very good at CAD but knows nothing about aeroplanes.

- **Tradespersons:** The trade in which AeroEngCo requires most of its tradespersons is 'aircraft mechanical engineer (structures)', someone who is trained in building and repairing aircraft structures, that is, the 'body' of the aircraft. To a lesser degree AeroEngCo also employs tradespersons trained in the mechanical aspects of aircraft engineering – people who work on the engines and mechanical components.

The production workers at AeroEngCo are mainly employed as trades assistants. However the company also employs a small number of tradespersons with qualifications from outside the aircraft industry (including fitters and turners, carpenters, boilermakers and mechanics) to assist with production.

Knowledge and skills required

In its trades and production employees, the company essentially looks for dexterity of hands – 'people who are good at building things, pulling them apart, etc.'. The skills these employees bring with them with are normally sufficient to meet the company's requirements. Very little company specific or industry training is needed.

Our trades and production workers especially need sheet-metal skills. The materials and processes used are fairly conventional, it's the way they have been building aeroplanes for years – aluminium alloy, various thicknesses – pretty standard stuff. The aviation industry is extremely conservative – any new materials or processes must go through rigorous testing and be approved by the regulatory bodies, so materials and processes used tend to stay fairly traditional.

Training provided

Even when the company recruits an employee with an Aircraft Maintenance Engineers' qualification, it cannot put them to work without on-the-job training. The type of work AeroEngCo undertakes does not exist anywhere else in Australia. For example, although the techniques in building a fuselage skin are probably the same as in replacing a fuselage skin on a Boeing 737, the methods of applying them are quite different. In-house training is necessary.

[In the case of] the two graduate engineers we have just employed, their productivity would be around 30 to 35 percent. If the company could get people whose training gives them the knowledge and experience we need, we wouldn't hesitate to employ them. You just can't get them – they are not around.

AeroEngCo recognises that, whilst, from a company perspective it would be nice to have employees trained in the aviation aspects of their qualifications, this is an unrealistic expectation. The small size of the aircraft manufacturing industry in Australia (AeroEngCo being the only commercial aircraft manufacturer in the country) means there is correspondingly small demand for training specifically directed to aircraft manufacture. Qantas and other airlines employ people with aeronautical engineering training, but their orientation is different – airline engineering employees are more involved in general maintenance and modifications rather than design and development. AeroEngCo believes that, as matters stand, there are no courses that specifically meet the needs of the company.

Adopting a pragmatic approach, therefore, AeroEngCo does not anticipate any changes in the formal qualifications it requires. Unless more industry-specific training is offered, the company will carry on operating on the assumption that incoming graduates know nothing about the industry. Existing trade certificates, diplomas and degrees will continue to be the norm.

Training for the future

In the next twelve months to two years AeroEngCo proposes to create a company training section. One in which the trainer's job will be to work with people on the job, checking to ensure workers are performing their tasks correctly and if not, showing them how to do it.

AeroEngCo has tried industry placements in the past. However they have found that, because of the specialised nature of the industry, placement trainees can only be given simple tasks which do not require extensive supervision or training for their successful completion.

Ideally, the company would like to access some form of government subsidy to enable them to train an employee for a 'train-the-trainer' role. This is seen as the best approach because it is unlikely that a person from outside the company would have the necessary industry knowledge and experience to be able to effectively carry out the training required.

AeroEngCo would like to take people out of school who have an interest in aviation, but don't necessarily know a lot about building aeroplanes. They would take them on with a view to training them specifically for their type of business. These new recruits from school would mainly be apprentices.

We plan to start a number of apprentices over the next three or four years. It won't be nearly enough, but it will be a start in which we will be training people in the skills, and to a standard, that we require for our particular operation. They will come out with an Aircraft Maintenance Engineers' Certificate. The training will take place here. The training institution has agreed to our providing a training room on site for their formal training. We believe this will work well for us.

AeroEngCo believes that the course that is most applicable to their sector of the industry is the Certificate 4 course in Aero skills. This is a full year apprenticeship course primarily designed around the airlines. A significant proportion of this course is not relevant to aeroplane manufacture. At the time of this review, the company was holding discussions with its RTO (Kangan-Batman College, one of only two such providers in Victoria) with a view to restructuring the course to better suit the aeroplane manufacturing industry. In such a scheme, it is envisaged that the RTO trainers would visit the company's plant for the first full week of each

month and would use the training facility provided by the company to conduct formal training. The RTO would also provide the qualified assessors.

AeroEngCo believes that the most urgent needs for new and redesigned training are those relating to people who actually build the aircraft – ‘the shop floor people’. More specialised training for diploma and degree students, although also required, is a lower priority.

AeroEngCo had applied for, and expected to get, a government subsidy for training of its employees.

About the company

AgEquipCo traces its origins to an innovative concept for agricultural spraying developed by the South Australian Department of Agriculture in the late 1980s. Based on this concept the company has developed a range of 14 different types and sizes of machine to apply a variety of agricultural materials in specialised applications.

AgEquipCo continues to engage in research and development of machines for new applications. However a major part of its effort is now devoted to manufacture of the specialised products for sale in both domestic and overseas markets. All research and development and manufacturing is undertaken at a single plant located in South Australia. To facilitate sales and service, AgEquipCo has a network of dealers across Australia and in other parts of the world. USA and France are the two major countries to which AgEquipCo exports, accounting for nearly half of the company's business. Other countries include: Canada, South Africa, Spain, Portugal, the UK and Chile.

For its overseas operations, AgEquipCo appoints distributors in the export countries and the distributors then take on the responsibility for developing appropriate marketing strategies and sales opportunities. One of the reasons the distributors in USA and France have done exceptionally well is that they were already in the agricultural equipment business. AgEquipCo values the assistance of Austrade in developing overseas markets, utilising the services of the Trade Commissioner and Business Development Manager for the countries concerned. The help Austrade provides includes provision of interpreters, assistance in negotiations and vetting of agreements.

Except for USA, all exports take the form of completed products in cartons. For USA, completed sub-assemblies are exported (to reduce freight costs) and final assembly takes place in USA.

About the workforce

AgEquipCo employs 16 people in the following occupational areas: General Management, Operations Management, Sales, Company Secretary, Despatch and Receiving, Research and Development, Metal Fabrication, General Assembly, and Welding. The Managing Director is a chartered professional engineer, the company secretary is a chartered accountant and the sales manager has a diploma in business studies. Despatch and receiving staff have received training in the computerised manufacturing/accounting package used by the company. The Research and Development employee has an associate diploma in Engineering and handles the CAD aspects of the company's design work. This employee joined the company initially as a welder and, upon showing an interest and possessing capability in CAD the company purchased an appropriate computer package ("SolidWorks") and he has, through his own efforts, become proficient at using it. None of the three metal fabrication employees holds any formal qualification in their trade, however one is currently undertaking a traineeship. Only one of the six general assembly employees holds a formal qualification, that of electrician. The supervisor of the fabrication and assembly operations is a qualified welder and oversees the quality of welding performed by the fabrication employees.

Knowledge and skills required

Characteristics and attributes sought in employees are:

- Reliability: with only a small number of employees, the absence of any employee or failure to perform on the job has a marked effect on production output.
- Good fabrication skills (rather than qualifications) in assembly shop employees. Other knowledge and skills required for the work can be learned on the job.
- Open-mindedness and a willingness to try new ideas – an important attribute in a company engaged in working with innovative ideas and creating new products.

Training provided

The company provides on-the-job training, much of it with a view to making employees multi-skilled – a valuable asset in a small company where the loss of even one employee's work contribution, due to absence or other reasons, can significantly affect output.

Trainees attend a TAFE institute for their formal training. The company does not currently see any benefit in providing formal training on the job, by TAFE or any other provider.

For highly technical aspects of its operations such as engineering tests, and development and manufacture of printed circuit boards for use in AgEquipCo products, the company generally subcontracts the work out. At the time of interview, a university was undertaking research work, and an electrical company was developing and manufacturing the printed circuit boards.

Training for the future

From 1994 the company's output expanded every year until the introduction of the GST at which point its Australian sales dropped by 20%. Exports however continued to rise after introduction of GST, although at a slower rate. AgEquipCo sees the new markets it is currently developing in Spain and Portugal as being likely to grow significantly over the next two to three years.

With regard to changes in its workforce, AgEquipCo sees only minor increases in its number of employees. Most of these increases would be in its operations section, that is, developing and manufacturing its products. The next person employed is likely to be an R&D person with practical skills – possibly an electrical tradesman who could take over some of the 'hands-on' work currently done by the existing R&D employee, thus allowing him to undertake more CAD-CAM work. Ideally this new employee would also be experienced in agricultural machinery, however this combination of skills and knowledge is unlikely to be found.

AgEquipCo does not see any immediate requirement for significant changes in the skills and knowledge of its employees – mainly because the company's operations in the near future are likely to remain geared fairly strongly towards basic manufacture with higher level components being provided by outside contractors. The company has already installed its own plastic moulding facility and, with the aid of in-house training (initially provided by the equipment supplier), has been able to train employees in its operation and maintenance.

CAD-CAM training, particularly in the SolidWorks program, could be useful, provided it covered aspects that the already very capable existing CAD-CAM employee did not already know.

Training in sales and marketing could also be of value in helping the company better project its image and develop a better approach to sales.

AgEquipCo finds it difficult to predict what training it will need further into the future. Much will depend on the nature of its products in the future.

About the company

AlloyCo is an engineering company specialising in the application of new technology to the forging of products from titanium. The company is credited with the design and development of the world's first single-forged titanium-head golf club – now used by golfers throughout the world. In 1998, AlloyCo won the Governor of Victoria Emerging Exporter Award. Forging titanium, which involves metal flow technology is a difficult process which relatively few companies in the world engage in. Most of the companies specialising in titanium technology are located overseas.

Commencing in the mid 1990s the company operates from a single location in Victoria. In producing the titanium golf club heads, AlloyCo works in affiliation with another company in Thailand which provides the finishing stages in their manufacture. The company has found that subcontractors in Australia don't have the necessary skills nor the reliability to complete this facet of the work satisfactorily.

About the workforce

The number of people employed by AlloyCo varies somewhat with demand for the company's products. In busy times there are as many as 110 employees on the payroll. Occupational areas identified included: human relations manager, accounting, product design, supply, and manufacturing (machinists and other operator personnel). Quality control is an important aspect of the company's operations. Taken overall, approximately 25% of AlloyCo personnel are engaged in design and management, another 25% in production and the remaining 25% in purchase and supply, accounting and human relations.

No major changes are expected in the composition of the AlloyCo workforce in the foreseeable future. Nevertheless the nature of the work is likely to change with a lot more of the work currently done in Australia being performed overseas. Because there is no more capital to invest, the company will need to 'operate smarter' with overseas sub-contractors doing much of the manufacturing work.

AlloyCo states that not only do sub-contractors in Australia lack the skills needed for the type of work required, but they also lack the incentive to develop them. AlloyCo does not believe there are many, if any, companies in Australia that currently have the requisite capabilities to do the work required – bending titanium requires special technology and processes. It is questionable, says AlloyCo, whether Australian companies would even have the machinery to do the job without substantial capital injection.

Australian subcontractors were also said to be less reliable and competitive than their overseas counterparts, for example, a job that would have a turnaround time measured in months in Australia can be completed by Chinese subcontractors in six or seven days. The AlloyCo spokesperson also noted that Chinese manufacturers can develop a copy of what his company produces in a matter of six weeks. AlloyCo has to concentrate on achieving superior quality and durability in its products in order to maintain a competitive edge.

Knowledge and skills required

Generally, with regard to qualifications: managerial staff have a degree plus some managerial training, engineering staff have trade qualifications plus advanced study such as associate diplomas and degrees, operators mostly possess skills learned on the job (high level hand skills can be required), and supply and accounting staff have accounting qualifications.

AlloyCo feels that many of the formal qualifications are too broad. Because of this, the company finds it necessary to look at subjects studied by an applicant in considerable detail in order to ascertain whether the person's formal qualification is relevant to its needs. This criticism applies to all forms of study including TAFE. An example cited was the Certificate in Production Engineering in which it was possible for a person to have studied subjects like art in preference to the mathematics essential to the work in which AlloyCo engages.

Currency of knowledge and skills is an important issue to the company. Many applicants are found to have neglected to update computer courses completed five years previously and are consequently badly out of touch. CAD-CAM, too, is an area which is rapidly changing and therefore in need of constant updating. The AlloyCo spokesperson would like to see government assistance provided to individuals to enable them to maintain currency of their knowledge.

AlloyCo would like to see incoming employees in possession of more than just basic level qualifications when they join the company. However, TAFE and schools do not seem sufficiently equipped to provide students with the higher level specialised skills the company is seeking. The company would like to see new appointees coming in with the skills needed to enable them to 'hit the ground running'.

Training provided

Literacy and numeracy has often been found to be a problem for production staff, more so for overseas born employees than those who are Australian born. Generally, production employees receive two to four weeks training on the job. Production of the club heads requires workmanship of a very high standard, specifications for the club heads being 'tighter than those used in aeroplanes'. New employees also spend some considerable time working beside an experienced employee to learn the highly specialised processes.

Graduates (especially university graduates) are said to come into the company highly knowledgeable in the theoretical aspects of their work but seriously lacking in practical application of their knowledge. 'We have to put old heads on young shoulders'.

Training for the future

AlloyCo was interested in the concept of adult apprenticeship and would like to see it promoted. But, it warns, precautions would have to be taken to ensure the scheme was not abused by employers treating it merely as an opportunity to obtain cheap mature-age labour.

The company believes there is a need for some specialised training in the forging of titanium – most of which is presently done overseas. In fact, it believes Australia has lost a lot of its 'craft' industries to overseas competitors because it has failed to keep them up to date with technological change. It notes that companies are not prepared to invest in capital equipment to accommodate technological advances, a consequence of which has been a shift of manufacturing to overseas. AlloyCo sends employees to Thailand to supervise its finishing operations in factories over there. It is currently looking for people with management skills to live in China and Thailand for this purpose.

About the company

CallingCo is a five year old company specialising in speech recognition software. This includes the development of speaker dependent software where the software is customised to an individual's voice, or speaker independent software where it can recognise any voice. Headquartered in Melbourne, it has offices in Sydney, New Zealand and Australia.

About the workforce

The company employs 40 staff in application development, computer programming, finance, marketing, management, training, computer telephony integration, sales and technical support. Staff working in computer programming, finance, training, technical support, marketing and management have bachelor degree qualifications and relevant experience, while sales and clerical and administrative personal do not have degree qualifications.

Any future development of the business may require the hiring of professional engineers to build the core technology program, and linguists and dialogue designers to modify the applications.

Knowledge and skills required

In the main, employees are selected for their relevant skills, knowledge and attributes. They also need to be team players and adaptable and flexible in working with others and with new technology. Because they are in a small organisation, staff are expected to be flexible and to be able to do a variety of tasks. They should also be willing to try their hands at different things.

Computer programmers

Computer programmers must have skills and knowledge of C++ programs, telephony integration, CTI hardware, telephony boards, and dialogic. They must also be able to understand how speech recognition works, and build the application. Although there is no prescription that such staff have special skills in speech recognition it is better for the individual and the company if these skills are already in place. Because building speech recognition applications is intensive work it also helps if computer programmers have a background in areas in which they have had to deal with stress and frustration.

Finance officers

Finance officers require the standard financial skills, knowledge and experience required of company accountants. The CEO who is an accountant and a CPA also has 20 years experience in the accounting area.

Marketing officers

Marketing officers require the standard skills, knowledge and experience needed to market products. However, they must also understand the technology that is used in building the speech recognition application so that they are able to market this to prospective clients.

Trainers

Employees involved in training need experience and expertise in technical training. They need product knowledge of the company's broad range of products and an ability to decide on the knowledge that will be required in order to provide training in new areas.

Sales personnel

Sales personnel need an understanding of telephony and the technology on which company products are based. Current personnel come from the major carrier Telstra or Orange.

Technicians

Technicians require skills to be able to deal with the various company products.

Corporate Services personnel

These employees require clerical and administrative skills, and the experience to run an office.

Training provided

The training that is provided for technicians at CallingCo mainly deals with speech recognition technology. These courses are run by vendors who provide training in Nuance technology. There is also currently a Language Technology program available for those who want to enter the area.

Future training

It is envisaged that vendors would continue to provide the training and that the employer would meet the costs.

About the company

CellGrowCo is involved in the development, production, application and commercialisation of naturally occurring and insulin-like growth factors and recombinant variants some derived from cheese whey. Its major clients are bio-pharmaceutical or pharmaceutical companies that use large scale cell culture to produce cell-derived protein products such as therapeutics, vaccines and antibodies. The company both develops human pharmaceutical products, and supplies growth factors and associated reagents to domestic and overseas researchers in universities, institutions and companies. First established in 1988 as a joint venture between the CSIRO (the Australian Government's Commonwealth Scientific and Industrial Research Organisation) and Adelaide University, the company at one stage was the commercial arm of the Co-operative Research Centre (CRC) for Tissue Growth and Repair. In August 2000 was listed as a public company on the Australian Stock Exchange. Over time CellGrowCo has established cooperative activities with Nestle, Mayo Clinic, International Diabetes Institute, PrimGro Pty Ltd, TGR BioSciences Pty Ltd and OSI Pharmaceuticals and Adelaide University. It has a site in Adelaide.

About the workforce

CellGrowCo employs just 85 workers. In the main the company employs workers with tertiary level bioscience qualifications.

In general scientists are biochemists, [molecular and cellular biologists]. The inaugural managing director and managers of the cell culture, drug development and quality assurance divisions have doctoral degrees. The manager of the biotechnology reagents division has two degrees and 30 years experience in the field. Other managers have science degrees. The business development manager has a masters degree, the Chief Financial Officer has an MBA. The Corporate Services Manager has degrees in accountancy and economics and an MBA. Of the scientists, 28 have doctoral degrees and 20 have honours or ordinary bachelor degrees. There are 8 researchers who have double degrees. Production technicians also have science degrees.

However, managers understand that graduates who come straight from university will need time to get acclimatised to an operational environment in which they will be required to apply problem-solving skills and work independently to devise solutions to day-to-day problems that arise. It is imperative the new staff understand that they must work to internationally recognised quality standards of good manufacturing practice, good laboratory practice and good clinical practice.

Knowledge and skills required

In the main, the company has recruited workers with higher level and ordinary degree qualifications in areas which are appropriate to their roles, and has used the formal qualification as a measuring stick for intellectual capacity, aptitude, and fundamental and or advanced understanding of science and scientific applications. Their practical experience includes research and clinical work in CSIRO, universities and other pharmaceutical companies. It is also important for those involved in business development activities to have a fundamental

understanding of science so that they can communicate with Research & Development staff from drug companies.

It is also essential for CellGrowCo to maintain currency of its knowledge of developments in the industry. For this reason some researchers are involved in a continual scanning of the scientific publications for research findings which will either help them to improve their processes or decide whether any joint ventures with other companies will yield some advantage. This is also a valuable process for checking for any breaches of patent regulations.

Because all employees need to work with people it is very important that they develop skills that will help to achieve group or team goals. This means that they need to be prepared to support their colleagues with practical assistance when required, contribute to a harmonious environment and be mature enough to accept team decisions even if these conflict with their personal views. They should also be able to admit mistakes or failure if something goes wrong.

It is also important for workers to have good communications skills to enable them to get their message across in a clear and concise manner, both in written reports and as presentations to meetings. To do this they need to have a sound understanding of the knowledge they are trying to convey to others. Employees are also required to have problem-solving skills which will enable them to work independently. The company wants its workers to be able to take responsibility for a project and see it through to conclusion.

Training provided

In the main, the company has hired university graduates and trained them in company-specific applications. For the majority of employees this training has focussed on skills development in human resource development areas such as negotiation skills, performance management, principles of adult learning, team work and marketing. Managers have had training in project management, problem solving and decision making and entrepreneurship. For those in production, training has also focussed on improving on-the-job techniques including operating procedures, and developing and maintaining high standards in laboratory practice, manufacturing practice and clinical practice. There has been training focussed on how to run fermentation processes, statistics, and software.

Training for the future

Training plans will need to be adapted according to increases or decreases in demand for company products. The company will continue to recruit workers with appropriate formal qualifications, and will continue to provide company-based or identified training in the areas previously described. However, it will also adapt its on-the-job training to ensure that workers are kept abreast of changes in technology and techniques.

Because all workers are encouraged to enhance their knowledge of scientific processes and business operations, the company has a training budget which funds the provision of required in-house or external training. Training is also based on identification in individual development plans of the skills and knowledge workers request or are required to develop.

The training budget is also used to subsidise individuals who wish to upgrade their formal qualifications in relevant areas. Four hours per working week is provided for workers to engage in this type of external training. If workers are successful in gaining these qualifications the company meets 60% of the cost of courses. If four hours are not sufficient for workers to attend courses they are expected to make up their work time out of normal hours. Currently, individuals are engaged in upgrading qualifications in formal marketing, accounting, master of business administration, and science.

About the company

CompuHealthCo is a small Melbourne-based company that designs computer-based medical monitoring and diagnostic equipment. It was established in 1987. Its Head Office is in Melbourne and it has a service facility in Sydney and Sales and Service facilities in USA, Singapore and Europe. In the late 1990s it won the Governor of Victoria Exporter of the Year award and the Victorian Premier's Award for Technological Innovation in the Small Business Awards. It has also won two contracts to supply the United States Space Agency with monitoring equipment to be used for the physiological monitoring of astronauts. The monitoring equipment attaches probes to people's heads to allow doctors to diagnose sleep, neurological and epileptic disorders.

About the workforce

The company employs 90 workers with diverse educational backgrounds and experience. There are 17 managers, 23 research and development engineers, 20 electronic technicians, 15 sales support personnel, 5 accountants and 10 logistics staff. Managers have a diverse range of experience and or qualifications. There are some who have no qualifications and some who have bachelor or doctoral degrees. Research and development engineers have bachelor or doctoral degrees. Electronic technicians have VET certificates or diplomas in the areas of soldering, repair and electronics. Sales and sales support personnel have a wide range of qualifications. Accountants have bachelor degrees and CPA qualifications. Those in logistics support have diverse experience and background, some have no qualifications but appropriate experience, others have VET qualifications. Managers tend to have degree-level qualifications.

Knowledge and skill required

Managers at CompuHealthCo require relevant knowledge of and experience in their field of expertise. They need to have an understanding in how the business is run, and be able to interpret financial accounts. Although some managers may have a Master of Business Administration degree which will help them understand principles of business operations, in general, managers are expected to have picked up knowledge of business administration during their employment. Managers need to be able to demonstrate leadership and vision in deciding goals, objectives and measures of performance.

Research and development engineers are expected to be to be knowledgeable about current developments in their fields of specialisation.

Electronic technicians are required to be able to assemble and test sleep diagnostic equipment. They need to be able to identify the components of the equipment, solder the components, test the functioning and then apply final assembly and packing procedures. Technicians need also to be able to apply relevant re-work troubleshooting techniques to identify problem components and develop and implement remedial action. They also require an understanding of occupational health and safety. Technicians need to be flexible in their approach to work and must be able to work well with colleagues and apply themselves diligently to the tasks that need to be done.

Sales and sales support personnel need selling skills and the financial skills to meet budgets.

Logistics or warehousing personnel need to have an understanding of purchasing processes and purchasing systems, stock movement and how the sales process works. They need to be able to interpret information on what has been sold. They also require the interpersonal skills to be able to communicate with senior managers. Because they will be responsible for training all workers about safe work practices and occupational health they need to be able to train workers on the factory floor.

Training provided

In the main, the training that is provided revolves around the tasks people need to do their jobs.

Future training

The mix of skills and corresponding training requirements is only expected to change if the business grows and develops. In such a scenario the company will be expected to increase its automation of processes. Although such activities will require more technicians and process workers, the number of logistics personnel would be expected to remain stable, and highly paid R&D personnel and technicians with superior skills and knowledge would be retained for troubleshooting activities.

Different training would also be required for technicians who are to build the prototypes developed by R&D specialists. For example, faster and more miniaturised components would require different processing capabilities. This would require technicians to develop different and more complex soldering skills, and new packaging techniques. Although process workers would be expected to apply 'go no-go' tests during manufacturing of circuit boards, there is no major expectation that they would have to undertake any formal training. There is also no expectation that warehousing or logistics personnel would require any different types of training to cope with any increased business.

Employer-funded training to take account of these new requirements could be provided through TAFE either at the worksite or at the college during work time.

About the company

EarCo has operated in the high-tech medical technology industry since 1981. It is committed to pioneering and advancing implant technology through worldwide clinics. The company has recently won a design award for its latest generation cochlear implant hearing device.

EarCo was the first company to introduce cochlear implants for adults and children, auditory brainstem implants, neural response telemetry and speech processors for recipients.

Although its corporate headquarters, manufacturing facilities and principal research and development centres are located in Sydney, Australia supplies a network of clinics, which provide support and care to about 50,000 recipients of EarCo's implants in 80 countries. There are also research and development facilities in Antwerp, Belgium, USA and Melbourne, Australia.

In 1995, EarCo was floated on the Australian Stock Exchange.

About the workforce

EarCo has over 800 workers worldwide. These include engineers, production workers, technicians, management executives, marketing admin, finance, IT, quality and regulatory, and human resource professionals.

In the main, typical formal qualifications of the scientists and engineers are bachelor of engineering, and masters in audiology and engineering. Other professionals in the organisation generally have a bachelor of business qualification.

Knowledge and skills required

The major skills required of engineers and technicians are highly specialised mechanical, electrical and software engineering skills. Production workers require well-developed spatial dexterity, good hand-eye coordination and precision skills.

Engineers and technicians mostly come into the company with formal qualifications (engineering, audiology, bio-medical engineering) and marketing and human resources personnel may have marketing/HR qualifications.

In selecting recruits, the company looks for appropriate university qualifications for those positions requiring theoretical knowledge, specialist skills, and demonstrated behavioural competencies required for each role. In addition, EarCo likes to hire employees who have integrity and initiative, and the qualities to enable them to work in teams, display mutual respect for others, and work in an innovative environment.

Training provided

Although the company hires employees who already possess qualifications for specific jobs there is a variety of off-and on-the-job training that is provided for, and available to employees. This includes training in information technology, quality systems and continuous improvement,

project management, communication skills, teambuilding, and negotiation skills. Training in business letter and report writing is also available. For those in technical positions it includes updating skills and knowledge about different technical systems to be used in the production of appliances. Although this type of training is mostly for those in technical positions, production workers also need training in applying technical skills. Supervisors and managers receive training in supervision, general management and project management, while team leaders receive leadership training. Production workers are also provided with on-the-job training to develop any new skills required for manufacturing appliances.

Future training

Future off-the-job training will depend on the mix of skills that are available for specific projects, the need for management development training, and specific skills technical training. In particular, engineers will have to maintain and update their skills and knowledge of new technologies. Such training may involve short external courses (say one or two days full-time) or more in-depth programs (say 10 days full-time). Also important in the future will be the development of potential managers from within the company. Such courses typically run for one or two days full-time. All courses would be delivered off-site and be paid for by the employer.

Although there will be no major changes in the on-the-job training that is provided, the company may introduce a rotation system to enable employees to develop a wide range of company-specific skills, and a buddy system where experienced workers pass on skills to less experienced workers. The company is also hoping to implement a graduate program where new graduates will be provided with focussed training to enable them to progress more rapidly through the company.

ElectroChargeCo

About the company

ElectroChargeCo is an electronics engineering company at the forefront of its field in a fast developing area of electronic technology. Formed in the late 1990s, the company originated from research into electronic technology conducted in partnership with the CSIRO. The company aims to become the dominant player in the world market for the particular electronic devices in which it specialises, a market which it forecasts could exceed \$US2 billion by 2006. With only a handful of manufacturers of these devices in the world and ElectroChargeCo the only one in Australia, the company is in a very competitive position to secure a major place in the world market.

In its present operations, ElectroChargeCo continues its research into the underpinning technology, but as well, now custom designs the devices, manufactures them to customer specifications, and provides follow-up service to customers.

Currently, the company is still deeply involved in developing its products and associated operations. Even so, the split between the functions of research and development, production, and service is fairly even with approximately one third of the company's effort being devoted to each. As the company continues to develop, its operations will become more commercial with additional emphasis on production.

ElectroChargeCo presently operates from two locations. Its primary location is its plant in Australia where all research and manufacturing is conducted together with some sales operations. The second location, in USA, is devoted solely to marketing of its products. Almost all of the company's production is exported – because the goods in which the company's products are used are largely designed and manufactured in USA and Taiwan. The US based office plays an important role in consulting with design people from the companies with which ElectroChargeCo trades.

About the workforce

At the time of interview, the ElectroChargeCo workforce totalled 33 employees. These employees could be identified with five broad company classifications: senior management, administration, research/engineering, production/manufacture, and sales. However, many employees were also members of what the company referred to as 'cross-functional teams' in which, for instance, employees might work both in research and production. For example, a research engineer who developed a product or process might also spend time in the production section implementing it.

As could be expected of an organisation engaged in cutting edge technology research, many of the company's staff are highly qualified:

- The senior management personnel (what the company refers to as its 'executive team') has a variety of qualifications, mostly at degree level. They include: two mechanical engineers, a physicist, an electrical engineer, a chemist (PhD), and an accountant. Several have also undertaken management studies such as Master of Business Administration.
- The three administration staff generally have basic training in administration functions, one is studying towards a qualification in human resource management.

- In the research and engineering section, there is a laboratory manager who is currently studying towards a degree in chemistry, a graduate chemist, two graduate scientists. There is also a laboratory technician with a chemical engineering background and experience in laboratory work.
- In the production and manufacture section, known as the applications department, there are eight production personnel, all of whom are qualified fitters. They work as fitter-operators, not only operating the production equipment but also maintaining and repairing the machines they work with. Within this department, there are seven personnel with electrical/electronics engineering qualifications.
- The sales staff are mostly technical people, able to talk in technical terms with customers as well as promote sales of the company's products. Of the three in Australia, the vice president of sales has a marketing/sales qualification, the business development manager has a degree in science, and the third who works under contract, has an electrical engineering qualification.

Workforce projections suggest that the number of employees will increase. These will mainly be in the areas of production and sales as the customer base and production output increase. In the production area, personnel recruited will generally be fitter-operators.

The company would also be considering appointing a supply-chain manager to carry out production planning, oversee production processes and co-ordinate materials purchases, and a manufacturing scientist who would work both with production and engineering personnel overseeing quality control and auditing products and processes. As research continues, there was also a possibility that additional research personnel would be employed.

Knowledge and skills required

The ElectroChargeCo spokesperson identified one of the most frustrating difficulties experienced in recruiting suitable employees as being that of determining what graduates had actually covered in their training. It was common to find that a large proportion of training for people with qualifications in electrical/electronic engineering was directed towards computer-related technology.

One of the biggest problems we have is trying to decipher what applicants have actually done in their training. A lot of people coming through with electronics certificates have actually studied more in computer software electronics. We have found it hard to determine what their skills and knowledge are before we actually interview them. Many know a lot about computer-related technology but can't work with a circuit board. Out of 30 applicants for a position, we might interview six, and out of that six, only find one that is suitable. To minimise this problem, we really have to spell out in detail what we want.

Training provided

The company has found it difficult to recruit people with adequate knowledge and skills in the area of its specialisation and almost impossible to find people who are familiar with the particular type of device it researches and manufactures. However, it recognises that, because it is the only company in Australia dealing with the devices, there is not much point in arguing for provision of specialised training in the short term.

The biggest difficulty we have is in getting people with the basic electrical qualifications who have adequate knowledge and skills relating to [our devices]. While electrical qualifications cover the basics of [the devices], there is not any course in Australia which provides in-depth knowledge and skills in the area of [our specialisation]. For this reason we always have to provide in-house training in the electrical engineering side of our

operations. We accept that we just have to get people with good basic qualifications and then train them.

Training for the future

While ElectroChargeCo would like to see training related to its specialisation available, it recognises this is not feasible while its sector of the industry is in its fledgling stages. In the mean-time it would like to see training applicable to the general technology related to the devices it manufactures retained and enhanced in the curriculum. More importantly, it would like to see any such training a job applicant has completed clearly specified in the applicant's record of training.

Any specialised training in technology directly related to the devices it manufactures, whether provided by the employer or a training institution, would best be provided on a part-time basis. This would be necessary to allow the employee to complement the training with specific on-the-job experience. As the employees recruited by the company are generally high in ability, on-line training would also be an attractive option. The company would like to see a mix of off-the-job and on-the-job training.

Although ElectroChargeCo does not bring in outside trainers at present, it is something it will be considering as it formulates its training plan for the future. The external trainer could be either a private provider or TAFE. Current thinking was that a private provider might be able to provide greater flexibility in provision of the training, particularly regarding adapting to employer requirements such as fast-tracking learning that was needed urgently.

Like some other companies interviewed, ElectroChargeCo held the view that training which primarily benefited the employer should be paid for by the employer, and training which primarily benefited the employee should be paid for by the employee. The company also felt that government subsidies should be available where the employer provided the training.

About the company

EnergyCellCo is an Australian company with two facilities in Melbourne, Victoria. It uses Solid Oxide Fuel Cell (SOFC) technology to develop energy generation products, namely alternative electricity. The company is a public unlisted company which also receives funding from the Australian Federal Government through the Research and Development Start program.

About the workforce

EnergyCellCo employs about 157 workers including 30 engineers, 30 scientists, 15 draughtsmen, 25 specialist technicians, and 57 support workers including, technicians, accountants, personal assistants, a human resources manager, information technology personnel, a quality manager and occupational health and safety managers. Engineers and draughtsmen generally work in the company's operations department, while scientists and technicians work in the company's technology department.

Engineers and scientists generally have bachelor degree level qualifications. However, ten of the scientists have doctoral degrees. Draughtsmen generally have a TAFE qualification or experience in the field. There are also draughtsmen who have done draughting as part of an engineering degree. Technicians generally assist scientists in the production, manufacturing, or manufacturing and development areas. In the main, these workers do not have formal tertiary qualifications, but most have completed secondary school at the year 11 or 12 level. There are isolated instances of technicians having a diploma qualification.

Knowledge and skills required

Although the skills, knowledge and formal qualifications required of EnergyCellCo employees vary according to their occupations, all employees are expected to be good team players and to keep current their knowledge of their particular fields. Engineers, scientists, technicians and quality assurance personnel are expected to work in cross-functional and project-based teams. To help achieve their team goals they need interpersonal skills to get on well with others and commitment to the work of the team. .

Project leaders oversee the work of these teams, conduct meetings, and write reports. They need to be able to think about the work of the team, and to ask appropriate questions of senior management.

Engineers, scientists, accountants, and human resources personnel are required to have the formal tertiary qualifications and experience for the tasks that they have been employed to do. Technicians are given on-the-job training to enable them to work as assistants to scientists in the technology department.

Draughtsmen are expected to have experience and understanding of 3D-CAD technology and SolidWorks. They must be able to understand and produce designs and drawings and take instructions. Managers of draughtsmen are expected to have the necessary managerial skills.

Corporate support personnel are required to have the specific skills, knowledge and experience that apply to their particular roles in the organisation. For example, in addition to specific accounting knowledge, accountants are required to understand and apply legislation for Fringe Benefits Tax and Goods and Services Tax. They also need to be able to monitor the company budget so that they can inform managers about the state of finances. The Quality Manager requires an understanding of quality assurance processes so that when the company applies for accreditation the right documentation and processes are in place. The Human Resources Manager needs to understand issues about human resource management and workplace relations. The Occupational Health and Safety manager needs to keep current with safety issues. Other workers also need to have a working understanding of workplace health and safety.

When its products have been sufficiently developed the company will employ more production workers. Production workers will be expected to follow instructions and understand the quality process.

Training provided

Training for employees at EnergyCellCo is delivered in a variety of areas including report writing skills, supervisory skills, project management, software knowledge and application, and 3D-CAD. Currently, one employee is employed as an instrument technician apprentice. Training is done in company time and is paid for by the company. The company also helps workers to complete their formal tertiary qualifications.

Future training

There are no current plans to alter the type of training delivered at EnergyCellCo. The company has no particular preferences as to who should provide the training and would bring in specialist trainers if it feels they are required.

About the company

FanTechCo is an engineering research and development company working in the area of fluids technology. Specialising in fan technology, the company has developed a revolutionary new fan, which not only delivers much higher air pressures than conventional fans, but does so with greater efficiency. It is expected that the fans will have wide application in industrial and domestic markets.

Formed as an unlisted company in 1995-96 FanTechCo currently operates purely in a research and development capacity from a single location in Queensland. However, in the near future the company plans to commercialise its inventions by entering into a manufacturing partnership with a consortium of companies based in South Australia (including ToolingCo, also studied in this report). In effect, this will result in the company having two operating locations. The company has plans to export its products and technology but, at this stage does not have any plans for overseas manufacture. The long-term plan is to have the Queensland site devoted purely to research and development with the South Australian site taking on manufacture, marketing, sales and general management.

FanTechCo engineers do as much of the practical work as their resources allow, but prototypes are manufactured (in nylon) by another South Australian company directly from computer-based 3D drawings and sent back to Queensland for evaluation.

About the workforce

In its current R&D phase, the company employs four people – two directors and two engineers. The engineers are ‘jacks of all trades’, involved in all aspects of product development from design through to laboratory work and product testing. FanTechCo contracts some work out, such as the manufacture of prototypes previously mentioned and some of the engineering draughting.

The engineers currently employed by FanTechCo both come from fitting and machining backgrounds. One has a diploma in engineering, the other, an advanced trade certificate. The company looks for a broad range of knowledge and skills and adaptive resources in its development engineering employees to enable them to deal with innovative concepts and the practical challenges they present. Their work includes making special devices, testing them, collecting data and conducting analyses of test results.

The two managers come from diverse backgrounds, neither of them having a formal mechanical engineering background. The inventor of the new fan technology is, interestingly, an osteopath who through pursuit of an interest in hovercraft developed the concept and in doing so became a self-trained engineer. He does not have any formal qualifications in engineering. The other manager is a formally qualified computer engineer. Neither of the managers have yet undertaken any formal management training. While it is accepted that management training could be beneficial, the pressure of work to date has precluded them from doing it.

When manufacture of the company’s products commences it is expected that a further five or six employees will be needed for production operations – the remainder of production employees needed will come from the SA companies participating in the partnership, which currently have

under-utilised workforces. Eventually, FanTechCo hopes to operate as a stand-alone company with its own workforce.

Workforce projections for the future suggest that in two years the company would be looking for an engineer with a university degree in fluid dynamics or a related field – to take some of the load off the manager/fluid dynamics expert, plus an additional skilled technician in the workshop. The company will also require an employee trained in office administration to handle the growing amount of office work. At the present time all four staff are ‘cross-trained’ that is, multi-skilled, enabling them to share the workload of their colleagues.

Training provided

The engineering employees have had to be given extra training in aspects of their work that they would not have come across in their previous trade environment – particularly testing procedures. Because the impellers employing the FanTechCo principles are used in pumping both water and air, this has entailed a ‘steep learning curve’ for all concerned. The company has not actively sought training in this highly specialised area, having been able to provide all the new knowledge and skills required from within its own resources. However as new demands arise, outside sources of training will be considered.

Regarding the more conventional facets of their job, both engineers have undertaken external training in CNC machining and CNC programming and one has learned sufficient CAD-CAM knowledge to enable the company to prepare its own 2D machine drawings for use in the workshop. The more complex major prototype design work, however, is undertaken by the company’s contracted design draughtsperson who works at the company’s Queensland location. With the expansion expected in the future, the company would be looking to employ a full-time draughtsperson.

Training for the future

FanTechCo has not, at this stage, sought any training applicable to the specialised aspects of the company’s operations. However it indicated that TAFE courses in fluid dynamics and testing procedures would be of interest. Testing procedures and report writing were items of particular importance:

We are continually having to go back to text books ourselves to find out the right way to do it [testing]. We have to have our test rigs set up to international standards, so a course covering international standards as well as Australian standards would be valuable. When you start publishing results of experiments and will be quoting figures to overseas people in say, Europe or the US, you have to be using an ISO standard.

Training in report writing would also be useful. I recently had to get on the internet and write research reports for a large US company. Good report writing is important to the image of the company.

As a company that will be engaged in promoting and selling its products on world markets, training in marketing is seen as a future need:

Marketing training and experience is necessary, but we presently have a guy down in Adelaide who is part of the consortium [we have entered into partnership with] who will handle that for us. [One of the managers] can go overseas and sell the idea and the technology, but to actually close the deal – that’s been the hole in our organisation up until now. We’ve been close to signing up some large licences a couple of times, but they’ve fallen through at the last minute.

FanTechCo expected to encounter some difficulty locating companies that could provide the skills and resources needed to develop the concept into a working product. In fact, the South Australian consortium of manufacturing companies they co-opted for the work (leading to a working partnership) turned out to be a world class organisation, already doing work for international companies like Wahl Clipper, Hewlett Packard, IBM, and in Australia, Holden. Not only that, the company believed it could do the work 5% cheaper than Chinese competitors.

FanTechCo is still in the embryonic stage. Its next goals are to get people on its management board who have financial expertise and then, in six to twelve months, to seek listing on the stock exchange as a means of raising capital. The company would then be looking to employ someone with finance qualifications.

About the company

FibreOpticCo is a company specialising in the areas of Information Technology and Security. The company is involved in researching new concepts and developing them into practical products; manufacturing the products; and installing, maintaining and servicing them. Initially the company was predominantly focused on research and development. More recently it has shifted towards manufacturing and marketing the products developed. The technology the company specialises in is capable of being applied in a wide variety of fields. For example, the company has been researching the application of its technological ideas to a device for weighing moving vehicles travelling at high speeds (up to 100kph).

Operating from a single location in Victoria, the eight year old company develops and manufactures its products in Australia and markets them locally and overseas. Approximately 90 percent of the company's products are sold overseas.

In 2002, FibreOpticCo experienced a substantial increase in business and expects more in 2003. However this rate of increase will not be sustained. The increase is a consequence of the shift from a research and development orientation to one that is marketing products in an overseas market. The degree to which the marketing side of the company expands depends on how well the sales go in overseas countries (which include USA, Korea, Japan, Singapore and Great Britain).

About the workforce

The FibreOpticCo workforce currently consists of twelve employees comprising: three managers, three production staff (who assemble the products, test them, 'burn them in' and pack and dispatch them), one clerical staff member, three scientist/engineers (who are primarily engaged in research and development, product development, and product improvement) and two sales and marketing personnel.

The company also employs external consultants on a casual basis.

Knowledge and skills required

Knowledge and skills of particular value to the company include physics (which provides a particularly good background for much of the work the company specialises in), electronics, optical communications, manual skills and computer software (FibreOpticCo writes a lot of its own computer software which is used in signal analysis and control of the systems it designs). The spokesperson for the company was critical of the decreasing importance attached to physics throughout the education system, from schools through to university.

If we could get good, skilled technicians, trained in optical fibre assembly work, we would bring them in, because they would be faster to get up to speed. But because they don't exist, we recruit people with good eyesight and attitudes and nimble fingers and train them ourselves

With the shift towards greater emphasis on marketing products, FibreOpticCo anticipates some difficulty in finding marketing and sales personnel who have an adequate understanding of the technology involved in the products. Past experience has shown that it is best to find a person who is technically trained and then provide them with the necessary training in marketing. It is easier and quicker to train a technical person in marketing than to train a marketing person in the technology. In dealing with other countries the company feels it is better to use marketing personnel recruited and trained in the countries concerned rather than attempt to train Australian personnel to deal with idiosyncrasies of overseas markets and cultures. FibreOpticCo has used the services of Austrade in developing its overseas marketing contacts.

Training provided

Currently, the majority of employees have technical qualifications such as Bachelor of Engineering, Bachelor of Science and Diploma in Electrical Engineering. However as outlined in the next section relatively unskilled people will also be employed.

The clerical employee does not have any full qualifications, but has done training relevant to the job (such as MYOB and other software applications).

FibreOpticCo conducts in-house training for its employees. Some of this training is on-the-job and is supplemented by classroom training commonly consisting of a series of specialist lectures for one and a half to two hours each afternoon over a period of four to five days. In this classroom training, one of the company employees gives in depth lectures on some aspect of the company's operations, such as product development or how particular products operate. Employees in training also accompany other employees into the field as observers, to learn the processes involved in installation and commissioning work.

Training for the future

Although the company is currently using employees with diplomas and degrees in production work, this is a legacy of the intensive research and development orientation of the company's origins. Future recruits in this area will only be required to possess lower level qualifications. FibreOpticCo will provide the necessary training for production workers.

As the company develops, the pattern of qualifications across the workforce will change. The trend will be towards a highly educated top end with high level qualifications gradually extending downward through management, control, supervision, and R & D.

In recruiting future employees FibreOpticCo would like to see applicants presenting with the following qualifications:

For employees expected to have a degree, the company would be looking for a degree in engineering and/or physics. An important component of such a degree would be training in opto-electronics. In the context of the company's operations, opto-electronics refers to the application of fibre and laser optics rather than optical communications processes used in the communications industry. Ideally, the degree should consist of a broad three year engineering/physics course plus a specialised fourth year. It should not consist of a truncated course which only makes people useful in the company's particular discipline.

We use fibre optics or laser optics, these are the things that are important to us. The laser is our basic optical tool. It is a technically complex area – a bit of a boutique technology which lies outside of the communications area. We use the technology in such a different way that, if we get an experienced Telco employee, there is a substantial amount of training necessary.

For employees expected to have a lower level qualification [e.g. AQF III or IV], FibreOpticCo would be looking for a qualification in engineering plus additional study in opto-electronics. Ideally, the company would like to see this extra study consisting of a six month equivalent-full-time course with training provision shared by TAFE and the employer. It would be best if this training could be undertaken part-time while working in an opto-electronics environment. At the time this study was conducted, the company spokesperson was unaware of any course of this nature available in Australia. He suggested there may be courses available in Europe and USA which are currently leading the way in this field.

FibreOpticCo believed the provision and cost of training should be shared by the government and the employer: the government providing general training through TAFE and the employer accepting the responsibility and cost of providing company-specific specialised training.

About the company

FinishesCo is an Australian company that has developed a process by which high quality metallic finishes can be applied to virtually any solid surface. Finishes including bronze, brass, copper, and stainless steel can be applied to objects formed from a variety of materials including concrete, custom wood, plaster, ceramics, metal, glass and perspex. In the process, a liquid containing the required metal is applied as a veneer to the surface of the object to be coated.

The company, which has been in existence for six years, operates nationally and internationally from a single location in New South Wales. As part of the licensing process FinishesCo provides training in the application of the technology at its New South Wales plant.

The company's operations mainly involve on-going research and development of the technology, some manufacture of the materials used in the coating process, licensing of the use of the process and products all around the world, and small-scale production of coated objects. FinishesCo does not manufacture large quantities of the raw materials used, choosing instead to sub-contract this work to other suppliers. The company states that 99% of the materials used world-wide are produced in Australia. The company also provides training after-sales service to its clients.

Although FinishesCo does some of its own product testing most of this is undertaken by outside agencies including CSIRO, James Hardy and chemical manufacturers. Testing by outside agencies, which operate independently of the company, is seen to be advantageous from a sales standpoint.

About the workforce

At the time of interview, FinishesCo employed 12 people, all of them at its NSW plant. Five of these employees were engaged in administration and sales, the remainder in development and production. An additional employee was about to be taken on as described below.

Administration and sales employees mostly come with a background in sales, administration or in some cases, IT. None have degrees, some have certificates in IT. Production employees have backgrounds in relevant practical skills, in particular, woodworking and spray painting although none have formal qualifications in these areas.

The company hopes to see manufacture and application of its products double over the next two years. Recent increases had already led to one additional employee being appointed several weeks before the interview for this study and another person was to be appointed to sales in the next two weeks bringing the total to 13.

Knowledge and skills required

Knowledge and skills looked for when recruiting production personnel include an artistic background or ability, good hand skills, and background and ability in spray painting.

Training provided

FinishesCo employees are not required to undertake formal training. Because the process is so unique and specialised, virtually all of the training that production employees receive is provided on the job. It is unlikely that the processes would ever be taught outside of the company. A few years back, the company did try TAFE training in spray-painting for its employees who were engaged in spray-painting work. However, from a company standpoint, the training was not very effective. What the trainees learned was far broader than what the employees work involved, to the extent that '90% of what they learned could not be applied.'

Any external training that would be undertaken by employees would most likely be for staff engaged in marketing and sales. Company training in the products and processes is also provided for licensees of the technology, who come from overseas as well as Australia. The in-house training program employees and licensees take is normally of about two weeks duration.

Training for the future

FinishesCo did not anticipate any major changes in training in the next few years other than to accommodate increased output. Any changes that were required therefore were likely to be either in the area of sales and marketing, or in production to support increased mechanisation of the processes used. Consideration would be given to sales and marketing training offered by TAFE.

In sales and marketing, the company would prefer to bring people in with proven skills rather than employ either untrained people with a view to training them, or trained people who did not have experience.

The company would continue to provide on-the-job training for its employees, and for licensees learning the process. However, as the products and process are now well established, no real need to change the training is envisaged.

FinishesCo would not be looking for any additional qualifications in its workforce in the immediate future. 'We don't need formally qualified people at this stage.'

About the company

ScanningCo is an Australian company based in Melbourne and is listed on the Australian Stock exchange as a biotechnology company. Its technology can be applied to medicine, science and industry.

ScanningCo designs and manufactures imaging devices and associated products to be used in medical examinations. The company aims to 'make available new procedures with which clinicians will be able to deliver better service to their patients...and to ... eliminate the pain and delays associated with biopsies'. Its ability to design and manufacture these products is based on their optical-fibre technology which allows the miniaturisation of high-magnification microscopes able to be held in the hand and inserted into body cavities.

The company has developed a hand-held scanner, which allows clinicians to examine a diverse range of skin conditions including skin cancers, sun damage and inflammation. This scanner can be used by the pharmaceutical industry to monitor the effect of skin therapeutics, and by the cosmetic industry to investigate the effects of skin product interactions with living skin.

The company also plans to develop other scan heads for examination of other parts of the body, including the colon, rectum, mouth, throat and nose. The scan heads will also be used for orthopaedics.

ScanningCo has recently entered into an alliance with a leading Australian pathology and analytical services group.

About the workforce

The head office, research and development, and manufacturing branches of the company are located in Victoria. ScanningCo has a subsidiary in Milwaukee, United States. The company employs 40 workers including managers, engineers, a scientist, accountants, technicians and clerical staff.

There are six managers who are all tertiary qualified with degrees either in pharmacology, physics, accountancy, science or biochemistry, and 17 engineers with engineering qualifications at bachelor degree, masters degree or doctoral degree level. The company also employs two accountants with accounting degrees and six technicians with certificate level qualifications in electronics and advanced or basic trade qualifications. There are five clerical support workers who have office experience and either Year 12 or Year 11 qualifications.

Knowledge and skills required

Although the knowledge and skills required for ScanningCo employees vary according to their roles in the organisation, all employees are required to have the formal qualifications and experience necessary for their particular jobs. For engineers, scientists, and accountants this means appropriate tertiary qualifications, and for technicians and tradespeople it means appropriate VET certificate, diploma or trade qualifications. Clerical personnel need to have completed secondary schooling at the year 12 or year 11 level. All employees are required to have

reasonable standards of literacy and numeracy commensurate with their roles in the organisation. They are also expected to have the ability and willingness to engage in further learning and development.

ScanningCo employees are required to have good interpersonal skills to enable them to work well within a group so that work can be completed in a timely and sensible manner. Each member of a group is expected to contribute to the achievement of group tasks and to be able to 'fill in' for absentee group members.

ScanningCo employees are also required to have good problem-solving skills. This means that they need to be able to identify a problem, work out root causes and develop a solution. Having done so they are then expected to discuss the problems and their solutions with managers. ScanningCo also expects workers to discuss workplace issues with managers and colleagues in an open and frank manner.

Senior managers

Senior Managers at ScanningCo need also to have about five years experience in the field and a demonstrated track record of successful management. They are required to have formal qualifications in their areas of expertise, and people skills which will enable them to empathise with clients and employees.

Engineers

ScanningCo wants its engineers to have at least three years experience in the field, appropriate technical skills and knowledge, a track record of success, and formal qualifications in their areas of expertise. Of most importance are their technical skills and qualifications. Engineers need to be able to keep up with new technology (for example, software, new design methods, state of the art applications) and make sensible judgments about the use of this technology. They, too, need to be willing to develop and to fit in with other members of the organisation.

Scientists

Like the engineers, scientists at ScanningCo require at least three years experience in the field, appropriate skills and knowledge, a track record of success and formal qualifications. They must also keep up with the latest developments in their fields. The scientists also need to be able to work as effective members of teams made up predominantly of engineers and tradespeople.

Accountants

ScanningCo requires its accountants to have at least three years experience in the field, appropriate skills and knowledge, a track record of success, and formal qualifications. They must have knowledge of the Statutory reporting requirements for the Australian Security Commission, CPA (Chartered Practising Accountant accreditation), and knowledge of general accountancy, cost account book-keeping and management accounting. Accountants are also expected to keep up with developments in their field and to improve professional qualifications if required.

Technicians and trades persons

Technicians at ScanningCo must have the task specific abilities required to apply the skills of their trade or field. They also need good manual dexterity, the ability to read mechanical drawings and circuit diagrams, and the ability to operate manufacturing technologies and apply mechanical and optical assembly techniques. Technicians are expected to have an adequate level of literacy and numeracy skills.

Clerical support workers

Clerical support workers are required to have the task-specific abilities for providing administrative support for corporate activities. In the main, year 12 and year 11 qualifications are required for these positions. These workers need to have well developed computer key board skills, and be fast and accurate typists. They require good telephone techniques for dealing with internal and external customers, and the organisational skills needed to undertake normal administrative activities (for example, filing, mailing, paying accounts and receiving monies).

Training provided

The majority of the training provided for employees at ScanningCo is either on-the-job training for technicians and clerical support workers, or external management training for those in managerial positions. Such management training generally takes place in employer-paid residential programs.

Senior and line managers, engineers, scientists and accountants are expected to have already developed job-specific technical skills and knowledge. However if the company can see benefit from these workers being involved in further formal training then it considers subsidising the cost of the programs.

Future training

There are no plans to vary the types of formal qualifications employees will require. However, there may be increased training in the areas of intellectual property management , knowledge management, and business skills.

About the company

Established in 1998, SecuritySoftCo is a Melbourne based company specialising in computer software engineering and development, particularly, advanced security software. Working in close association with the University of London the company has developed a 'state of the art' security software application which is capable of identifying individual persons of interest (such as criminals or terrorists) within a crowd 'locking on' to them and automatically tracking their movements.

About the workforce

SecuritySoftCo currently employs 14 persons comprising, three directors, four consultants and a workforce of seven.

Occupational areas in which employees work include: management, computer programming, computer science, and computer engineering.

Qualifications possessed by staff include: Doctorate in Computer Science, Bachelor of Science, Degree in Electrical Engineering, Degree in Computer Science and Degree in Accounting/Management.

Over the next two years, SecuritySoftCo expects to increase its work force by eight to ten people, mainly in the clerical areas. Formal qualifications required of employees are not expected to change in that period. However the company expects to upgrade the existing knowledge and skills as new demands appear.

Knowledge and skills required

Specialised knowledge and skills required of employees developing the company's products focus particularly on software development. They include proficiency in Visual CC++, Java, ANSI C, Unix windows, Unix Lates, systems engineering and digital processing.

Training provided

The company does not envisage any significant changes in formal qualifications being required of incoming employees in the next two years. Skills and knowledge will be updated through ongoing training as the need arises.

Training for the future

With regard to training in the future, the company sees the Bachelor of Science and PhD in Computer Engineering as particularly suiting the needs of its very specialised operations. It would be desirable for incoming employees to have completed these studies or be close to completion upon their appointment.

It is envisaged that the training would be undertaken through a university. The mode of training delivery (e.g. full-time, part-time, day, evening, distance education or online) should be left to the discretion of the student. Cost of training should be shared by the employer, employee and government.

About the company

StrainGaugeCo is a Perth-based company established to detect structural fatigue in aircraft. Its technology can be used to monitor structures for stress and fatigue cracking both in solid and permeable structures. The system can be used to monitor 'in situ' and report on the condition of components in aircraft, marine vessels, industrial plant, large buildings and concrete structures. The technology can even be used to monitor components in operational mode. The StrainGaugeCo technology used is able to detect very small cracks in structures and can be safely used in places where there is a need to avoid electro-magnetic interference or accidental ignition.

StrainGaugeCo operates in domestic and international markets. It provides products and services for military aviation in Australia, USA, and Singapore. It also provides expertise and services to the Airbus consortium in Germany and France, and is involved in the provision of modifications and repairs to all planes in South East Asia.

About the workforce

The company employs 20 staff in Australia. Of these 14 are technical staff including assemblers, and 6 are in corporate support positions. The company also has two staff responsible for representing the company in the USA.

StrainGaugeCo mainly employs workers with already developed expertise and formal qualifications or accreditations in their specific fields. Apart from assemblers and clerical personnel who have high school qualifications, all staff have formal tertiary qualifications (including doctoral, masters, and bachelor degrees) in the areas of physics, mechanical engineering, material science, accounting, economics, business administration, law. One employee is a qualified fitter and turner and another has a TAFE certificate for laboratory testing. The quality assurance manager is licensed to Australian and New Zealand standards. Employees who are providing liaison support between client and technical staff also have commercial sales experience.

Although there are no plans to increase the number of employees or occupational mix there may be an increase in overseas staff numbers. There are no plans to alter the qualifications that are going to be required.

Knowledge and skills required

In the main StrainGaugeCo employs workers with already developed expertise and formal qualifications or accreditations in their specific fields. In fact, applicants for employment are first screened for demonstrated experience and formal qualifications.

In general StrainGaugeCo senior employees have high level expertise and experience in high level positions in their particular fields. One manager has 20 years management experience in commercial aviation, another is a retired air commodore. One of the US employees is a former assistant under-secretary to the USA Navy.

Accountants and those involved in corporate management positions are required to have an understanding of finances, commercial contracts, revenues, and costing. Project managers are required to have an understanding of how to apply market research techniques to identify suitable markets, prices and clients for their products. They also need to have an understanding of regulations that apply to insurance in particular markets and countries. The project managers also need to have strategic planning skills to enable them to make informed decisions about where they need to take the product, the cost that the market can bear or is prepared to pay, and the markets that will yield the most gains.

Senior managers in StrainGaugeCo also require an understanding of corporate governance and an ability to run the company so that it maintains its competitive edge. Managers whose role it is to run the commercial side of the business require public relations skills to raise capital for ventures and network with potential clients at special events. They require effective communication skills to maintain good regular communication with markets of interest, and to understand the needs of potential customers. In addition, they must be able to ask discerning questions so that they can relay accurate information gathered from customers back to technical staff at the company. These managers need marketing skills to promote the company via regular write-ups in trade and business journals, company web-sites, advertisements in the print and electronic media, and presentations at appropriate tradeshows. Commercial managers need to be committed to following up any leads that are established during their networking. In the main, their role is to constantly promote the company around the clock and around the world. They need to be able to deliver presentations both to potential customers, and to StrainGaugeCo technical staff. Potential customers will want to know what the company can do for their organisations, StrainGaugeCo technical staff will need to know what the customers are looking for.

In addition to suitable experience, formal qualifications and specific expertise in their own disciplines StrainGaugeCo engineers, scientists and technicians also need well-developed analytical and problem-solving skills to develop customised solutions for corporate clients. Because they are often required to meet and discuss client needs with senior managers from client companies it is essential that they be good communicators and listeners. It is also important for them to be professional in their dress, demeanour and behaviour, and alert and attentive in their interactions with clients. They must also be diplomatic and sensitive to confidentiality issues when discussing other peoples' businesses or organisations.

StrainGaugeCo employees need to be able to use e-mail, and Microsoft software packages including MS Word, Excel and Internet. If they are on the road talking to customers they are also required to send timely information back to the company. This means being able to operate laptop computers, and mobile phones.

Assemblers need to have very good manual dexterity and hand-eye co-ordination. They must be diligent, clean and tidy in their work processes and display a good standard of behaviour. They need to pay attention to detail and be willing to learn and are expected to stay in the job for at least two years.

Although the knowledge and skills required may change according to whether the company develops new markets, it is difficult to estimate the nature of these changes. For example, if the company decides to sell products and services to the mining industry it will need to employ people with relevant mining experience and qualifications, if it is going to sell its products and services to the rail industry then it will need to hire workers with other types of expertise and qualifications.

Training provided

In the main, StrainGaugeCo likes to hire staff who already have the qualifications and experience to do their jobs. Recruitment is based on individuals firstly having the required technical skills and qualifications, and then also being able to display the appropriate attitude. A pre-requisite for a senior manager in the company is an engineering degree. The company also wants employees who can convey a particular image to the outside world.

When employees commence their StrainGaugeCo jobs they are required to undergo on-the-job Occupational Health and Safety training conducted by their team leaders, and a one day off-the-job induction program conducted by the Quality Assurance manager. In induction training they are introduced to the components of the organisation, to 'contracting', and to the quality assurance system. They are provided with information on rules about e-mailing clients, purchasing procedures, and ISO 9001 standards. New employees are required to read a manual that details rules and procedures and are then tested on these at the end of the induction period. Assemblers are led through the manual by their team leaders who signs off their understanding of its contents.

Once induction is over new employees undergo a three-month probation period. During this time the employee is getting acclimatised to the organisation and to the way work is done. Although some mistakes are tolerated during this initial period, it is during the three months that the company makes a decision of whether or not to keep the employee on. The decision is based on whether the person is able to display the standards and qualities necessary to become a productive member of the organisation.

Most technical staff also attend a five day project management course delivered in house by the Australian Institute of Management. The aim of this course is to provide employees with a common understanding of project management and a baseline understanding of what needs to be done to meet quality standards. Employees who will be required to write reports are provided with a three-day report writing course also conducted by the Australian Institute of Management. Accountants and other corporate managers attend TAFE courses on commercial contracts, revenues, costings, and market research.

The company is prepared to help employees undergo extra training. However, it is the employee who must show initiative by indicating the motivation to do the training. The company will allow the individual to attend training during work time if need be, but the individual is generally responsible for meeting the cost of fees and resources for the course.

Assemblers are provided with on-the-job training through job rotation. This is to help them to develop skills in mechanical, electronic and polymer assembly processes, and to provide assemblers with a repertoire of skills. Technical staff are also taken outside of their usual work environment to visit job sites and clients so that they can see how things are done, and how the business process is applied including budgetary limits, project processes, and information flow.

There are also opportunities for staff to undertake higher duties which involve higher level responsibilities. These opportunities arise when employees are away and there is a need for someone to take charge of a project.

Future training

The company does not foresee any major changes to the off-the-job training it provides for its employees and will continue to provide training in project management and report writing. It will continue to allow employees to attend such training during work time.

There are also no major changes envisaged for on-the-job training for workers. They will continue to be given an understanding of the technology that is used, the products to be developed, business operations and client service. They will also be given an understanding of the needs of clients in different markets at home and internationally.

About the company

SunPowerCo is a publicly listed Australian company that operates domestically and abroad. Its main business is the design, manufacture, installation and service of renewable energy equipment. Its specific focus is on water pumping, purification and power systems in remote areas.

The company manufactures solar water pumps used to provide water for stock consumption and water filtration plants used to filter water for human consumption. Its products are distributed by agents. Solar pumps are distributed to Queensland, Western Australia and the Northern Territory and are subsidised by government rebates at the rate of 40% of the cost of the pump.

Although the company is 8 years old, it was publicly listed on the Australian Stock Exchange in 1999.

The company was established when three friends, a brick paver, a loans officer, and a stock broker, working at separate jobs, met with an inventor who happened to live next door to the stockbroker and decided to take his idea for renewable energy further.

About the workforce

The organisation currently comprises 20 employees, working in manufacturing, sales and marketing, research and development, and administration. The eight manufacturing workers are general factory hands who have received most of their training on the job. Accreditation of these employees is necessary if they are to install equipment over a certain size. If they do not have accreditation they obtain it from the local TAFE institute which provides a course. The majority of these workers have year 10 qualifications.

There are five sales and marketing staff responsible for selling equipment through agents. These sales and marketing staff have business and marketing degrees. There are three R & D staff who are qualified engineers with engineering degrees. There is a receptionist who is also the book-keeper, an accountant and a chief of operations. The chief of operations is responsible for finance, manufacturing and human resources issues. This individual has a degree in mechanical engineering. The accountant has an accounting degree and the book-keeper has year 12 qualifications.

Knowledge and skills required

The knowledge and skills required of Solar Energy employees varies according to their roles in the organisation. Those who work in manufacturing require mechanical aptitude for assembling and dismantling components, and experience in electrical and electronics and metal fabrication. They also need to be able to work autonomously (at their job interview applicants are asked to describe their experiences in working independently and self-managing their work). They are also expected to think of the company as one with which they would like to stay for the long term, one that believes in promoting employees to senior positions. For example one of the employees is a refugee from Kosovo who started out gluing components and is now wiring solar arrays and moving on to more complicated tasks.

The sales staff are required to have good interpersonal skills with the ability to communicate with agents about the sale of the company's products. They are required to have a passion for renewable energy and to have an understanding of the social, economic and environmental effects of implementing sustainable processes. Sales staff need to be able to fit in with current employees, operate in a friendly working environment, and be able to work effectively as a member of a team. This requires them to listen to other people's ideas, be ready to compromise or change tack when necessary, be open to new ideas and suggestions, and be able to close a deal. Sales staff are expected to have a good record in selling and setting up a network for improving and expanding the sales of the company's products.

Research and Development staff need to be creative and have the ability to apply this creativity to commercial production to reduce manufacturing costs, and make equipment more reliable.

Training provided

SunPowerCo's training has been strongly focussed on team building with a view to improving company productivity and profitability. An external consultant was hired to use a brainstorming approach to identify how effective teams should be structured.

SunPowerCo also believes in encouraging and supporting employees in their pursuit of training where the company stands to gain some benefit. It has paid for employees to attend English language training, and for one worker to upgrade his general fitting and turning and mechanical qualifications.

The majority of workers in the manufacturing area are also undertaking a traineeship in Renewable Energies while senior managers have been involved in time management and financial management training.

Training for the future

At this stage, there are no plans either to expand or decrease company training effort for the future. While plans are currently in place to increase the manufacturing workforce, the company does not intend to increase senior management or sales support staff.

About the company

ToolingCo is an engineering company specialising in plastic injection mould making, which is the design and production of moulds used by industry to manufacture moulded plastic products (as opposed to toolmaking which is more concerned with dies used to manufacture objects from sheet-metal). Formed thirteen years prior to this case study, the company, operating from a single location in South Australia, is working closely with other companies pioneering the development of new products in emerging industries.

The principal focus of the company is in producing tools, particularly moulding dies, to be used by the customer in manufacturing products. Although not extensively involved in product design, ToolingCo works with clients to develop and refine the design of their tools to overcome problems in their manufacture and operation. The company provides on-going service to customers in the form of trialling the new tools for the customer's production environment and troubleshooting and solving problems that arise in their subsequent use.

ToolingCo serves customers both nationally and internationally with international clients representing approximately 20% of its customer base. The company enjoys a high reputation for its level of expertise and product quality.

About the workforce

Employing 18 people, ToolingCo operates in conjunction with a custom moulding company located at the same address. The combined workforce of the two companies is 60 employees.

The ToolingCo workforce consists of a managing director (working across the two companies), a tooling manager, an administrator (shared by the two companies), a mechanical engineer, and 14 tradespersons.

All but the administrator and mechanical engineer are qualified toolmakers. The managing director has completed some management training. The mechanical engineer has a degree in engineering. The training completed by tradespersons includes Computerised Numerical Control (CNC) and Computer Assisted Design (CAD) much of which was done with TAFE (the remainder generally being done in-house), and tool-pathing which was almost entirely in-house.

Training undertaken by the administrator included Mind Your Own Business (MYOB), spreadsheets and production data entry.

Knowledge and skills required

Knowledge and skills expected of employees working on the shop floor includes: interpretation and application of 3D computerised design, CNC machining, general machining, fitting, and project management. Administration employees are expected to use business software, including MYOB, spreadsheets, data entry and payroll programs.

Hand skills are currently still a very important part of the final stages of a job. However they are being lost – primarily because employees no longer want to learn them. In many cases the hand

skills can be replaced by machine skills, such as CNC machining, but this requires additional training.

In mouldmaking the one aspect that is critical and not always done well is die polishing. Every mouldmaker should learn the hand skills involved in die polishing. These days there are not many people who can get the mirror finish necessary on a tool. It's a craft. Whilst 95% of the work is in making the tool the last 5%, spent in die polishing, is critical. But it is definitely neglected. In a factory environment these days, everybody wants to push buttons rather than do physical work and get their hands dirty.

Training provided

ToolingCo is moving more and more into CNC machining. This allows greater utilisation of the company's machines by enabling them to be operated unmanned outside of normal working hours. The aim of the company is to use normal working hours to set up the machines and then have them continue operating unmanned outside of normal hours. Increased unmanned operation is seen as one of the keys to competitive operation of the company.

Company employees attend industry seminars relevant to their work. Suppliers, particularly, are seen to be providers of training in leading edge technology. The company also provides a considerable amount of in-house training closely targeted to specific aspects of work it does.

We have people come in from outside from time to time to aid with training. This commonly occurs when we buy a new machine – the supplier provides, say, two weeks on-site training on the machine to get people up to the required level [of competence].

The company is seen to be heading towards a higher level of technology requiring more advanced training.

Training for the future

The company spokesperson drew attention to the increasing competition coming from countries developing industrially overseas. If Australian companies like ToolingCo are to maintain their competitiveness it is essential they use modern machines and technology and thoroughly train employees in their use. He made an interesting observation regarding how these industrially developing countries are acquiring the practical skills and knowledge to complement the advanced technology they already possess:

We give a lot of on-site training. In the type of work our company does, every task is different, so we are constantly striving for better ways of doing things, constantly experimenting to find ways of doing it better and more cost effectively. We have to do this to stay competitive... For example, other countries such as China are well into CNC and we have to keep up with them [technologically] to stay competitive. They have the technology but not the individual toolmaking skills we have developed over the years. What they are currently trying to do is buy those skills through business arrangements and technology exchanges. They are trying to learn from us how to do it – they've got the machinery, they just need the know-how. Once they get that they won't need us any more.

If, in order to maintain their competitive edge, ToolingCo and other Australian companies are introducing modern machines and latest technology, their employees will require correspondingly advanced training. For instance, in the area of machining (a major part of ToolingCo's operations) the company presently uses three-axis CNC machines. In overseas countries, particularly Japan and Europe (thought by ToolingCo to lead the field in this type of work) five-axis machines are now being used. These machines are more complex to set up and will require additional training for their operators. ToolingCo recognises that it will need to move

to five-axis machines if it is to remain competitive. At the time of interview, the company did not feel there was much training available in five-axis machines. Laser cutting of cavities was another area of technology developing fast overseas that would necessitate new training in Australia.

ToolingCo sees on-line training as having particular merit in some circumstances. For example, one of the problems in the industry sector in which the company operates has been the separation of toolmaking from mouldmaking. ToolingCo believes that on-line training offers a convenient means for employees in these two trades (many of whom, through the nature of their job are computer literate) to learn more about technological developments in the 'other' trade. Toolmakers may better understand the problems that mouldmakers deal with, and mouldmakers may benefit from first-hand knowledge of what the toolmaker is able to do.

Training ToolingCo expects to be seeking in the future includes: courses in advanced technology, such as five-axis CNC (computerised numerical control), laser cutting of cavities, CNC-EDM (electrical discharge machining), 3D design (the company expects the industry to shift totally from a base level of 2D to 3D), project management (for all employees down to apprentice level, not just senior level employees), quotations, and ISO 9001 quality accreditation. Training in project management, quotations and ISO 9001 is especially important as a means of enabling the company to compete effectively with overseas companies and to satisfy the more stringent requirements of international clients. Project management is particularly important to international clients who, because they are unable to visit the company regularly, want assurance as to the progress of their job.