THE WORLD IS YOUR *oyster*

DESIGNING YOUR CAREER
IN ENGINEERING & SCIENCE

JOHN EDWARDS

The world is your oyster

Designing your career in engineering and science

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Epigraph

God will not seek thy race

Nor will he ask thy birth;

Alone he will demand of thee

What hast thou done on earth?

Persian proverb in the front of my grandfather's family bible.

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Preface

It is a truly strange thing that, when launching their careers, new graduates often fail to apply the skills that they have recently learnt. In terms of planning, research, marketing and execution they don't always use their talents to maximum advantage. There is wisdom in the well-known cliché "Those who fail to plan; plan to fail". This book was written to provide encouragement and practical advice for this first critical step in your professional journey. The ideas presented may also be relevant to those already employed and looking for a change.

There are many books that are already available within the self-help genre that are aimed at vocational guidance. What is distinctive about this book is that it offers reflections based on my own experiences in industry and research institutes and discusses the issues that underpin a successful career. Professional expertise has many facets and, as will be explained, a significant number of these have nothing to do with academic prowess.

One of Socrates' most famous statements was "The unexamined life is not worth living". As a person suffering from advanced emphysema I often share reflections on life with my friend, Professor Graham Goodwin, over a slow coffee on Friday afternoons. In one of our discussions I commented on how ineptly I had managed several stages of my career, particularly the early stages. These discussions were the seed from which this book has grown.

Over the years, I was mentored and helped by many people. Similarly, I hope that this distillation from 45 years of professional experience in university and industrial environments may help others.

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1. A serious conversation

Why should I read this?

In writing this book, my intention has been to provide guidance in designing your career, with particular emphasis on the earlier stages. Frequently, the first position of professional employment we accept can dictate our entire career path and consequently this decision justifies serious consideration. I will encourage a holistic approach to keep in mind the longer-term implications of key decisions which may not always be obvious to young graduates. There is also the opportunity to use this broader understanding to impress a potential employer by asking searching questions about your future career options within the organisation.

In this book I will cover a number of important topics:

- Selling yourself effectively to potential employers.

- Understanding the attributes sought by employers.

- Identifying technical roles which match your skills and interests.

- Developing your career vision.

- Understanding the important workplace characteristics.

- Work–life balance issues.

- Communication skills.

- The importance of networking.

- Consideration of postgraduate degrees.

The initial trajectory can be critical to the final outcome

Which offer is best for me, if any?

"To accept or not to accept?"

This is often the question facing a graduate desperate to find work and to start earning a salary. Depending on the state of the current economic cycle a graduate may feel more or less pressure to take any career position that is offered, regardless of whether it meets previously developed criteria. Haste in that first career step can have lasting consequences, consequences that are not always good and are often hard to unravel. Avoiding such a mistake requires that two conditions are met: having a clear description of the key characteristics of the desired position; and having the courage to say no to offers that don't match your expectations. This decision is particularly significant for honours graduates contemplating the choice between an academic and a non-academic career path.

When considering the merits of a particular appointment we tend to focus on salary, the technology involved and the role offered; however, other less tangible factors can be of equal importance. These fall under the heading of "values and culture" and cover matters such as the mutual respect between employees and management, cooperation between staff, handling of disputes, opportunities for attending conferences and publishing papers, overtime expectations, and performance reviews. The characteristics of organisations that provide a good workplace environment will be discussed in a later chapter.

Love your career with a passion

When Jack Nicklaus spoke to the assembled crowd after his last professional tournament golf game at the start of his retirement, he made the following comment about his career:

> *The game we play is a game and nothing more. It's a wonderful game. It's a game I love. I think that the game needs to be played in that spirit.*

While it is unusual to speak in such terms about the careers of engineers and technologists, I have largely worked in small research and development (R&D) teams whose nature is not too far removed from that of a professional sporting team, and the attributes for success are similar. In that context, I quoted Jack Nicklaus's comment at my retirement speech as I felt it reflected my own feelings. Work satisfaction can arise in many ways varying from pushing back the frontiers of knowledge, creatively solving challenging problems, working in a supportive working team, improving the environment, and contributing to the wellbeing of fellow humans to achieving financial security.

Come aboard and hang on!

Brief details of my career vision are provided as an illustration of how the winds of fortune can blow one off course, and also how the failure to research one's options carefully can lead to unexpected and potentially disastrous consequences. Further anecdotes will be introduced during the book to illustrate particular points of relevance.

Although, as a consequence of my background, the examples in the discussions will have an engineering flavour, most of the ideas and comments are equally relevant to careers in medical science and other technology disciplines.

References are denoted by superscript numbers. Key observations to take away from each chapter, and aspects to consider for your own situation, are highlighted for ease of reference. If a few career paths are directed to improved outcomes as a result of dialogue with these ideas, then I will be delighted and satisfied.

There is a wise saying concerning the navigating of our lives: "If your dreams don't scare you, they are not big enough". I trust that, at the end of your career, you might answer the question "What hast thou done on earth?" from the earlier quoted Persian proverb with the response "Everything I could have imagined".

Develop a career vision which is both challenging and satisfying.

As far as possible, and especially for your first position, accept a job which is consistent with your vision.

2. The working sandpit

Sandpit activities

With tongue in cheek, I would like to use a sandpit metaphor and discuss the workplace where graduates are likely to be employed. The objective is to provide an appreciation of the wide range of work environments that exist and their characteristics. From this you can seek an environment that seems to fit your personality, thereby maximising the potential for creativity and satisfaction. Clearly, opportunities exist in many corporate areas for graduates; however, I will mainly focus on the consulting, manufacturing and R&D arenas where the majority are likely to work when they first commence employment. You are urged to follow up on the thumbnail sketches given in the following paragraphs by reading case studies of successful, innovative companies, asking why they were successful, and identifying the types of individual involved. [1]

Key factors that influence the working environment are company size and organisation, marketplace, product type and maturity, and corporate culture. I will discuss these and also how company profitability, and dependence on developing new products, is also important.

Choose your weapon

When going into battle it is prudent to match up where you fight with your skillset. It would not be appropriate to fight in the front line of battle if you were poorly coordinated and short-sighted. In engineering the workplace can vary enormously so a careful choice is also needed.

Manufacturing plant engineer or technologist: The opportunity for inventing new products in this role is limited as the focus is very much a hands-on one in which maintenance costs, efficiency and machine reliability are primary.

Engineering or technical analysis specialist: A graduate with above-average mathematical skills may be more switched on by analytical challenges and research activities than by management and administration tasks. Analysis and simulation tools are frequently employed to gain a greater insight into the behaviour and characteristics of equipment and operational phenomena.

Consulting: Consulting roles can vary significantly. Consultants need good interpersonal and listening skills and are more often applying known wisdom and sound design practices than

they are creating new products or services. A small proportion of consulting work demands exceptional creativity and the solution of unique and difficult problems, and some firms take pride in their expertise in this role. The design of the Sydney Opera House would be a good case study for a large-scale innovative consulting project.

Leadership and management: Within any complex organisation, managers are required to ensure that plans are executed effectively and day-to-day matters are handled appropriately. Practical experience in the particular enterprise is usually a prerequisite for managers to perform their role. As they mature professionally, most graduates will be expected to take on increasing levels of responsibility; however, they probably have little desire to move into full-time, non-technical executive roles.

In addition to managers, a successful organisation needs leaders. Some people are born leaders and fill a key role that is of lesser interest to many technically focused graduates. Just as an army needs a general with vision and strategies to triumph against the opposition, so too does a business enterprise need a leader with similar attributes combined with entrepreneurial abilities. These can be improved by training and experience but leaders usually have an innate ability to inspire their colleagues and provide enthusiasm and vision, especially when the going gets tough.

Research: Research roles are available from industrial and government-sponsored organisations. They are also an integral part of academic life, which offers greater freedom to select research fields, although there are still constraints that need to be appreciated.

In the above classifications no mention has been made of which particular branch of engineering or scientific discipline you may be thinking about. Each will have its own nuances for the different roles and I urge you to investigate the disciplines of interest to you when considering where you might find a suitable niche. Descriptions of key Australian technical innovations are available from the Powerhouse Museum website; use this resource to investigate the case studies of successful, innovative companies, to understand why they were successful and, finally, to examine the types of individual involved. [1]

The potential excitement and opportunity that can arise from a research career will be illustrated by a brief note on the history of a famous research laboratory in the USA. In earlier times, particularly after the Second World War, many companies established extremely large research organisations. In the USA the Bell Labs, owned by the monopoly telephony

company AT&T, employed 15,000 staff at its peak and set the benchmark for classic blue-sky research, funded by their large profits. At Bell Labs it was not necessary to factor in potential profit when discussing the motivation for a project. Bill Gates once said, "My first stop on any time-travel expedition would be Bell Labs in December 1947". That was the time and place of the invention of the transistor, the device that powered the technology revolution upon which today's connected world is built. A brief note on the Bell lab's story. [3]

Bell Labs presented a more encompassing and ambitious approach to innovation than what prevails today. For a long stretch of the 20th century, it was the most innovative scientific organization in the world. On any list of its inventions, the most notable is probably the transistor, invented in 1947, which is now the building block of all digital products and contemporary life. Bell Labs produced a startling array of other innovations, too. The silicon solar cell, the precursor of all solar-powered devices, was invented there. Two of its researchers were awarded the first patent for a laser, and colleagues built a host of early prototypes. Bell Labs created and developed the first communications satellites; the theory and development of digital communications; and the first cellular telephone systems. What's known as the charge-coupled device, or CCD, was created there and now forms the basis for digital photography. Bell Labs also built the first fibre optic cable systems and subsequently created inventions to enable gigabytes of data to zip around the globe. It was no slouch in programming, either. Its computer scientists developed Unix and C, which form the basis for today's most essential operating systems and computer languages. And these are just a few of the practical technologies.

At Bell Labs, the man most responsible for the culture of creativity was Mervin Kelly. His fundamental belief was that an "institute of creative technology" like his own needed a "critical mass" of talented people to foster a busy exchange of ideas. Quite intentionally, Bell Labs housed thinkers and doers under one roof in a building designed to maximise interaction. Kelly believed that freedom was crucial, especially in research. Some of his scientists had so much autonomy that he was mostly unaware of their progress until years after he authorized their work. In sum, he trusted people to create.

After the dismantling of the telephony monopoly, the AT&T profits shrank and the scale of the Bell Labs research operation was greatly reduced; the blue sky was replaced by dark clouds.

My favourite engineering research story is in the book *Skunk Works* [3], in which the technical development by the Lockheed Martin Aeronautics Company of the Blackbird SR-71, mach3+, stealth reconnaissance aircraft is described. The crucial step in this project was the earlier discovery in an obscure Russian journal of the mathematical basis for designing surfaces that gave small radar signatures. There, in the middle of the Cold War, the USA was using Russian research to develop some crucial aircraft technology. The Blackbird SR-71 aircraft was so fast that if a surface-to-air missile launch was detected the standard evasive action was simply to accelerate and outfly the missile. The radical innovation techniques and management style developed by the Lockheed company under the legendary Kelly Johnston gives valuable insight into the importance of staff motivation and the encouragement of team *esprit de corps* when innovating in a demanding time schedule.

Academia: Many of the brightest graduates enter the land of academia after going through a rite of passage, usually in the form of completing a PhD degree followed by three years of high-powered postdoctoral research activity. Ideally, they will initially spend some time working outside the university to gain insight into the practice of their profession as this provides a good basis from which to gain credibility with students and to motivate them while lecturing. The length of time taken to achieve all of these steps is significant.

A distinctive characteristic of an academic career is that it potentially offers the freedom to pursue a special interest or research area whether or not it has an immediate financial return. It is frequently the case that ideas and fundamental understanding of a specialised topic arising from completing a PhD degree can lead to important research opportunities. These can generate a lasting benefit to humanity and the researcher.

Is size important?

As in other fields, size is not everything but it is highly significant in new product or service development. Experience suggests that unless there is a critical mass of employees working together on a project the chances of success are greatly diminished. Success is defined not simply by having a great idea but includes the transformation of the idea into a product or process meant for widespread practical use. In my experience a minimum of five or six people

is desirable to generate sufficient interaction, lateral thinking and team motivation for optimum progress. The corollary of this observation is that if departments try and tackle too many projects in parallel, with insufficient people working on each project, they will fare worse than if they are more selective and set up teams for the most significant opportunities. This means that it is desirable to join a well-structured and balanced team regardless of the size of the company or department.

The benefit of operating within a small company environment is that it is usually able to make decisions and change direction rapidly compared to larger more bureaucratic organisations. The term "gazelle" is sometimes applied to such organizations because they can move swiftly to take advantage of new opportunities and to avoid the dangers arising from competitors. Their downside is often a limited financial base from which to fund the development phase. Within Australia, most projects are in the small-to-medium size range.

For newly employed graduates another key need is to have one or more experienced mentors available who can teach the skills and attitudes that are essential for long-term success and satisfaction. Allied to this is a plan within the organisation for the training of new staff members in the employer's key technologies and products. Often this will involve changing department or work group regularly in the first 12 months or so, a strategy more common in larger companies that have greater flexibility in this regards.

The size of a development project, in terms of the number of staff involved, will impact on the form of satisfaction offered to participants. If a project is large then one can only expect to make a small percentage contribution to the overall effort. (Think of working on a Microsoft operating system software team in this context.) Small teams provide a significantly bigger sense of ownership of the outcome but usually the cake is smaller. There are exceptions, of course, and Bill Gates and Steve Jobs are two well-known, exceptionally talented individuals whose entrepreneurial flair capitalised on the results of relatively small development projects to achieve BIG outcomes. Even for them it took time and determination to achieve success.

Product life cycle

The typical product lifecycle, in which a new idea spawns a plethora of companies chasing the new technology, is well known. Gradually there is a consolidation of manufacturers, smaller profit margins and minimum R&D investment. A corollary is that research into such products at the end of the cycle has less excitement to offer than earlier in the cycle. If we

consider technologies such as motorcars, aeroplanes, radio, television, transistors, computer hardware, computer software and mobile phones the trend is reproduced each time. An Internet search will quickly assist in determining a company's position in its growth cycle.

In the 1970s I visited the R&D establishments of a number of steel and aluminium companies, which typically housed between 800 and 1,200 employees. Since that time the opportunities for making dramatic new discoveries in the manufacture of sheet metal have shrunk and the research organisations have been decimated by frequent recessions, which inevitably led to severe cut backs in the size of the R&D departments. In part this change was the result of the products becoming "commodity products" which have small profit margins and can easily be manufactured from readily available machinery and without too much process experience. It is important to recognise that, in the present era, if companies are not making adequate profits then R&D expenditure is one of the first budget items to be scrutinised. This lesson was brought home to me when I first started work in Newcastle, New South Wales, in 1972 for John Lysaght (Australia), referred to as JLA. Before the end of my first month an economic downturn led to 50 per cent of the R&D staff being laid off and the closure of an adjacent engineering division. I was relieved to discover that a policy of "last in first out" was not invoked!

Freedom and independence

Prior to 1970 the majority of large manufacturing companies in Australia were subsidiaries of firms based in the USA, UK or Europe. They did little significant research in Australia, although small R&D groups may have existed locally. Technology in use was largely imported from Europe and the USA. There were a few exceptions in domestically owned companies such as BHP. The opportunity for getting involved in cutting edge research was therefore restricted unless one transferred to the parent company laboratories in their home country. This comment highlights the importance of being aware of where the strategic technical decision making takes place. Exceptions can arise of course and I experienced that when working for the R&D Centre of JLA, in Newcastle in the 1970s. Although partly owned by a UK parent company, the R&D was locally controlled and executed because the steel sheet metal manufacturing operations of the UK parent had been sold and the UK research effort dissolved. The scope of major, world-leading innovations developed by JLA for producing the humble corrugated iron sheet makes for inspired reading. [4]

As an aside, it is worth noting that the public image of an industry may not reflect the potential for a stimulating technical career opportunity. I have mentioned above that I worked in the steel industry for many years. This large industry had a justifiably poor image as a place of work due to the dirty and noisy conditions usually found there, particularly in earlier times. In spite of this, the technical challenges and the sophistication of the automation systems installed in steel and aluminium rolling mills are very much in the forefront of current technology. The knowledge involved is also portable in the sense that you can apply it in a majority of metal-producing plants around the world. This enhances your long-term employment opportunities.

My suggestion is to talk to people employed in a company for an opinion on its strengths and weaknesses. You should also check the long-term profitability of a company since that is a good guide to the quality of its management and technical acumen.

The "D" in "R&D"

The process of finding an innovative solution to a problem or finding a new, previously unknown technology is only the first step in completing a successful R&D project. Often it is the easier step because it may require less than 10 per cent of the total effort to get a successful outcome. Therefore it will come as no surprise that 90 per cent of the work opportunities in R&D are really in a development role rather than in a pure research role. In practice, the distinction is blurred because staff work in both areas. Even so, it is still true that taking an idea and transforming it effectively into a saleable process or product is a challenge, and one which many companies perform badly, often due to a lack of funding. A frequent lament among observers of industry is that good ideas never make it to market due to an ineffective development phase. Conversely, the development phase requires many different skillsets and good teamwork and is extremely rewarding to work in. Although the key concept or idea may be known, there are inevitably numerous sub-projects that require innovation and creativity to solve on the way to a successful conclusion.

Culture and values

Appraising a potential employer tends to revolve around the technology involved in the role offered; however, other less tangible factors can be of equal importance. These fall under the heading of "cultural and ethical values" and cover matters such as the mutual respect between employees and management, cooperation between staff, handling of disputes, opportunities

for attending conferences and publishing papers, overtime expectations, and performance and salary reviews. Working in a company with poor values and culture can be distressing and, particularly if it reaches toxic levels, it may be best to plan an exit strategy and leave on cordial terms. There can also be individual issues with the company's products from an ethical or ecological perspective – such as tobacco, munitions, alcohol, greenhouse gases, unsafe devices, discrimination, etc.

Higher degrees

A final comment on the value of obtaining a higher degree before seeking employment. In Europe it is commonly the case that engineering graduates spend three years acquiring a bachelor's degree followed by two years getting a master's degree, a total of five years prior to seeking employment. In Australia, four years is the norm and brighter students often add a further year acquiring a science degree, usually by undertaking courses in mathematics, physics or computer science. Another option is to complete a master's degree by coursework with a small thesis. This option can significantly broaden the capability of a research and development engineer by adding greater depth to his or her technical knowledge and analytical skills than is achievable in an undergraduate course. This extra knowledge is attractive to employers, sometimes to a greater extent than a PhD might be.

A recent trend, sometimes called "credential creep", has occurred. This refers to the perception that degrees are slowly being devalued because more students are gaining a degree. This has pressured brighter students to gain a postgraduate qualification to further distinguish themselves to potential employers.

For those choosing between continuing to study for a higher degree or going into the workplace, it can be hard to find objective advice. Because the pool of talent is finite there is intense competition to gain the services of the top graduates. For this reason it is prudent to seek opinions from multiple sources covering the full range of employment options you are considering.

General observations

The discussion presented above may seem overwhelming and superfluous since the actual choice of employers may well be limited to a small integer, including zero. However, even if there is a choice of only two companies it is important to select the best one for you. In that context, reviewing the characteristics of each is valuable. This can largely be accomplished on

the Internet via corporate and stock exchange websites, augmented by newspaper articles. Sometimes you need to read between the lines to get the full picture. Perhaps a more appropriate path to consider is to review a wide range of companies and to select a subset of those who seem to match your requirements and then to court them directly, preferably by seeking a vacation or short-term work contract to establish a conduit for future negotiation. A significant number of first-time employment contracts are initiated by discussions that start while you are an undergraduate. Most employers are overjoyed to receive advances from high-achieving students. Proactivity in this context will be seen as a virtue.

I am sure there will be some graduates who want to ask, "What if I do not feel an attraction to any speciality of the course I have completed"? One answer is to be patient and to become more fully informed on the full scope of alternatives available. Another left-field response was suggested to me by an old friend, who found his niche as an entrepreneur in Silicon Valley 40 years ago and never looked back. His suggestion, which gives a new meaning to the term "regression techniques", involved casting your mind back to your late primary school and early teenage years and thinking about those games and activities that you enjoyed most. Apparently, our tastes in what we enjoy do not alter greatly as we mature, although they may broaden. The odds are that you would still find them, in a more mature form, highly pleasurable

Recalling the earlier quotation, "If your dreams don't scare you, they are not big enough", my advice is to seek employment in the highest calibre organisation possible. This will provide the best chance of acquiring attitudes, standards, and skills to maximise your career achievements. Top performers rarely emerge from second-rate institutions.

Review the different roles available within your chosen professional field and the education levels they require.

Research the careers of eminent achievers in your chosen area of interest.

Use the Internet to seek out only high-calibre target companies with sound technical opportunities and good ethical and cultural values.

3. Career vision

In this chapter I offer a warts and all account of my industrial career, which initially had some rocky patches but eventually ended on the desired track. The consequences of failing to observe many of the suggestions described in previous chapters will be highlighted.

Speaking personally

My career vision underwent several violent detours before it stabilised after a mid-life crisis at the age of 40. My first about-turn occurred at high school when subject choices had to be made for the last two years. I knew my father would have been thrilled if I was ever able to take over his small accounting practice, although he never voiced this thought to me. So I selected subjects in line with this vision, which was his vision. I lasted a week before acknowledging my mistake and getting my subject options replaced by applied and advanced mathematics. The applied mathematics proved to be my favourite subject and a clear signpost to my future career as an engineer. My motivation for the initial subject choices was totally inappropriate; a mistake we can make with good intentions and poor logic. My school career came to a conclusion with examination results modestly above the average and blighted by a B for English. This was a recognised indicator for a potential engineering undergraduate who is more at home with symbols and equations than words and sentences.

> Follow your own vision, not that of someone else.

When enrolling at the University of Sydney for an engineering course in 1959 I was stumped when asked which branch of engineering was my preference. Truth to tell I knew almost nothing of the detailed tasks undertaken by engineers in real life as none of my extended family and friends were engineers. I suggested civil engineering might be the go, comfortable that I could grasp the concept of bridges, dams and roads. With some embarrassment, I must confess that my passion for tinkering with motorcars had not triggered the obvious response that this was the domain of mechanical engineers. Fortunately, the first-year course was common to all branches, except chemical, and I was able to switch to mechanical engineering without any negative impacts.

> Research your options carefully.

After two busy years in the engineering course it seemed reasonable to have a gentler year of comparative rest doing two subjects in the Science faculty to gain a BSc degree. The additional grounding in maths and physics was extremely valuable in later engineering subjects.

After gaining a first class honours degree I felt that my future lay in industry or in consulting, and also that I did not have the "smarts" or the desire to study for a PhD. However, it seemed like a good idea to complete a coursework Master of Engineering Science degree to get as much exposure to numerical analysis techniques and computer science as possible.

Another significant event during my engineering course arose in a tutorial session with the dean of our faculty, Tom Fink. Tom had returned from England after a distinguished career at Imperial College and as an aerodynamics consultant to Donald Campbell for his successful attack on the world speed records in the Bluebirds. This gave Tom a super-engineer status in our eyes and we gave his comments more attention than those of many of our other lecturers who had less impressive achievements in their early careers. Tom's comment to my tutorial group was the following: "You fellows are as well or better educated than students from any other developed country. You can hold your own in any enterprise around the world and should not feel inferior in any sense. Don't hesitate to aim for the moon in your ambitions." Or, to quote the words of Shakespeare, "The world is your oyster". These ideas were really radical for us as we had never thought about where we stood in relation to our overseas contemporaries, and we would certainly not have made claims of this type. My response to Tom's comment was to set a goal of eventually working in Australia performing original research involving the application of the new computer technology to automation in industry. After seven wonderful years at university, I looked forward to the opportunity to start applying my engineering knowledge in real-world projects.

So, armed with a MEngSc degree and brimming with optimism, I wrote to all the major companies that had research laboratories or progressive engineering departments. Slowly, the responses dribbled in: some were outright rejections, some led to interviews at which the sad truth emerged that there was no interest in automation or genuine research other than the extension of overseas technology to suit local conditions. My knockback drawer gradually filled. After two months of disappointments an interview with the Process Control and Instrumentation Group of Imperial Chemical Industries Australia and New Zealand (ICIANZ) led to an offer in April 1966. Since this group was involved in genuine process simulation and

novel control system design I accepted the position even though there were no applications of digital computers envisaged in the immediate future. Looking back now, I can say that this was a great opportunity to learn about the practical aspects of control systems and their commissioning, topics which received scant attention in my university courses. The idea of learning to crawl before walking comes to mind. As small cogs in big teams building new green-field chemical plants I was exposed to some rudimentary project management fundamentals and many areas of conventional chemical process control technology. An extremely valuable experience.

Learn the fundamentals of professional practice as well as the hi-tech aspects.

Two even more valuable lessons from my mentors at ICIANZ were received. My first mentor was Gerry Ellis with whom I worked on solving a number of process problems. Gerry taught me to always go back to the fundamental physics of the process under investigation, taking nothing for granted, rather than jumping in halfway and relying on pre-existing (but seriously flawed) folklore. Gerry went on to become the chairman of BHP and Chancellor of Monash University. The other lesson concerned the importance of writing good reports. One of the first reports I had to read was the style manual for writing reports. My section head, John Lukey, had zero tolerance for deviation from the standard and met my suggestions for a better layout with a faint smile and a lateral shake of his head. He was also a pedant when it came to grammar, layout, spelling and clarity. After a period of frustration I realised the benefits of department reports having a consistent look and feel helped those engineers, like me, who could only manage a B for English. John left the company to join a high-powered management consulting firm where his report-writing prowess was better appreciated and much better paid! Not surprisingly, I made sure that similar report standards were the norm wherever I worked afterwards and, bound with brightly coloured hard covers and gold leaf lettering, were a significant factor in our marketing.

After two years at ICIANZ my wife and I decided it would be nice to live overseas for a time and see something of the world. There was also a realisation that mechanical engineers working on chemical plants are always working with one hand tied behind their back due to the limited grasp of chemical engineering lectures fundamentals. After another round of busy letter writing I eventually was invited to an interview with the Boeing Company. This resulted

in an offer which was subject to my acquiring a USA work visa to work in Seattle. Over 3,000 engineers were recruited globally at this time for the purpose of building a new supersonic transport (SST) aeroplane, the Boeing 2707, to compete with Europe's Concorde. Had I bothered to check, I would have discovered that the project had been mired in politics for 15 years and there was a strong possibility that it might be canned. That omission was a cause of significant regret a few months later when on our way to the USA via Europe and the UK, where our visas were to be collected. While in Germany we received a telegram stating that there was a problem with visa quotas and my US visa would not be issued. In fact Richard Nixon's administration had canned the project and needed to help Boeing block the visa applications. My inner harmony plummeted and sank further when Boeing declined to reimburse any airfares. No money, no job and a depressed economy is not a pretty scene.

Investigate potential employers diligently.

Check what can go wrong with a plan as well as its benefits.

Unexpected challenges require unexpected effort.

My wife and I rushed to London, where we stayed with friends until we could devise a solution. After six weeks of fruitless searching for work my luck changed and mother fortune smiled; through my friend Stuart's invaluable networking at the highly regarded Imperial College in South Kensington, where he was studying for a PhD, I was offered a temporary research engineer position on a 15-man project team. Of course, without the networking, the luck would not have arisen! The team was just getting off the ground in starting a three-year project which the British government had funded generously and arranged industrial partners to provide experienced engineering mentors to help guide the direction of the research. The project objective was to develop a generic, advanced automation system design for tandem cold rolling mills which took advantage of the capabilities of digital computers.

When in doubt, network it out.

Tandem cold rolling mills produce large coils of steel strip up to 2m in width and in thicknesses down to 0.15mm at speeds around 120 km/hour. In essence, the project involved

developing novel mathematical models of the process which could be used in designing improved control systems and optimal operating strategies. Several hundred control loops are involved in a typical tandem mill configuration, many of which interact in a tightly coupled manner. Prior control system designs had largely been implemented within the constraints of analogue control equipment, where a multiplication of two signals was a big deal; hence, the importance of using digital control equipment to facilitate new solutions.

At last, I was aligned with my career vision to an extent that was hard to believe! I was in my own engineering nirvana.

Driven by financial necessity and the technical challenge of the work I threw myself into learning about a new manufacturing process which incorporated a diverse range of electrical and mechanical engineering elements on a massive scale. As the only mechanical engineer in the group at that time I was asked to get to grips with the subject of "strip shape". This refers to the problem of buckles forming in the flat sheet after it has been rolled. I read everything I could find and extended my interest to include anything and everything related to the rolling process. Most of the published articles described analytical techniques based on hand calculation using mechanical desk calculations or slide rules. We were riding the cusp of the digital computing wave and had the freedom to incorporate model refinements and sophistications previously deemed impractical. This opened up many exciting, new avenues with which to push back knowledge boundaries.

Management expertise was scarce in the project team and my limited earlier project management experience led to me being given a second-in-command badge and a permanent appointment after a few months. The increased salary and wider range of responsibilities was welcome.

Never knock back the chance to pick up useful knowledge along the way, even if it is not obviously relevant at the time.

The three-year project came to a successful conclusion and the design incorporated into dozens of mill automation systems around the world by one of the project industrial partners. The decision was also made to write a book, *Automation of Tandem Mills*, detailing the research and automation design outcomes. Forty years later it is still the only comprehensive work in English on the topic and has been used widely by many companies. The project was

also hailed as an example of how the worlds of academia and industry could work together using the skill sets of each to generate advanced control system designs.

Mother luck smiled on me again when I had a phone call one morning from a manager at the London office of the Rio Tinto mining company. He asked if I could consult with them to analyse the potential of a core-drilling patent. Completing this work generated sufficient funds to pay for our airfares back to Australia. This brief consulting experience was illuminating and suggested that, if your overheads were low, one could rapidly earn a significant amount of money without much attached risk. Later, I realised that life is never as simple as that and the reason one is called in is precisely because the normal logic and experience has failed to solve the problem.

Efforts to secure a position in Australia from the UK were unsuccessful. The usual response was "We need to interview you, so call us when you return". In October 1971 the Edwards family returned to Australia, buoyed by the prospect of enhanced exposure to sunlight.

One unfortunate consequence of the favourable conclusion to the tandem mill automation project was the inflationary impact on my ego. I failed to recognise that I had played no part in winning the initial contract or managing the sales, marketing, financial, commercial or human resources aspects of the project, not to mention implementing and commissioning the design we had written down on paper. My total time observing an operating mill was a handful of weeks and my practical, hands-on experience was essentially zilch. These shortfalls hit home when I returned to Australia where a serious economic depression was in full swing.

My vision was to start a rolling technology consultancy and grow it into a small automation company, implementing the sort of technology we had designed in the UK. In my conceit I was convinced that I would be rushed by the half dozen companies who operated flat-product rolling mills producing coils of steel, aluminium, brass and stainless steel sheet. Wrong! The only rushing sound came from money exiting my bank account. After numerous presentations to all and sundry, a mill manager at the BHP Port Kembla steelworks took pity on me and organised a contract for 10 weeks' work solving a yield problem on his tandem tinplate mill. I had never seen a tinplate mill before and, although my application of the UK know-how did solve the original yield problem, it also generated side effects that made the yield loss an order of magnitude worse! The near total lack of hands-on operating experience revealed how much I had to learn before offering myself as a *bona fide* rolling mill consultant.

Don't let your ego get ahead of you.

With a severely shrunken ego I acknowledged that children need shoes, mouths need bread and I needed a job. I had maintained good links with my former university engineering department and to my surprise they offered me a lecturing position. I also had interest from the Research and Technology Centre of John Lysaght (Australia), whom I had written to from the UK since their products and processes were closely aligned with the mill in South Wales. They also offered to retrospectively pay my airfares. At the interview with JLA I was impressed by their process engineering group, with six motivated research engineers active in process modelling and simulation studies. This was a perfect environment in which to exploit my prior knowledge and to extend it to other processes. Without industrial funding, operating plant for testing and dedicated manpower resources I realised that I would not have comparable opportunities for serious research at the university, and so I accepted the JLA offer. Again I was made aware of the inherent wisdom in the advice of Henry Ford.

The next 10 years went by at the speed of light, with significant extensions and improvements to the UK simulation models and automation designs as well as extending the same approach to other steel-finishing processes and different types of rolling mill. After two years I was put in charge of the Process Engineering Group and a number of outstanding staff were employed. It was a wonderful time and the gaps in my knowledge referred to previously were shrunk by participating in frequent plant trials.

Attendance at international conferences and visits to other research laboratories around the world were strongly encouraged by Dr Peter Richards, the Technology and Research Centre manager. These networking contacts were critical in later years. The simulation programs were improved and redesigned and then marketed globally to other flat-metal producers with whom we shared a good relationship. The final highlight was the implementation of a complete automation upgrade with a multidisciplinary engineering project team using the models and control system innovations we had developed in the research department. The project was successful and provided a wealth of automation commissioning experience for all my team. It also gave a sufficient introduction to maintenance, quality, management and occupational aspects of the rolling process to avoid the label of "research boffin from an ivory tower". Most visitors to a cold-rolling mill see a dirty, noisy, physically intimidating environment, whereas I saw beautifully engineered, precision machinery, covered in grease and represented by deterministic sets of mathematical equations for every facet of the process.

Good times have a habit of coming to an end and this ending was caused by the takeover of JLA by Australia's largest company, BHP, and their decision to move research activities to Wollongong, three hours drive south of Newcastle. Three of my staff and I chose not to migrate. My senior team member, Arthur Carlton, an exceptionally gifted applied mathematician and software guru, and I decided to go into partnership and formed a company. The idea was to use our acquired skills and experience to offer consulting services and turnkey automation systems to industry via a vehicle we named Industrial Automation Services Pty Limited (IAS). I had just turned 40 and this was the midlife crisis I had to have. Our vision was to create a company actively involved in R&D and utilising the fruits of the research in its products. We also wanted to have a paternalistic culture where employees were valued and their individual needs addressed without running into rule-based barriers. The next 28 years working in IAS formed the last leg of my career. Once again, the holes in our experience led to challenging moments and some loss of sleep. As Oscar Wilde observed, "Experience is the name everyone gives to their mistakes".

We grow through recovering from our career tsunamis.

We were one of the early, small high-tech companies to start seriously exporting technology overseas. In recognition of this effort we were awarded the Australian Small Business Award in 1992 for all classes of company. In later years we won numerous other awards for excellence in industrial automation projects and product exporting. The talented group of people working within IAS were a superb team, which we referred to as "The Achievers" in recognition of their ability to meet the customers' expectations and performance guarantees. It was particularly satisfying to see how our mentoring processes generated the transformation of mostly young graduates to leading automation experts within our global and highly competitive industry. Whatever success the company had was a direct result of the efforts of the IAS technical and support staff.

The freedom of leading your own company has many attractions; it enables one to make mistakes really quickly as well as to respond rapidly to the need for change.

The other point to make is the significant benefit we received working with Graham Goodwin's control system design resources at the University of Newcastle. Our approach was to develop the process models and then put our control design problem in its most clearly defined form for his team to work on, without needing to be process experts. We also had staff taking postgraduate degrees and courses and one of our most talented members, Tino Domanti, completed a PhD investigating a demanding rolling mill analytical problem before returning to IAS as Research Manager. His contribution to IAS technology has been significant and was boosted by the experience of completing a PhD.

The IAS story is not of great importance for the theme of this book other than to illustrate the value of grabbing opportunities for gaining the experience and knowledge you may need to achieve your vision. The final act involved the sale of the company to the Hatch Group, a global engineering firm with over 8,000 employees, in September 2008, a month before the start of the global financial crisis.

In telling my story I hope to have illustrated some of the universal issues that confront most of us at some stage in our careers; this includes the pitfalls, things to investigate when looking around, and the rewards of engaging passionately with your chosen field.

All experience is potentially valuable, even if it does not appear so at the time.

The best-laid schemes of mice and men, often go astray.

4. A match made in vocation heaven

The quality of staff employed by a company or research facility will largely determine the potential for success of that organisation. Whilst a number of factors can stymie the achievement of that potential, it is reasonable to invoke the old idiom which says that one cannot make a silk purse out of a sow's ear. This means that the effectiveness of the recruitment process is critical for long-term success. This section concerns the attributes an employer may be looking for when assessing a potential new employee. That initial assessment is commonly based on the applicant's résumé. Advice on the writing of résumés will be provided in the next chapter.

This chapter describes the interviewing ritual and has the aim of giving applicants an understanding of the needs of an employer and how to tailor the presentation of their abilities to their best advantage. Most of the comments are valid for any professional position; however, some are particularly important for technical and research positions.

The staff recruitment courting ritual

As an employer, I found it valuable to delay reviewing the interview of an applicant with fellow staff until the next day, rather than doing it immediately after the interview. Being optimistic in nature, I focused on the positive responses arising during an interview and only started to think at a later stage about things that had not been answered well or which may have been omitted during the interview process. It was amazing how often the initially favourable assessment was reversed overnight while "sleeping on it". This same review process should be adopted by the interviewee for the same reason. That is, avoid accepting an offer on the spot. Ask for a night or a couple of days to review their offer, which should be made in writing with all the associated fine print.

Another reason not to rush in is to take time to check that the salary package is appropriate for the position offered. Once an offer has been made the applicant has the stronger hand since he or she is at the front of the queue for the position and can ask for changes in the salary or conditions as long as he has a reasonable case. A strategy I usually adopted as an employer was to ask the selected candidate to name the salary figure they sought. If this was lower than I was prepared to pay, then that was fine and there was some leeway for giving a better bonus or salary increase down the track. If the expectation was inflated then it could be negotiated on the spot while goodwill was in the air. The lesson from this discussion is to have

researched the salary scales ahead of the interview and to put forward a sensible figure at the upper end of your expectations. As stated previously, one can always check it after the interview but it is preferable to get a nominal, starting figure at the end of the interview if possible.

Similarly, the issue of starting date is often tricky because usually the new employer wants you as soon as possible. This may be in conflict with giving your current employer sufficient notice to minimise the impact of your departure. Sticking to the terms of your current employment contract to give proper notice might not be pleasing to the new employer; however, he will respect your integrity if you do so and rarely will it lead to any loss of an offer. The terms on which you leave a company can be important in the long term as you may later wish to interact with them on matters not foreseeable at the time.

> Potential employers will respect you more if you negotiate your salary and employment conditions responsibly.

Applicant fitness training

So what attributes are typically sought by a potential employer? One can generate a long list of those that are desirable, knowing that the "perfect person" is unlikely to turn up to be interviewed. So, while it is good for an applicant to tick as many boxes as possible, some boxes are going to be more significant than others. In any case it is hardly possible to achieve a makeover of your personality and character traits for the purpose of an interview. In fact, it is much better to be totally honest about your weak points than to try and bluff your way through. The former approach will gain some integrity points and avoid the severe downside of being caught out in giving misleading answers.

Most enlightened employers recognise that it is better to employ staff who have strengths in important areas and to live with their weaknesses rather than get an "average all rounder" with no special gifts. I well remember struggling with an applicant's body odour problems during a summer interview. The applicant was well suited to the intended role and we wisely decided that my secretary could solve the problem and we ignored that person's negative attribute. The important conclusion to draw from this discussion is the need to think about your strengths that are relevant to the position sought and to prepare a series of responses to likely questions that will allow you to effectively communicate those strengths.

Interviews are usually conducted by several managers from different company levels, either singly or as a group, followed by discussions with staff with whom the applicant may be working if taken on. The process is a bilateral one and the use that applicants makes of the opportunity to ask insightful questions and their ability to communicate effectively with brief but appropriate answers is an important aspect of the assessment process. Prior practice with a recorder is strongly recommended. From the applicant's perspective, the chance to talk with staff from the possible future area of work is an especially valuable opportunity to check whether the work being performed and the culture of the company matches the impression given by senior staff earlier in the interview. It is not uncommon for a manager to paint a rosy picture that does not match reality in an effort to attract an employee she or he may want. As young graduates, we tend to be more focused on the technical aspects of the position offered than on the culture and values of the company. Checking up on the culture can often be achieved by talking to a friend or contact who works in the company.

It would be stating the obvious to say that any successful applicant for a position would need to have the requisite training and level of graduation performance sought by the employer and ideally would have taken a number of subjects relevant to the employer's area of specialisation. A well-known catchphrase is that success is achieved with 99 per cent perspiration and 1 per cent inspiration. Sometimes an appointment may require a particularly gifted applicant to provide that last 1 per cent of inspiration within a research team. Different individuals of similar intelligence may have rather different abilities as far as analysis and synthesis are concerned and research breakthroughs often need a new idea or insightful question to be synthesised to achieve a breakthrough. This gift is rare and those that have it should use it to work out how to explain to potential employers that they possess it, without sounding boastful.

Interviews are stressful for all applicants, especially those with a quiet, more introverted nature. Whilst the latter may feel at a disadvantage, that is not necessarily the case as long as they take care to present their more reserved nature as a positive virtue. Introverts tend to sit back and listen more attentively than extroverts and deliver their answers with more thorough thinking behind them. It can be a temptation to answer questions too quickly to show how well prepared you are; however, this is not a good strategy. The Japanese regard the rapid answering of their questions as something of an insult since it suggests that the question was trivial and didn't need more than a moment's thought. Equally important, it takes a few seconds to think of the possible aspects underlying a question and to address the true intent of

the question to the best of your ability. In a team environment one does not want everyone to be an extrovert. The point of including this discussion is to highlight the need to identify one's strengths and to work out how to present them effectively. This exercise will help to grow confidence in your value and to believe that whoever employs you will be the better for it.

Let us now consider in more detail the attributes that may be sought in a new employee. While university examination results are important in getting an interview, they are not the only criterion and building a successful team requires a range of skillsets that may not be obvious to the applicant. Because most staff members are likely to be working in small teams, whose success depends on the team performance rather than an individual's performance, the following are important.

Ego: The team member should subordinate his own ego to that of the team so that internal competition is avoided and the primary focus is on team achievement and mutual support with shared kudos for project successes.

Social skills: These are the lubricant for team harmony and are important in interacting outside the team as well.

Attitude: Employee attitudes towards the achievement of goals and their commitment to meeting deadlines is contagious and helps team cohesion.

Flexibility: Sometimes circumstances dictate that a change in role or project plan is necessary and employees must adjust to this, even if it is personally painful.

Communication skills: Reference was made previously to verbal communication skills. Also important are writing skills, and these become increasingly important as higher levels of responsibility are reached. In research fields, especially academia, they are critical.

Curiosity: To varying degrees we all tend to accept the conventional wisdom. A small number of contrary individuals question nearly everything and cause eyeballs to roll around a meeting by their persistence in questioning things that everyone else takes for granted. On many occasions I have seen this frustrating behaviour lead to a completely new viewpoint on a problem when first one person and then other will gradually recognise the perceptiveness of the question and acknowledge that the conventional wisdom was in error. In a similar vein, I well remember a visit to the production facility of an automation company in Silicon Valley

in 1988. When we went to meet the production manager I saw the following sign on the outside of his door:

> *"Don't be afraid to ask dumb questions, they are much easier to handle than dumb mistakes!"*

Leadership potential: Employers of young graduates always have an eye on the future and recognise the need to have a source of potential leaders who can be nurtured for the long term. Technical employees in an R&D environment often have a limited interest in seeking leadership positions, especially at the start of their careers. This often changes at a later stage. If an applicant has contributed to community activities or sporting associations it is worth highlighting this as leadership qualities often present themselves in such activities. Participation in team sports is also an indicator of how a person will contribute in a workplace team.

Approach interviews with confidence in your own abilities and present a cheerful, honest and positive persona.

Identify your relevant strengths and highlight them in your résumé and interviews.

5. Communicating and networking

Usually the starting point of a job application is the writing of a résumé (or curriculum vitae – "CV" to many) in response to a job advertisement found in the newspapers, social media, on the Internet or from employment agencies. The first section of this chapter will therefore start with a discussion of writing résumés; a critical step in finding a position. However, employment opportunities may not come along and jump in your lap from a newspaper or online advertisement. Often they have to be generated by taking the initiative and going out to seek openings and then offering yourself in the marketplace. This activity I refer to as "networking" because it involves finding people who might be seeking new employees or, more likely, can direct you to one of their contacts who they believe may be employing new staff. My guess is that approximately 30 per cent of positions are filled through networking rather than through the conventional advertisement and job application route. For this reason a failure to pursue the networking tack could needlessly result in "not work". The balance of the discussion will focus on various forms of networking initiative that are available to you.

Effective communication is also a necessary skill in the workplace and takes several forms, from written documents to verbal interactions in formal presentations, team meetings and casual, but significant, conversations with colleagues. The importance of developing good writing skills, with correct grammar and spelling, should not be underestimated. This may be difficult for those who do not have English as a first language, but if so then it is all the more important to work on.

Preparing your résumé

When writing to a potential employer, one normally includes a résumé accompanied by a covering letter. Too often, a person seeking work will generate a rather standardised format résumé and send the same résumé to everyone.

A search on the Internet for advice on writing job applications will generate a large number of sites offering suggestions. Many of these offer free samples and formats to use for covering letters and résumés as well as coaching for interviews. [5] You should also use the Internet to perform research on the company for information that might be relevant to your covering letter.

Résumés written by a third person are usually obvious and raise the concern with potential employers that if a person can't generate their own résumé then how are they going to write a serious technical report. On the other hand, a poorly written and ineptly typed résumé may generate an even worse response. Another approach, which I would recommend where it is feasible, is to research several of the many websites offering advice on application writing and summarise the desired features of an application. Then write your own résumé and have it reviewed by one or more friends or contacts who are older or more experienced in the chosen area and, preferably, know you reasonably well. The benefit is that you will get a more personal critique of your draft and also will gain some experience in the art of application writing. They may also make suggestions for some strengths you have to offer that you may not have thought to include.

A good, one-page, covering letter accompanying your résumé is critical to success. Imagine the unfortunate person charged with the task of reviewing a hundred or more job applications. If the covering letter does not make a favourable impression there is a good chance that the résumé will not even be read. Therefore the purpose of the covering letter is to provide incentive to read your résumé and to put your name on the recommended list for an interview. An interesting example of a successful covering letter was provided by Robert Pirosh in his request for an interview as a screen writer in Hollywood in 1934. [10] It read:

> *Dear Sir:*
>
> *I like words. I like fat buttery words, such as ooze, turpitude, glutinous, toady. I like solemn, angular, creaky words, such as straitlaced, cantankerous, pecunious, valedictory. I like spurious, black-is-white words, such as mortician, liquidate, tonsorial, demi-monde. I like suave "V" words, such as Svengali, svelte, bravura, verve. I like crunchy, brittle, crackly words. Such as splinter, grapple, jostle, crusty. I like sullen, crabbed, scowling words, such as skulk, glower, scabby, churl. I like Oh-heavens, my-gracious, land's-sake words, such as tricksy, tucker, genteel, horrid. I like elegant, flowery words, such as estivate, peregrinate, elysium, halcyon. I like wormy, squirmy, mealy words, such as crawl, blubber, squeal, drip. I like sniggly, chuckling words, such as cowlick, gurgle, bubble and burp.*
>
> *I like the word screenwriter better than copywriter, so I decided to quit my job in a New York advertising Agency and try my luck in Hollywood, but before taking*

the plunge I went to Europe for a year of study, contemplation and horsing around.

I have just returned and I still like words.

May I have a few with you?

Robert Pirosh

This letter secured Pirosh three interviews and a stellar career in Hollywood.

Items you should consider for your covering letter include:

- introducing yourself to the employer

- defining the position of interest

- describing your career vision

- expressing your enthusiasm for the position and the company

- highlighting the special attributes that make you worth considering as a candidate

- mentioning any special links you may have to the employer.

Typically your résumé should be three to five pages in length. Attach an academic record from your university career, especially if it has impressive results. The layout of your résumé should be neat, easy to read and not cramped onto the page. The use of section headings and bullet points can assist in achieving an ease of reading.

Topics to consider including in the résumé are:

- a brief introduction, with career vision

- contact details

- final high school results with any special awards

- university results summary mentioning distinctions and any prizes or awards

- other relevant training courses

- professional strengths relevant to position

- employment history, including vacation employment (if it is an application for your first position)

- sporting and social interests including any executive positions demonstrating leadership potential

- succinct demonstration, with relevant examples, that you have the required experience, skills and abilities to meet any defined selection criteria

- the names of several referees, with contact details and possibly their written reference letters as well, depending on what has been requested by the potential employer.

The selection of referees should be given serious thought. When it comes down to choosing between a couple of decent candidates, a good referee who can speak about your professional and personal qualifications and skills can make a big difference. If you can find a referee who is known to the employer or who is well known in the technical field relevant to the position that also helps. As a courtesy to your referee, after they have agreed to their name being included in your résumé, send them a copy of the résumé. One of the first questions often asked of referees is: "Have you actually seen the candidate's application and can you verify its contents?" It's amazing how many reply, "Well, no I haven't, but he's a lovely lad" or whatever. In a 50:50 situation this can be the deciding factor.

Effective networking

One approach to this challenging task is to use an analogy in which you consider yourself as a salesman with a product to sell; namely, your skills. Drawing on our understanding of selling in a materialist society we can focus on the various sales and marketing ploys that are used to achieve success. The more obvious elements of such a plan are given below.

Advertising with attractive, focused ads whose message is short, sharp and unambiguous and tailored to the particular customer to whom it is addressed. These advertisements of your available services may be directed to targeted employers or contacts or they may be inserted into social media websites.

Letters enquiring about available positions are often accompanied by the résumé. These letters need to be written to highlight your skills as they are relevant to the letter addressee and need careful crafting. They are often critical in getting that first interview from a company that is not actively hiring new staff – unless they are approached by a particularly

good applicant with the right interests to match their business. Students with good exam marks are often welcome as vacation students since this gives both parties a chance to assess each other in a realistic environment. A small wage is usually paid; however, the experience, and a good reference, are the more valuable items as far as future employment is concerned. I strongly recommend this method of gaining work experience.

Conference and professional body meeting attendance where middle or senior level staff from employers of interest may be present. It takes a bit of courage to front up to strangers and engage them in conversation before asking about employment opportunities. With practice it gets easier. Always remember they may be at the conference looking for potential new employees and it could lead to a "match made in heaven". I am reminded of a conference in Pittsburgh, USA, where a high-level contact with whom I had done business when he worked for a large international company came up for a chat. It turned out he had recently been made redundant on short notice and was unemployed. As luck would have it, we were looking for a competent manager for the Pittsburgh office and wanted someone with good experience in business and finance management and also a detailed understanding of our technology. This person ticked all the boxes and was employed shortly afterwards: a win–win for all concerned.

A **brochure** defining your skillset and the type of work you seek, which should obviously match the work performed by your target employer. This should be a short, attractive, easily read document often only one page (possibly double sided) and could be similar to the executive summary some applicants would include at the front of their résumé (usually for a long résumé from an older professional with extensive experience). The point to emphasise here is that busy people will be reluctant to spend more than one or two minutes reading an unsolicited letter and brochure.

The three-minute soundbite. During networking, as you find people to talk to you should be aware of their attention span and tolerance for being interrupted, and this has a similar limit to that for written communications: namely, about three minutes. On top of that requirement is the need to get their attention at the beginning of a discussion or letter. I suggest that the first thirty seconds is critical to gaining the listener's or reader's attention, otherwise you won't even have three minutes. Getting a message across in a short time is harder than taking a longer time and needs to be crafted and practised to achieve maximum effectiveness. Don't try and "wing it" or you may crash in flames.

This discussion would be incomplete without a warning concerning the psychological risk of sending out numerous letters soliciting employment. It is likely that most of your communications will be unsuccessful, and this is depressing. After graduation I wrote many letters. In those days employers politely sent a reply thanking you for your letter and said they had no positions available and then tried to soften the blow by saying "we will keep your name on our files in case something changes". Of course it never did. I had a drawer in my desk, which gradually filled up as this searching process continued, which I called my "knockback drawer". In recent times, you probably won't need a knockback drawer because most companies don't bother to reply and leave the poor applicant sweating with wasted hope.

On the positive side, you only need to find **one** position that meets your criteria.

Prepare for your job applications and interviews as you would for a critical exam.

Create a way to stand out from the other applicants with whom you are competing.

Sometimes the choice is network or "not work".

Highlight your relevant strengths when networking.

6. Work–life balance

Even though the work–life balance topic may not be of initial interest in a graduate's career, it is likely to become important before eventual retirement. This section on work–life balance is probably of greater interest to mature employees; however, it is useful background for young graduates when assessing the culture of a company under consideration**.**

We all work with fellow employees who have a range of personalities, strengths and weaknesses. By developing some understanding of how to analyse the characteristics of yourself and your colleagues, you will be able to interact with them more sensitively, avoid unnecessary conflicts and lead more effectively as you are given greater responsibility.

A definition of happiness

How would you define a successful balance between our lives spent at work and the remainder of our lives away from work? The Greek philosophers gave this question a great deal of attention, and Socrates (born in 460 BC) investigated many aspects of the subject. Two important conclusions he reached were:

- All human beings naturally desire happiness.

- Happiness is obtainable and teachable through human effort.

A few hundred years later, another Greek philosopher, Epicurus, added a corollary [6]:

> *"We do not play in order to have fun, we simply have fun playing. Pure play and joy are intimately connected … Life must be lived as play."*

Some would seriously question the expectation to have fun in one's workplace. My experience suggests strongly that since the majority of our professional technical employees are operating in teams, it is therefore reasonable to draw a parallel between them and a highly professional and dedicated rugby football or cricket team where the game is played extremely seriously and requires 100 per cent effort, yet can still be a source of happiness. A further note of caution is necessary here to point out that, just as not all people play or enjoy sport, so it is in the work place where some highly talented staff may have an introverted personality that makes some of the team activities I have referred to difficult for them. Yet they can still contribute equally significantly with a different style of interaction.

Key employment issues

Three items commonly linked to an unbalanced work–life scenario are excessive travel demands, long hours at work, and occupation-induced stress. When I first started work, one of the highlights of my first year was being sent from Melbourne to Sydney for a week of plant-problem investigations. The impact of a couple of short visits like this over a two-year period was small and the experience gained was beneficial. In my third job, the thrill of a round-the-world visit to an international conference followed by meetings with research centres in the USA and Europe was even more of a buzz. Again, the contacts made in these visits were to prove invaluable later in my career. In my final employment, working in my own company, the travel demands, domestic and international, grew steadily as the business expanded and in many years up to 12 weeks a year were spent away from home. This impacted negatively on both family and social life. When working as an employee, one has the right to negotiate a reasonable level of travel, with limits on the maximum time away from your family, or an acceptable form of compensation. This is no consolation for frequent absences from family, sporting and social commitments or community involvements.

When a project gets behind schedule, most staff understand the need to work longer hours to meet a deadline and are happy to do so as long as the situation doesn't become endemic. Discussing how a potential employer handles overtime is a topic worth covering in an interview.

In my early career, working in large companies, it was rare for anybody in my section to be at work 10 minutes after "closing time" and I copied that habit. At Imperial College, my hours gradually expanded as my interest in the technology and my commitment to the project grew. I often took work home and even asked my wife to type some small reports because she could read my terrible handwriting with fewer mistakes compared to the College typists. In my own company, a passion for the technology of rolling mills, concern for the job security of the employed staff, and the needs of a growing business led to me working 20 to 45 per cent of additional hours over many years. By keeping weekends free from work, and maintaining significant sporting and community involvement, my work balance was only partially out of whack; however, the energy levels required were significant.

In contrast to the above scenarios, some employees work long hours because they choose to and not because it is necessary for the business. Often this situation arises when the employee finds great satisfaction in the role they are performing or they develop a passion for the

technology and its associated challenges. There is also another possibility in which the longer hours have grown gradually and become a habit rather than a conscious choice. Alternatively, a toxic relationship on the home front can be an incentive to maximise time at work. Usually there is a consequence for our work–life balance when these longer hours are worked on a routine basis and whether or not this is a good thing will be discussed under the heading of "workaholics and workaphiles".

Having fun and working hard are not incompatible.

Limits on the maximum overtime and travel away from home should be negotiated if necessary.

Sustained high levels of stress are not healthy for an employee or the productivity of an organisation.

Workaholics and workaphiles

The term "workaholic" is well known and is commonly used to describe someone who is perceived to be overemphasising the working component of their life to the detriment of their work–life balance. The choice of the word suggests a link to the term alcoholic; namely, a person who drinks to excess and has severe negative consequences as a result. There is an interesting Japanese word, *karoshi,* for workaholic, whose literal meaning is "death by overwork".

Studies of working behaviours have suggested the following definition of a workaholic [7]:

> *"A workaholic is somebody who's driven to work hard, doesn't really like doing the work, needs to do it and is suffering under it."*

Some of the factors driving a workaholic may be a feeling of insecurity and a concern about losing one's job, a desire for status and wanting more material "stuff" to get a superficial boost of happiness. People have scaled up their lifestyle expectations and we have become a more consumer-oriented and materialistic society. In the words of Epicurus [6]:

> *"Nothing is enough for the man to whom enough is too little."*

Other attributes of a workaholic may include [8]:

- existing on small amounts of sleep

- typically having a 16-hour working day

- taking few holidays and time off

- having minimal relaxation activities

- often becoming anxious or depressed.

As one humourist commented [8]:

> *" **Workaholics don't retire. For them, retirement is death.** "*

Distinct from the workaholic is the workaphile, who may outwardly appear similar to a workaholic and may work long hours, but whose work motivation is rather different.

> *"The workaphile is a person who loves their work, their work is their pleasure and also their relaxation."*

Other workaphile characteristics may include:

- not using work as a defence against other anxiety or emotional problems

- it being a healthy form of workaholism

- indulging in relaxation

- participating in social activities such as sport and community volunteer groups.

Employers definitely discourage workaholic behaviours as they are unhealthy for the employee and can be disruptive for colleagues. Even strong workaphile tendencies may be frowned on if there is evidence that family life is negatively impacted. At the end of your career, you don't want look back and have regrets about your work life balance. This is best avoided by reviewing your life style regularly and discussing it with your family.

Consciously manage your work-life balance and review it regularly.

7. Goodbye and good luck

Well, here we are at the end of my story and the beginning of an important step in your professional journey. Occasionally, people remark on how lucky someone is when opportunities seemingly fall into place and events flow favourably in their career. Our statistical observation is the remarkable correlation between foresight, hard work and good luck.

In concluding this book, I feel a need to share a note of warning on giving and receiving career advice [10]:

> *Dear Hume,*
>
> *You asked for advice: ah, what a very human and a very dangerous thing to do! For to give advice to a man who asks what to do with his life implies something very close to egomania. To presume to point a man to the right and ultimate goal – to point with a trembling finger to the RIGHT direction is something only a fool would take upon himself.*
>
> *I am not a fool, but I respect your sincerity in asking my advice. I ask you though, in listening to what I say, remember that all advice can only be a product of the man who gives it. What is truth to one may be disaster to another. I do not see life through your eyes, nor you through mine. If I were to attempt to give you specific advice, it would be too much like the blind leading the blind.*
>
> *Your friend*
>
> *Hunter*

Finally, a career vision from *The Prophet* [9] by Kahlil Gibran. A ploughman asks the man of great wisdom to speak to the assembled gathering about work. The response was:

> *"Always you have been told that work is a curse and a misfortune.*
>
> *But I say to you that when you work you fulfil a part of earth's furthest dream, assigned to you when that dream was born, and in keeping yourself with that labour you are in truth loving life,*
>
> *And to love life through labour is to be intimate with life's inmost secret."*

Goodbye and good luck

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About the author

William John Edwards was born in 1942 and grew up in Sydney. After finishing university with engineering and science degrees he lived and worked in Melbourne before he and his wife moved to London.

Returning to Australia he started his own engineering firm, Industrial Automation Services, in 1982. Through this business he achieved great success and received many accolades in the fields of industrial automation projects and product exporting.

John had a lifelong love of travel, adventure, fine wine and food, and family and friends – especially his three children and two grandchildren. Following retirement in 2009 he wrote extensively, including a biography of his grandfather, George Grill, a booklet on living with emphysema, and this guide for graduates. He died in 2014.

Other books by John Edwards

A day in the life of an Emphyseme

My name is John and I am an emphyseme. That is, I have emphysema which is at an advanced stage. I am moderately disabled and need a relatively high flow of oxygen 24 hours a day to survive. When I meet people for the first time they always ask me "Did you smoke?" in a judgemental tone and seem disappointed when I answer "No". I have what is labelled alpha-1 anti-tripsin deficiency; a genetic disorder causing a shortage of an enzyme which is important in healing damaged lung tissue. The consequence of this disease is that lung function declines at an accelerated pace and the symptoms are the same as for smoking-induced emphysema. Two years ago, when my lung function was down by approximately 80 per cent from what is normal, I was told that I would be fortunate to be around in five years' time and that the end game is pretty tough. I can't comment on the first bit but the second comment is accurate.

George: Outcast, entrepreneur, photographer

A biography of Geo. F. Grill, 1862–1912

George Frederick Grill, the author's grandfather, was born in Germany in 1861 and migrated to Australia I n1870, where he led a colourful and prosperous life before he died at an early age in 1912.

Grill left behind an unusually large amount of family photographs and business-related documents, and these form much of the basis for the author's affectionate and meticulous biography.

To purchase a copy, contact the author's daughter, Claire Manners Wood, by email:

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