Submission to the Productivity Commission on the Economic Implications of an Ageing Australia

Engineers Australia

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Executive Summary

For every young person entering the employment market today, there are already seven older (over 45) workers and while 170 000 people now join the workforce each year, only 125 000 will join in the entire decade from 2020. It remains clear that as our population ages we will need policies to maximise the capacity of older people to participate and contribute to Australia, through better health, better retirement incomes and more flexible employment and caring arrangements.

If older people and their families have the flexibility to make choices allowing them to maximise their participation and contribution to the community and economy, then ageing can be seen as increasing our economic well-being, not an impending burden. Engineers are at the core of solving the problems created by an ageing Australia. Key issues related to engineering and the economic impact of an ageing Australia include:

- Skill shortages generally, and in particular in engineering, will emerge due to the falling numbers of young people entering the workforce each year. This trend will be exacerbated by the limited options provided to older workers to actively participate in the labour market. A cultural change will need to take place to ensure more job opportunities are available to mature workers and that they have the necessary skills through "life-long learning" initiatives to undertake continued employment.

- Engineers have an important role to play in health technologies and improving and prolonging people's lives and reducing the impact of physical impairment allowing them to remain in their own homes and participate in society though volunteer positions and paid employment. Advances in medical technology have already resulted in age specific disability levels falling.

- The ageing of the population, combined with changes in family units into two or more lone person or single parent households will work to increase housing demands and urban expansion, placing pressure on governments to provide adequate amenities to citizens such as public transport. Engineers will play a significant role in using and supporting the development of sustainable planning practices throughout Australia created through the pressure created by an ageing population.

Population ageing is a complex, multifaceted issue that will have ramifications for different levels of government, communities and businesses, individuals and their families. Engineering has an important role to play in determining just how these problems will impact on the Australian economy.

1. Introduction

Engineers Australia is the peak body for engineering practitioners in Australia and represents all disciplines and branches of engineering including information technology. Engineers Australia has around 75,000 members Australia wide and is the largest and most diverse engineering association in Australia. All members of Engineers Australia are bound by a common commitment to promote engineering and facilitate its practice for the common good. Engineers Australia welcomes the opportunity provided by the Productivity Commission to comment on the economic implications of an ageing Australia.

As outlined by Chairman of the Productivity Commission, Gary Banks in his presentation, "An ageing Australia: small beer or big bucks?", the story of Australia's ageing of the population and labour supply is a positive one when viewed over a long historical perspective, *" it becomes apparent that labour force participation today is at its highest rate since just before World War I…if we look at the proportion of the total population in employment, this is the highest it has ever been. Even with the projected decline in participation, the ratio of employees to population will still be higher in 2050 than at almost any time in the period since the Great Depression."*

While this assessment seems positive, for every young person entering the employment market today, there are already seven older (over 45) workers and while 170 000 people now join the workforce each year, only 125 000 will join in the entire decade from 2020. It remains clear that as our population ages we will need policies to maximise the capacity of older people to participate and contribute to Australia, through better health, better retirement incomes and more flexible employment and caring arrangements. If older people and their families have the flexibility to make choices allowing them to maximise their participation and contribution to the community and economy, then ageing can be seen as increasing our economic well-being, not an impending burden.

Increasingly, society will need to overcome its image that an ever-growing population of frail older people will place increasing financial pressure on a diminishing pool of tax payers. Instead the potential for more active older years through increased life expectancy and increasing good health needs to be recognised. "Active ageing", where people are encouraged to remain active and independent as they get older, is important to minimising the impact of Australia's ageing population on the economy.

Another important factor is that business needs to accept and recognise that they have no other option but to accommodate the mature-aged worker. Reform to recruitment practices that covertly discriminate against older workers, rigid career paths and attitudes to part-time work will need to be removed it the increased participation of older workers in the workforce is to be supported.

2. Engineering and the economy

Engineering is about applying science and technology to satisfy basic human needs. The role of engineering in developing and implementing new technologies places engineers in a central role in improving the health and living standards of the community, improving the standards of environmental care and generating wealth for Australia.

Engineering, science and technology are major contributors to the Australian economy, particularly through the contribution they make to the innovation process. Engineering provides a bridge between science and technology and between technology and commerce. In advanced economies, engineering provides essential infrastructure, products and services including for example innovations in the communications, energy, transport, health and defence fields. These areas are also dependent on high quality engineering support to provide improved services to the Australian community.

While Australia has enjoyed strong economic growth over the last ten years, it is questionable whether this growth is sustainable in the longer term. Consumption rather then investment has financed much of Australia's recent economic growth, with Australia maintaining a high deficit on current account. Australia's industrial structure, while modernising, still has remnants of an economy dependent on extractive industries. Australia's economic health in a world subject to global competition will depend on our capacity to invest in knowledge-intensive industries. While Australians have been quick to take up new technologies as users or customers, particularly information technologies, we seem to have lost our edge in developing and retaining the benefits of innovations.

Engineering is at the heart of the manufacturing and secondary industry sectors. Engineers Australia believes that strong manufacturing and secondary industry sectors are essential for Australia's future development. Unless Australia can produce wealth creating employment, it will not overcome existing problems, nor address Australia's future in the global economy. The importance of value added industries in our resource rich country is not a new concept. However, its application has been disappointing to date. One of the main reasons for this has been the poor conversion of ideas into marketable products. Australia needs the skills to convert ideas into reality and to create sustainable secondary industries.

A study undertaken by the Department of Industry, Science and Resources (2000)[1], into the potential for companies operating in high growth and knowledge intensive industries to grow and produce high quality sustainable jobs found that highly successful companies share a set of common characteristics. These include a demonstrated capacity for innovation, and a reliance on technology and brainpower as a source of competitiveness.

Successful companies tend to increase the employment of highly skilled people at a considerably higher rate than employment of less skilled production workers and tend to employ a relatively higher proportion of people with tertiary qualifications compared to other firms in their industries. They also tend to devote more resources to training. It is this aspect

[1] Department of Industry, Science and Resources, *Shaping Australia's Future: Innovation Framework Paper* and National Summit, 2000.

that needs to be fostered in the Australian business environment for Australia to develop a sustainable competitive advantage. A highly skilled engineering workforce will continue to be invaluable in driving the growth of companies.
Employment of well-qualified engineers and scientists pays off in terms of a nation's competitiveness. This is especially so in relation to high quality, high technology industries. The use of highly skilled engineers can increase a company's profitability and through it, the nation's productivity. Higher productivity is likely to lead to higher economic growth.

Conversely, fewer and less skilled engineers and scientists and the associated diminished innovative activity adversely affects domestic market share for local goods and services, decreases international trade share, and erodes product quality and variety.[2] Ageing of the population without suitable policy interventions has the potential to impact on the Australian economy through the erosion of the skills base and thus our technical advantage.

3. Employment, skill shortages and the ageing of the population

Skill shortages occur when there is a lack of adequately skilled individuals at current levels of pay, conditions of employment and geographic location. In other words, skills shortages exist when employers have difficulty filling, or are unable to fill, vacancies in recognised occupations and specialisations or common occupational groups.

Along with most of the developed world, the Australian workforce is ageing. As the percentage of the population over 55 increases, eventually the number of retired residents will surpass the number of residents who are in the job market.

These demographic pressures will develop into the challenge of replacing skilled, older workers from a much smaller pool of younger workers. Industries with older-than-average workforces will be particularly affected by these factors. Due to demographic pressure, the engineering workforce is getting older and the ability of engineering expertise to drive innovation has the potential to be eroded.

3.1 How many engineers are there?

According to the 2001 Australian Census, there are 21,356 professional engineers if an engineer is defined as a person having a bachelor degree or above, and who has selected an occupation title associated with only non-management specific professional engineering (eg Electrical Engineer but excluding Construction Project Managers, Engineering Managers or Production Managers).

However, there are 44,822 professional engineers if an engineer is defined as a person having a bachelor degree or above, and who has selected an occupation title associated with management and non-management specific professional engineering (eg Engineering Manager or Electrical Engineer). However, there are 193,399 professional engineers if an

[2] Engineering & Technology Board (ETB): *Technology, Education and Economic Growth*, 2002.

engineer is defined as a person having a bachelor degree or above in the field of study entitled Engineering and Related Technologies.

The average age of a professional engineer is 37 years. An engineer employed in the manufacturing sector would be on average aged 43 years (the oldest average age in the engineering profession), while an engineer employed as a software designer would be on average aged 33 years (the youngest average age in the engineering profession). This data would suggest that long-term shortages will emerge for a large number of engineering disciplines. This is particularly worrying given that each year more and more eligible students are turned away from engineering degrees due to a lack of government funding.

The Australian Vice Chancellors Committee estimated that 1,400 eligible engineering applicants were turned away from study due to a lack of Commonwealth funded places in 2003. Commencing student numbers in engineering have stagnated. If Australia is serious about developing an innovative culture and working towards mitigation strategies against growing skill shortages then there will need to be more graduates from engineering courses. Australia must produce more engineers to increase its skill base and set the scene for the development of a strong knowledge economy.

3.2 Skill Shortages

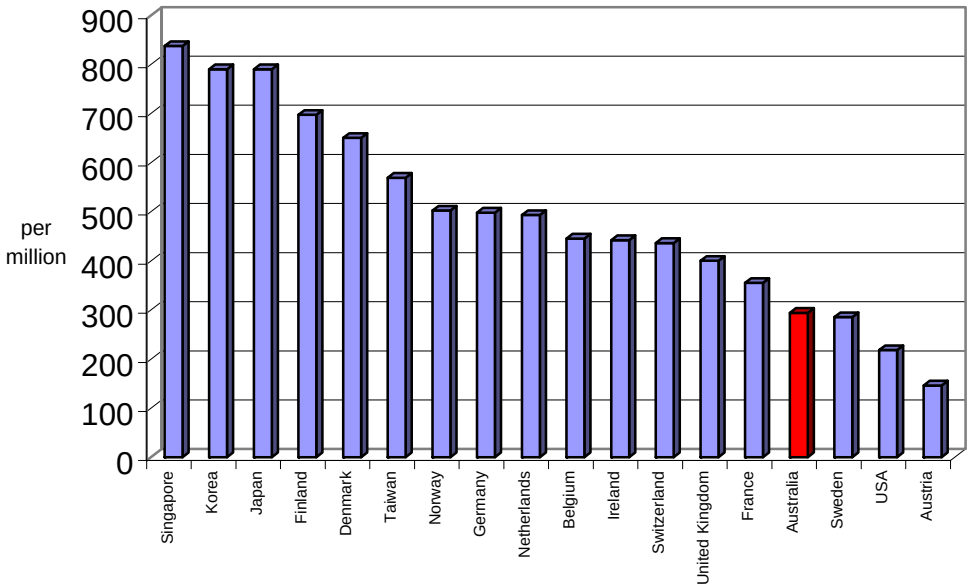
Engineers Australia is concerned with growing shortages of graduates across the engineering, science and technology base. For engineering, evidence suggests there are shortages of graduates in the mining, rail, electrical and power industries. Other sector shortages exist for software and systems engineers. The number of enrolments, particularly in the engineering field, is declining.

In 1999, only 8% of degrees awarded in Australia were in the essential "translator" areas of engineering and technology (converting ideas into internationally competitive products, processes and services) placing Australia at the bottom of the international league. In comparison Korea produced the most graduates at 27.1% followed by Finland with 23.8%. Twenty OECD countries produce more engineering and technology graduates than Australia.[3] Also of note is that the OECD has identified Korea and Finland as leaders in the transition toward a knowledge-based economy, investing 5.2% of GDP in knowledge annually. Australia in comparison is ranked well below the OECD total, investing less than 4% of annual GDP into the knowledge-based economy.[4]

In relation to Australia's age structure, the number of Australians with university education and the number entering university are around the OECD mean.[5] In comparison with other countries, Australia has a low rate of entry into and graduation from engineering.[6] The proportion of engineers in various countries' populations is given in Figure 1.

[3] Organisation for Economic Co-operation and Development (OECD), *OECD Education at a Glance 2001*, Indicator Table C4.3.
[4] Organisation for Economic Co-operation and Development, *Science, Technology and Industry Scorecard: towards a knowledge-based economy*, 2001, page 14.
[5] AVCC *Key Statistics* 2001, Indicator Table B18.
[6] AVCC *Key Statistics* 2001, Indicator Table B11.

Figure 1: Annual number of first degrees in engineering per million



Source: The Engineering Profession: a statistical overview, 2003, Edition 3, Engineers Australia

Also of concern to Engineers Australia is the balance between science and engineering as fields of study. Australia is currently producing twice as many scientists as engineers. Within OECD countries, Australia produces the lowest percentage of engineering graduates and the highest percentage of biological scientists. This comes at a time when we should at least be equally focused on converting ideas into products, as we are with discovering new ideas.

As Australia moves into the knowledge-based economy, it is vital for Australia's future development that the number of engineering graduates increases. To increase the number of engineers, children must develop an interest science, engineering, technology and mathematics throughout their school life.

Commencements at university by Australians in engineering and technology continue to decline and rather than this being a result of demographic changes in the population, the evidence suggests that this decline is attributable to the diminishment of school leavers' interest in undertaking engineering studies.

At least in the short term, the decline in the number of degrees awarded in engineering will continue. It is likely the number of Australians graduating in mechanical and electrical / electronic engineering will decline more rapidly than those in other areas of practice. A marked reduction in these specialties could act as a limiting factor in the further development of the manufacturing sector's R&D capability.[7]

[7] Michael R. Rice, *Recent Trends in Engineering Course Commencements and Completions in Australia*, 2003.

A full consideration of the implications of failing to encourage students into the enabling sciences and engineering can be obtained from Engineers Australia's submission to the House of Representatives Standing Committee on Science and Innovation inquiry into encouraging student participation in the enabling sciences.[8]

When economies with good export performance are examined, not only is there evidence that technical and engineering education and qualifications are highly valued, but there is also a high value attached to education overall. Those countries in which engineering related activities appear to make a particularly important contribution to economic performance are characterised not only by a strong demand for engineers, but also by developments in education, industrial research and continuous training.

With around 5,000 engineers graduating annually in Australia, it might be asserted that the engineering base is being replenished at an appropriate level. However, the figures mask or fail to comprehend factors that erode the replenishment rate. In the order of one thousand of the annual cohort are international students who are expected to return to their countries of origin soon after graduation.

In addition, many engineers - and this may be as great as between 20 and 50 percent, based on feedback from Engineers Australia member surveys - move into management roles and out of direct practice in their field or discipline. The sleeper issue is the expertise drain from engineering practice to management and leadership. Increasingly, an engineering degree is regarded as a good 'general' degree by employers. Engineering formation is highly regarded by employers due to its emphasis on risk management, stakeholder relations and sustainable outcomes. In this way, engineering is a source of managers and leaders for many organisations and professions and this pattern is expected to not only continue, but increase.

At the other end of the scale, those comparatively large proportions of engineers who graduated in the 1960's and 70's and are now the mainstay of the profession are due to retire within 15 years. Examination of the membership demographics of Engineers Australia reveals that up to 40 percent of its current members will retire within a decade. The ageing of the Australian population combined with a stagnated interest from school students in engineering studies will have significant implications for the economy.

3.3 Skilled migration

Engineers Australia recognises the significant contribution made by migrant engineers to Australia's early development and their continuing contribution to Australia's economic, physical and social well-being. Migrant engineers are a vital element in generating new ideas and approaches to engineering, and for providing skills where there are shortages.

[8] http://www.ieaust.org.au/policy/res/downloads/govtsubmissions/04008.doc

A skilled engineering workforce is essential if Australia is to achieve the quality and standard of living to which we aspire in an increasingly competitive world. At present, the country is importing a significant number of engineers every year to cover the shortfall in engineering skills. Between 1988 and 1996, 22 000 engineers migrated to Australia.

The skilled migration program is essential to Australia's future competitiveness. The Australian economy needs investment and skilled migration to grow. While supporting skilled migration generally, Engineers Australia has one particular area of concern. This is that the value of educating and developing the skills of Australians may be overlooked by a preference by industry to taking on large numbers of skilled migrants to overcome skill shortages. In a cost conscious commercial environment, there is a danger that employers will be tempted to make greater use of "off the shelf" skills available overseas. This is especially true where there may be delayed access to such skills through local training.

Over the 1990s, Australia supplemented a low turnout of engineers from Australian universities with migrants. Currently, 36 percent of Australia's engineers are migrants as depicted in Table 1. There are already periodic shortages of engineers in particular industries and disciplines throughout Australia and arguments exist that Australia will need greater levels of engineers in the future. If current migration levels in engineering fields are not maintained, or the number of engineers graduating from Australian universities is not increased, then more widespread shortages of engineering professionals could develop.

Table 1: Average annual flows of engineers 1990-1998

Australian graduates	4 621
Plus permanent settlers	2 371
Total supply	6 992
Less permanent departures	555
	6 437

Yates, Agnew, Kryger & Palmer, *The Engineering Profession: a statistical overview*, Institution of Engineers, Australia and Australian Council of Engineering Deans,2001.

3.5 Labour market participation of older workers

The OECD has identified two key factors in increasing the labour market participation of older Australians including:

- Public pensions systems, taxation systems and social transfer programs be reformed to remove financial incentives to early retirement and financial disincentives to later retirement.

- A variety of reforms be implemented to ensure that more job opportunities are available for older worker and that they are equipped with the necessary skills and competencies to undertake continued employment.

While early retirement rates have increased, comments from our members have indicated that they are happy to continue working past retirement age if there are able to seek changes in lifestyle at the same time. One comment included *"I retired from corporate management in 1992 at the age of 64. Since then have been doing what retired people are entitled to do – that is, I am doing what I enjoy most, and what I do best. In my case that happens to be hands-on engineering…I managed to get out of what I didn't particularly enjoy – corporate management and make a radical change in my lifestyle."*[9]

There needs to be a cultural change in employment practices in Australia to enhance the ability of people to have opportunities to find a new employment direction, either within their profession or in a completely new field. Currently this is quite difficult and there is a role for governments and businesses to help change ingrained social attitudes or perceptions working to undermine the ability of people to find suitable employment throughout their 50s, 60s and 70s.

As one engineer commented, *"our society is too rigid…retrenchment should not be regarded as being "thrown on the scrap heap" but rather as becoming available for a new project. The same applies to retirement…it is the job of governments and business leaders to organise the country so that people who want to work can do so."*[10] According to Trevor Moir, who formed The Executives' Co-ordination Group (TECG), a professional and social support network for older workers from a management or executive background, workplace culture is blatant in its discrimination against older workers and retrenched workers in their 40s, 50s and 60s are frequently unable to find work.

While many of the projections of what will happen to the workforce over the next 10,15 and 50 years are important, business needs to be accommodating the mature-age worker now. If businesses do not change their culture and best practice in employment of mature age workers now, they will be suffering from severe skill shortages in the future.[11]

There is also a covert pressure for retirement by age 55 and as a result, 89 percent of workers currently retire before 65 years of age. The latest government survey, in 1997, revealed that 54 percent of men and one-third of women aged between 45 and 64 who retired, left the workforce voluntarily. The study also concluded that involuntary retirements and retirements for family reasons were found to have outnumbered voluntary retirements by more than three to one. Unions have also estimated that one in three unemployed 45 year olds and 60% of unemployed 55 year olds can't get a job because of age discrimination.[12]

With the population ageing, employers must re-evaluate their attitudes to mature workers. As one of Engineers Australia unemployed members reflected, *"remember - we want to work but employers don't want us!"*

[9] Comments from Alastair Eddie, FICE, FIEAust, MASCE, a Consulting Civil Engineer still actively employed in the engineering profession at age 76.
[10] *Ibid.*
[11] Catherine Fox, "WorkSpace: action needed on ageing workforce", Australian Financial Review, 10/8/04, p59.
[12] Peta Donald, "Age discrimination a problem in the workforce", ABC PM, Thursday 26 February 2004 18:18.

3.5 Volunteering and unpaid work

Older people make a significant contribution to the volunteer sector. The ABS has calculated that in any given year approximately 24 percent of volunteers were aged over 55 years and they contribute over 141 million hours of voluntary work. On average, older Australians contribute 2.5 to 3 hours a week to charity, while young adults under 40 contribute least to volunteer activity. People 60 to 69 contribute the most, volunteering for approximately 3.3 hours a week with these high participation rates continuing into old age, with those 70 and over still contributing about 2.6 to 2.8 hours per week.[13]

Engineers Australia is a non-profit professional organisation that relies on the time, experience and expertise provided by members who volunteer. Membership of our Committees and Societies at a national and divisional level is voluntary and the wide range of schools based programs and competitions supported and operated by Engineers Australia rely on the generosity of volunteers. Without volunteers, Engineers Australia would not exist. It is certain that the same could be said for a number of other community and professional organisations.

A report from the Australian Financial Review which drew on information compiled from the Australian Bureau of Statistics outlined that "Non-profit organisations and their volunteers contribute more to the Australia economy than Australia's miners, the communications sector or the farm industry." The article also reported that while the value of non-profit work to the economy was about 4.7 percent of GDP, a third of the sectors workforce were volunteers who had they been paid, would have earned $8.9 billion.[14]

The role that volunteers play in the Australian economy will have important implications towards how strategies are developed to offset the economic costs of an ageing population. Policy programs will need to consider the impact of greater workplace participation of older Australians, on the ability of people to contribute to the volunteer sector. As people are called on to work beyond traditional retirement ages, their ability to spend considerable time and energy as volunteers may be reduced.

4. Medical care

The Productivity Commission has already identified that the major drivers of rising health care costs per capita in advanced economies will continue to be the demand for new medical technologies. While some of these technologies will work to lower the costs of care (for example cataract operations) overall, there is an acceptance that the cost of expansion of treatment is generally considered to outweigh any unit cost reductions. Regardless, developments in health technologies reflect the positive success of modern medicine in improving and prolonging peoples lives and reducing the impact of physical impairment.[15] The role of engineers in the development of health technologies is discussed below.

[13] *The National Strategy for an Ageing Australia*, Background paper, April 1999, p26.
[14] Cherelle Murphy, "Non –profit work outstrips industry", *Australian Financial Review*, 29/11/02, page 3.
[15] Chairman, Productivity Commission, Gary Banks, *An ageing Australia: small beer or big bucks?*,

4.1 Health technologies and engineering[16]

Advances in 20th century medical technology have been remarkable. Armed with only a few instruments in 1900, health professionals now have an arsenal of diagnostic and treatment equipment at their disposal. Artificial organs, joint replacement, imaging technologies, and biomaterials are but a few of the engineered products that improve the quality of life for millions.

Today, people live nearly 30 years longer, on the average, than their great-grandparents did at the beginning of the 20th century. To this end engineers have worked with the medical profession to develop technologies for surgery, medical implants, bioimaging, and intensive care units, as well as methods to develop and manufacture technology to: (a) Investigate human physiological function and performance, (b) observe the structure and organs of the body in great detail in real time, (c) diagnose illness, disease states and abnormal function, (d) treat infection, disease, cancer, genetic and functional abnormalities via pharmacological techniques, ionising and non-ionising radiation therapies, implantable devices, surgical repair, transplant and replacement techniques. Indeed without the involvement of engineers medicine could not have developed to its current level of sophistication.

Each year, worldwide, surgeons implant 200,000 pacemakers, 100,000 heart valves, 1 million orthopedic devices, and 5 million intraocular lenses. Technology and machines make these procedures possible for example, electronic anaesthetic machines delivering sophisticated anaesthetic agents, robot surgeon assistants that perform accurate surgery and accurately locate positions in the body, imaging technologies that show hard and soft tissues in great detail to enable planning of elaborate surgery. The heart-lung machine, blood-heat exchanger, kidney dialysis machines and artificial hearts. Mechanical or electromechanical devices such as pacemakers and defibrillators regulate heartbeats and correct rhythm dysfunction. Damaged valves are routinely replaced with prosthetics while ventricular assist devices can provide circulatory support by assuming the work of the failed heart, allowing the organ to recover normal functions.

The modern pharmaceutical industry introduced highly active medicinal compounds in the 19th century and life-saving sulfa drugs, antibiotic agents and vaccines in the 20th. But without two major engineering components, these discoveries would have meant little to the masses: the fermentation process through which many pharmaceuticals are grown, and the large-scale manufacturing techniques that mix, shape, package and deliver drugs in all their forms, from millions of vials and pills to gallons of serum and liquids. These medicines greatly reduced or completely eradicated diseases that plagued the population throughout human history, such as rheumatic and typhoid fever, lobar pneumonia, poliomyelitis, syphilis, and tuberculosis.

Pharmaceuticals have also provided greater protection from infection, which has allowed doctors to go farther in repairing and replacing damaged or worn-out tissues with engineered

presentation to the Australia Centre for Economic Studies, Economic Briefing, Adelaide, 29 April 2004, p17.

[16] This Section draws heavily from the information provided by the website, Greatest Engineering Achievements of the 20th Century, Health Technologies www.greatachievements.org

materials (biomaterials). Synthetic and biological polymers, metals, and ceramics, are used for almost everything from suture material to heart valves, and to replace bones or eye lenses. Inert metals, such as vitallium, are used to repair fractures or replace joints. Silicone capsules protect implanted electric equipment, such as cardiac pacemakers. Woven acrylic artificial arteries prevent rapid clotting of blood in artificial blood vessels. With such a tremendous increase in medical applications, demand for new biomaterials grows by 5 to 15 percent each year.

Engineering-based advances are occurring in technologies that assist people who have lost physical function. This is occuring in 2 areas; (1) orthoses and prostheses (devices to assist and replace musculo-skeletal function) and (2) rehabilitation engineering and assistive technology (devices to assist people with physical disabilities).

Orthotics and prosthetics is making advances due to integration of material science, electronics and computing and understanding of limb dynamics. For example a prosthetic limb for a person who has undergone an above-knee amputation can incorporate a knee joint that responds to the speed of walking and running of the user by processing signals from accelerometers to provide the user with a very natural gait. Laser scanning the stump to acquire data to machining an accurate socket achieves intimate fit of the prosthesis with the user's limb. Silicon socket-skin interface materials reduce friction and moderate skin temperature to reduce sweating. A new technique, osseointegration enables a prosthetic limb to be securely attached to a metal stud embedded into bone (e.g. femur) and penetrating through the skin at the end of the stump. Composite material construction ensures light weight and high strength prostheses to reduce the user's energy expenditure to walk.

Assistive devices to help people with disabilities regain independence and function are relient on professional engineering input for their development and design and also for their customisation to suit an individual user's requirements. A wide array of devices is available to enable people with disabilities to participate in living, working and enjoying sporting and recreational pursuits. Assistive devices from wheelchairs to communication aids are constructed and tetsted to international standards for durability, safety and adaptation to suit a range of user requirements. Assistive Technologies will be important in aiding an aging population to retain independent mobility and function for as long as possible, to help contain ongoing costs of care to the elderly.

The types of medical device and the complexity of medical technology are expanding constantly. Medical device development relies heavily on professional engineers with expertise in mechanisms, electronics, optics, metallurgy and material science, computing and software, manufacturing and risk management.

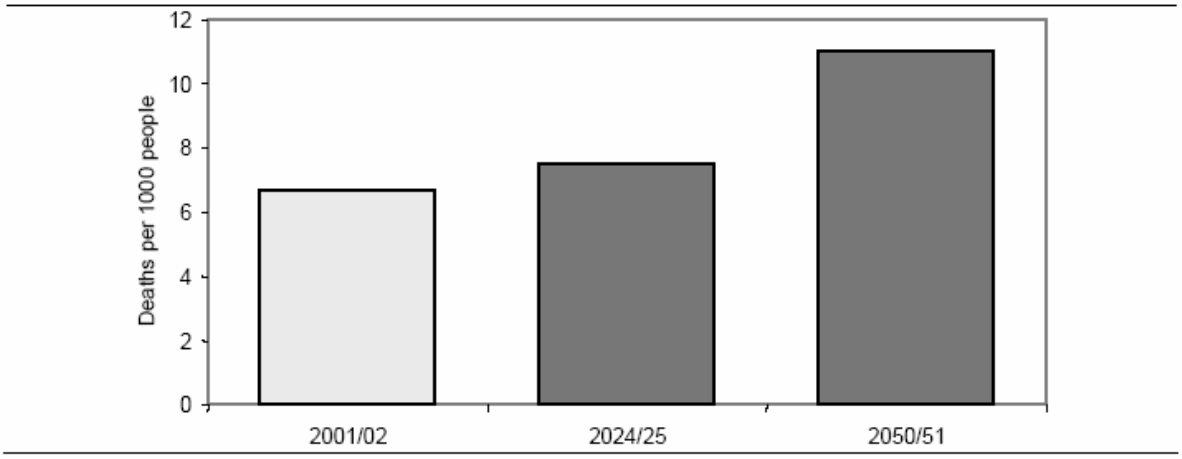
Significantly, the ongoing delivery of health care in Australian hospitals, particularly is dependent on professional engineers who develop and manufacture medical technology, install and commission it, oversee or actually maintain and service the equipment through its working life, ensure its proper and safe function and see to its safe disposal to prevent harm to the environment.

4.2 Benefits of better medical care

Studies would suggest that advances in medical technology have resulted in age specific disability levels falling. People are not only living longer, but they are ageing later. This development is working to off-set the ageing of the population by redefining what "elderly" actually means. If most 70 year olds today are as healthy as most 60 year olds used to be, there is scope to encourage people to work closer to age 70. And if in the future 80 year olds are as healthy as 70 year olds or even 60 year olds are today, there could again be a corresponding push to allow and encourage people to work to age 80. If this occurs the whole idea of what "elderly" means will be altered.

Another reason why age is not directly related to increased medical costs is that high medical costs are linked to the 2 year period just before death. As age specific death rates fall over time as people live healthily into their 70s, 80s and 90s, there will be fewer people in the last years of their lives and age related health expenditures will be offset. However, this trend will only postpone rising health costs associated with an ageing population – it will not eliminate them, as represented by Figure 2:

Figure 2: Projected deaths over 1000 persons 2001/02 – 2050/51



Source: Chairman, Productivity Commission, Gary Banks, *An ageing Australia: small beer or big bucks?*, presentation to the Australia Centre for Economic Studies, Economic Briefing, Adelaide, 29 April 2004, p22.

Overall, it is difficult to calculate exactly what the health costs will be in relation to the ageing of the Australian population. What is clear is that increased health spending yields benefits. It promotes longevity and enables people to live higher quality lives, contributing to the economy through increased periods of paid work and to the community as volunteers, carers and active and able community members.

The OECD has identified in its "active ageing strategy" outlined further below, that "in health and long term care, there should be a greater focus on cost effectiveness. Medical expenditure and research should be increasingly directed to ways of reducing physical dependence and explicit policies for providing care to frail older people need to be

advanced." As outlined above, engineers have a significant role to play in these developments.

4.3 Active ageing

It is a common assumption that as we grow older we work, produce and earn less and our health is poorer. The reality is that at any one time over 80 percent of the population that is over 70 are not using any aged cared services and the majority of older Australians living in the community rate their health as "good", "very good" or "excellent".[17] The OECD is actively promoting the idea of "active ageing" where the assumption that ill health is a defining feature of old age has been discarded.

Comments from our members included *"I am fitter now at 76 than at 46 …[and] what I am doing today at the age of 76 is equivalent to what some people were doing at the age of 66 one hundred years ago...physical fitness is of course an essential part of the equation in continuing in the workforce in later years, and I am certain that I would not still be enjoying working if I was not physically fit."*[18]

There is evidence that older people who follow active lifestyles and undertake regular exercise have the daily functioning equivalent to less active people aged 15 years or younger. One study found that healthy, middle aged men who were inactive but began to participate in moderately vigorous sports, had a 23 percent lower risk of mortality from all causes than men who remained sedentary.[19]

A recent report in the Sydney Morning Herald outlined that walking as little as 90 minutes a week could significantly reduce the rate of mental decline in the elderly, delaying the onset of dementia and Alzheimer's Disease with the mental benefits of regular exercise the equivalent of being 3 years younger. The report also outlined the results of earlier studies that have concluded that regular physical activity reduces the risk of heart disease, cancer and diabetes. These factors all combine to reduce the rate of residential aged care needed by the population and as a result reduces the costs of the ageing of the population on health budgets.[20]

Given the relationship between healthy ageing and the costs associated with the ageing of the population, government, business and community leaders will need to actively work together to help encourage the population to make healthy lifestyle choices including not smoking, exercising regularly and maintaining a healthy diet. This would have positive benefits for health costs and the ability of older people to actively contribute to the workforce well beyond the current retirement age.

[17] *The National Strategy for an Ageing Australia*, Background paper, April 1999, p6.
[18] Comments from Alastair Eddie, FICE, FIEAust, MASCE, a Consulting Civil Engineer still actively employed in the engineering profession at age 76.
[19] *The National Strategy for an Ageing Australia*, Background paper, April 1999, p22
[20] "Beating dementia just a walk in the park", *Sydney Morning Herald*, 23 September 2004.

4.4 Carers and the costs of aged care

Older people make a range of contributions to the economy and society and a significant proportion of this contribution is work as unpaid carers to other older people, mainly their spouses, but also for other members of their family. In particular, up to a half of employed women have their children looked after by a grandmother while they are at work.[21]

The vast majority (94%) of older people living in the community with a severe handicap (who require help with self-care, mobility or communication) received assistance from an informal care network of family, friends or neighbours.

The increase in per person health expenditure with age is the greatest for people requiring nursing home care. There are significant cost savings to the government when aged care is being provided in the home. As a result, an increase in the proportion of older people staying in their homes, and active ageing strategies will diminish the economic costs of Australia's ageing population.

According to the ABS, 4 million people will be living alone in 2026 and 49% of couples will not have children. Changes in the make-up of family units into single person households or relationships without children may work to increase pressure on government provided aged care programs. This pressure is outlined in Table 2:

Table 2: Family Type 1991, 2001, 2011. (percentages of total.)

Family Type	**1991**	**2001**	**2011**
Single-parent families	8.8	15.9	16.5
Childless couples	31.4	36.5	39.8
Couples with dependent children	53.9	45.8	41.9
Other	5.9	1.8	1.8
Total	100.0	100.0	100.0

Source: ABS (1999b, 2000b).

Changing social patterns and family structures as well as differentials between male and female life expectancy mean that very old people will be increasingly likely to live alone. In addition, as female participation in the labour force continues to rise and couples choose not to have children, a traditional source of carers for the elderly (spouses and daughters not active in the workforce) may disappear. These demographic and social changes may work to limit the ability of family, friends and neighbours to continue to support and care for elderly people within their homes. This demographic trend may have significant implications on the costs associated with supporting an ageing population as more people may require higher levels of assisted care than in the past, simply because of an absence of traditional informal care networks.

[21] [21]*The National Strategy for an Ageing Australia*, Background paper, April 1999, p6.

5. Housing and urban design

The increase in Australia's population choosing to live in single person households and the recent property boom has had a major impact on urban expansion. Cities such as Melbourne and Sydney are experiencing significant growth in new urban development and redevelopment in established suburbs. Without significant change to future planning for our cities, Australia faces a number of problems including increasing pollution and health risks and difficulty in and providing adequate amenities such as public transport.

The ageing of the population, combined with changes in family units into two or more separate lone person or single parent households is working to increase housing demand with the ABS predicting that lone-person households will increase by 39% by 2021. A lower turn over of housing stock as older people live longer and healthier lives, living at home until they die, is also a factor working to increase housing demand and fueling urban sprawl.

There will be a significant role for engineers in using and supporting the development of sustainable planning practices throughout Australia in response to the pressure created on urban expansion through population ageing. These measures will include methods for reducing energy and water consumption, improved transport links, conservation areas, community centres and sporting facilities.

6. Conclusion

If increases in lifespan are achieved with favourable health results, the elderly will be able to contribute more in the economic and social aspects of life in Australia and lead more autonomous lives, putting less pressure on social systems and as a result increasing their quality of life. If this does not occur, if "active ageing" is unattainable, than older populations will need an increasing level of support, as their numbers as a proportion of the population increases and informal care structures break down.

It is clear that the health status of the elderly is one of the key variables in future government policy dealing with the ageing of the Australian population. Given the role that engineers will play in improving the quality of life of the elderly and thus their ability to participate in the labour force, as volunteers and as carers, the Australian government will need to address shortages in the engineering profession and support the work of Engineers Australia in attracting students into engineering through programs in primary and secondary schools.

Another significant challenge for the Australian government is to roll back the trend to early retirement evident in recent decades by introducing polices to support the aims and goals of the concepts of "active ageing" and "lifelong learning". This could go a long way towards easing the economic and social problems caused by population ageing. Population ageing is a complex, multifaceted issue that will have ramifications for different levels of government, communities and businesses, individuals and their families. Engineering has an important role to play in determining just how these problems will impact on the Australian economy with engineers at the core of solving the obstacles created by an ageing Australia.