AUSTRALIAN FUTURES PROJECT

WELCOME TO THE FUTURE
DRIVERS AND TRENDS THAT WILL SHAPE AUSTRALIA

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A MULTI-SECTOR, NON-PROFIT, NON-PARTISAN INITIATIVE HOSTED BY

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The objective of the Australian Futures Project is to build Australia's capacity to make decisions for a flourishing shared future in the 2020s and 30s. The Australian Futures Project is a multi-sector, non-profit, and non-partisan initiative hosted by La Trobe University.

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1   WELCOME TO THE FUTURE

Imagine waking up one morning to a future world where every hard surface is a telecommunications interface, where Peru, Poland and the Philippines are global economic powers and where commercially farmed insects make up the protein in your microwave ready meal. You can print a new car part on your 3D printer, take a summer cruise across the Arctic shipping lanes and sequence your own DNA. Canada is second only to Saudi Arabia as an oil exporter, cybercrime police forces operate on a global scale, and a new city is being built every week. It could also be a world where one-third of the population lives with water scarcity, where food self-sufficiency is no longer a possibility for every country, and where the temperature is an average 3 degrees warmer.

Such a future is not so implausible nor is it so far away. These futures are all possible according to the people and organisations thinking about tomorrow - trying to determine potential drivers, key trends and probable futures. We never arrive at the future but we all imagine what it might be like. From the visions of the Oracle at Delphi and the creators of the Mayan calendar through to Treasury predictions of GDP growth, humans have wondered about the future since time immemorial. Today, it is an academic discipline with the methods and theory to match.

There is no crystal ball. The future is not predetermined, nor is it predictable. Yet we can use a range of tools from modelling and forecasting to scenarios and synthesis to better understand alternative pathways in our complex and rapidly changing world. This discussion paper provides a glimpse of what various organisations and people are writing about the future, and what this might mean for Australia and the world. It summarises some of the key forces shaping the future, including eight mega drivers:

1.   Climate change (mitigation and adaptation)
2.   Global cooperation and conflict (trends in geopolitics)
3.   Demographic change (population growth, ageing and urbanisation)
4.   Economic shifts (towards emerging-market economies)
5.   Resource security and scarcity (reconciling resource consumption and ecosystem health)
6.   Virtual connectivity (global networking)
7.   Values, behaviours and lifestyles (changing expectations)
8.   Technology (development and application)

This paper isn't an exhaustive review of all literature, but instead a brief overview of some of the best known and more thought provoking assessments publicly available. It aims to inspire thinking and ideas about the future - not as a scary and uncertain place, but as the expression of the decisions and actions we take today and a source of new opportunities for tomorrow.

2   THINKING ABOUT THE FUTURE

2.1   STUDYING THE FUTURE

The Futures field emerged during the mid-Twentieth Century as it became apparent that there was no single destination for humanity, but rather that there were many possible futures, some more desirable than others (Slaughter, 2008). The field is broad, with varied terminology and even more numerous methods, techniques and frameworks. Uniting the field is a common purpose, not to predict the future, but to highlight the many possible alternative futures (hence the use of the plural 'futures'). While accepting that the future is not predetermined nor predictable, we do have the ability influence the shape of the future by the choices (whether action or inaction) we make in the present (Voros, 2001). When thinking of alternatives, Voros' (2003) five categories can be useful:

1.   *Potential futures:* alternative futures in general, including those we cannot even begin to imagine;
2.   *Possible futures:* all the kinds of futures we can possibly imagine;
3.   *Plausible futures:* futures which could happen according to our current knowledge;
4.   *Probable futures:* futures which are considered likely to happen ('business-as-usual);
5.   *Preferable futures:* what we want to happen based on subjective value judgments.

These five types of futures are further illustrated in Figure 1.

FIGURE 1: FIVE TYPES OF FUTURES (VOROS, 2003)
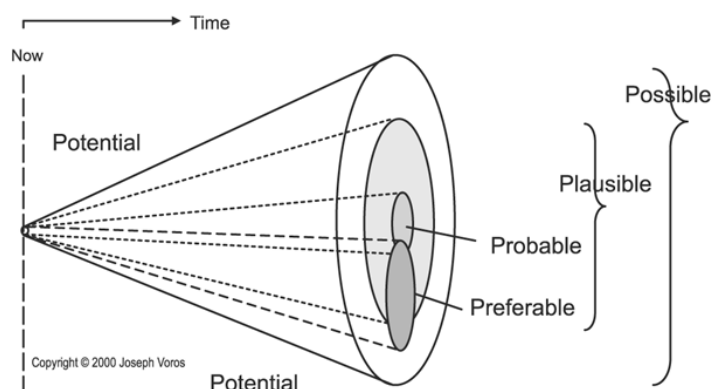
As the future becomes an experience of the present and a memory of the past it will be lived differently by each and every one of us, depending on location, time and context. Therefore, judgment of what is possible, plausible, probable or even preferable will differ between people and over time, which means that opinions may change as the future unfolds (Voros, 2001).

2.2 CREATING ALTERNATIVE SCENARIOS

In terms of Futures methods, qualitative approaches such as synthesis and the use of scenarios are as valid (if not even more so) as more quantitative and mechanical projections. Containing large elements of the unknown, thinking about the future requires drawing upon more than logic. It also requires intuition and inductive reasoning. Scenarios based solely on quantitative analysis of trends and forecasts will generate a very narrow range of alternative potential futures (Voros, 2003).Scenarios based upon a wide range of alternative potential futures can generate a rich narrative from which to consider options. Table 1 provides some examples of particularly vivid scenarios for the planet.

TABLE 1. EXAMPLES OF SCENARIOS IN USE

PUBLICATION	SCENARIOS
Delivering Tomorrow: Logistics 2050 - A Scenario Study (DHL, 2012)	• *Untamed Economy - Impending Collapse:* a world characterised by unchecked materialism and consumption, fed by the paradigm of quantitative growth and the rejection of sustainable development. • *Mega-Efficiency in Megacities:* a world in which megacities are both the main drivers and beneficiaries of a paradigm shift towards green growth. • *Customized Lifestyles:* a world where individualisation and personalised consumption are pervasive. • *Paralysing Protectionism:* a world where, triggered by economic hardship, excessive nationalism and protectionist barriers are in place, and globalisation has been reversed. • *Global Resilience – Local Adaptation:* a world initially characterised by a high level of consumption but, due to accelerated climate change, a new economic paradigm emerges involving a shift away from efficiency maximisation to vulnerability mitigation and resilience.

PUBLICATION	SCENARIOS
Global Water Futures 2050: 01. Five Stylized Scenarios (United Nations World Water Assessment Programme, 2012)	• *Conventional World:* a business-as-usual scenario based on what could be expected according to widespread conventional expectations. • *Conflict-world:* economic instability leads to increasing conflicts associated with inequality within and between countries and the exclusion of the 'poor masses'. • *Techno-world:* together with governments, large corporations dominate the international scene. • *Global Consciousness:* new channels for international cooperation develop and unprecedented levels of international cooperation result in drastic reductions in poverty and a gradual process of convergence between countries. • *Conventional World Gone Sour:* actions to mitigate global climate change are insufficient and tardy and crisis management increasingly dominates global concerns.
Futurevision: Scenarios for the World in 2040 (Watson and Freeman, 2012)	• *Imagine - a world of intelligence:* A society where people are fully aware of the threat to the future, such as climate change, but have an unshakeable belief in the power of science, technology, and free markets to make life better. Most homes in Western nations have at least one 3D printer to print products and commercially farmed insects are used to provide protein in some microwave ready meals. • *Please Please Me - a world of greed:* An era of economic growth, free markets, individualism, consumerism, selfishness, and self-indulgence, where people work harder and longer, and where greed and status remain key – and unapologetic – drivers of much human activity. Police and healthcare services in most countries are privatised and FTSE 500 companies begin to offer scholarships to kindergarten children. • *Dear Prudence - a world of temperance:* A society where people are alarmed about the health of the planet and about the pervasive influence that materialism and individualism has had upon their lives. There is a 50% year-on-year growth in ethical savings, the EU limits the working week to 22 hours and imported bottled water is banned globally. • *Helter Skelter - a world of fear:* A world where a series of unexpected events creates a general sense of fear and fragility. The impact of climate change, the implosion of global financial systems and institutions, cyber crime, soaring food costs, high taxation, and the ever-growing disparity between rich and poor mean that people turn their backs on the notion of a single global economy. One in four adults worldwide takes anti-anxiety medication and the global airline industry collapses.
Global Trends 2030: Alternative Worlds (NIC, 2012)	• *Stalled Engines:* In the most plausible worst-case scenario, the risks of interstate conflict increase. The US draws inward and globalization stalls. • *Fusion:* In the most plausible best-case outcome, China and the US collaborate on a range of issues, leading to broader global cooperation. • *Gini-Out-of-the-Bottle:* Inequalities explode as some countries become big winners and others fail. Inequalities within countries increase social tensions. Without completely disengaging, the US is no longer the "global policeman." • *Nonstate World:* Driven by new technologies, nonstate actors take the lead in confronting global challenges.

Scenarios have also been used in the Australian context. For example, to understand future demand for and supply of post-school qualifications, the Australian Workplace and Productivity Agency (AWPA) commissioned Deloitte Access Economics (Deloitte Access Economics, 2012) to undertake modelling which was based on the development of economic parameters for four a range of scenarios for 2010 to 2025:

1. *The 'long boom' scenario:* largely based on the steady growth view of the Australian economy, consistent with budget projections from Federal Treasury
2. *The 'smart recovery' scenario*: where the current difficulties facing the Australian and global economies live on for several more years
3. *The 'terms of trade shock' scenario:-* where the global economy continues to grow at a healthy rate over time
4. *The 'ring of fire' scenario:* combines a lower global growth path over time with significant volatility

2.3   MODELLING AND FORECASTING

In addition to scenarios (often generated across a matrix of 4-5 options), other common methods include forecasting and trend analysis, the T-cycle, causal layered analysis (CLA), integral theory and environmental scanning (Slaughter, 2008). Modelling can

also be a useful tool for thinking about the future. However, like any analysis, a model is only as good as the data and assumptions that go into it. Most large general equilibrium global models tend to be conservative and consider factors such as natural resources, economic development, technological change, population growth and food demand separately, rather than in aggregate form. This is because the most challenging component of integrated global models remains linking impacts on ecosystem health back to human demographics and economic projections. Truly integrated simulation models – those that address the dynamics of both the natural and human components of the system and their interactions – are still relatively rare (Costanza et al., 2007). While there are many models, three (GTEM, IMPACT and IMAGE) are briefly summarised in Table 2, as they feature in some of the publications reviewed in this discussion paper.

TABLE 2. MODELLING THE FUTURE

MODEL	DESCRIPTION	ORGANISATION	WEBPAGE
IMPACT **(International Model for Policy Analysis of Agricultural Commodities and Trade)**	IMPACT is designed to examine alternative futures for global food supply, demand, trade, prices and food security. IMPACT covers over 40 commodities, which account for virtually all of world food production and consumption. It is specified as a set of 115 country-level supply and demand equations, with the world linked through trade.	International Food Policy Research Institute (IFPRI)	http://www.ifpri.org/book-751/ourwork/program/impact-model
IMAGE 2 **(The Integrated Model to Assess the Global Environment)**	IMAGE 2 models global and regional climate change. The model simulates emissions from energy and land use, biogeochemical cycles, atmospheric chemistry, and circulation and impacts. IMAGE 2 consists of three major components: the Energy-Industry System, the Terrestrial Environment System and the Atmosphere & Oceans System.	Netherlands Environmental Assessment Agency (PBL)	http://themasites.pbl.nl/tridion/en/themasites/image/
GTEM (Global Trade and Environment Model)	GTEM is a dynamic multi region, multi sector, general equilibrium model of the world economy. GTEM captures the impact of policy changes on large numbers of economic variables in all sectors of the economy including gross domestic product, prices, consumption, production, trade, investment, efficiency, competiveness and greenhouse gas emissions.	The Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)	http://www.daff.gov.au/abares/models

3   REVIEWING THE LITERATURE

3.1   IDENTIFYING PUBLICATIONS

Not every paper that deals with future trends could be included in this review of futures literature. In particular, papers have been excluded that relate primarily to opinions about what the future should be (ie. 'preferable futures' based on subjective value judgments) rather than what it could be (ie. potential, possible, plausible and probably futures). This meant that position papers, documents that exclusively focus on reform and investment ideas, or 'visions' and aspirations for the future were excluded. Instead, the focus was on publications considering possible futures, given current drivers and possible trajectories. Rather than focusing on academic journal papers, books, reports and other grey literature from government, intergovernmental, non-government and private sector organizations were sought. Publications were reviewed which related either to global futures in general or which had an Australian focus. In regard to global futures, a total of 16 global assessments were identified. They were all of a mid- to long- term range from 2030 to 2050. Of the 16 publications, 6 were by the private sector while 5 were by intergovernmental organisations. There was one publication by a not-for-profit and two by self-described "think tanks". See Table 3.

ORGANISATION TYPE	PRIMARY TOPIC	TIMEFRAME	METHOD
Intergovernmental	Water	2050	Scenarios
Government (UK)	Food	2050	Expert opinion/ synthesis
Private Sector	Logistics	2050	Scenarios
Private Sector	Energy	2050	Scenarios
Private Sector	Economy	2050	Data analysis
Private Sector	Business	2050	Data analysis/ expert opinion
Think Tank	Global challenges	2050	Synthesis
Not-for-Profit	Population	2050	Synthesis
Intergovernmental	Environment	2050	Modelling/ projections
Intergovernmental	Energy	2035	Scenarios/ modelling
Government (Australia)	Global megatrends	2032	Expert opinion/ synthesis
Intergovernmental	Bioeconomy	2030	Expert opinion/ synthesis
Intergovernmental	Family	2030	Synthesis and scenarios
Private Sector	Water	2030	Synthesis
Government (US)	Global megatrends	2030	Expert opinion/ synthesis/ scenarios
Think Tank	Global challenges	unclear	Modelling/ projections

In addition to these 16 reports, five recently published books on the future were examined:

- *Megachange: The World in 2050* (Franklin and Andrews, 2012)
- *The Next 100 Years: A Forecast for the 21st Century* (Friedman, 2010)
- *2052 - A Global Forecast for the Next Forty Years* (Randers, 2012)
- *The World in 2050: Four Forces Shaping Civilization's Northern Future* (Smith, 2010)
- *FUTUREVISION: scenarios for the world in 2040* (Watson and Freeman, 2012)

Interestingly, it was in books that authors seemed to have the freedom to be more creative in their scenarios for the future, and to consider longer timelines. While one book was based on synthesis of existing literature, four of the five books used forecasting, scenarios and social prediction, and each had a mid- to long-term timeframe.

In scanning the literature on futures publications with an Australian focus, it was evident that studies had again been produced by a mix of sources. The timeframes for analysis were more varied, from short- to long-term studies. There were at least 10 papers with a shorter timeframe of 2020-2025. For these, the focus was on employment, economy, health and energy. Methods for these studies included modelling and projections of trends, as well as synthesis of existing data. There were 7 papers with a 2030 timeline, again a mix of modelling and projections of trends, as well as synthesis of existing data. Topics included climate, energy, technology, defence and waste. There were 4 papers with a 2050 timeline, based on modelling, scenarios and data analysis. The topics were mixed and included energy, agriculture, economy and technology, with Government authoring 3 of the papers. There were 2 publications with timelines longer than 2050, one on demography by Government and one on urban water demand by an industry association. Both were based on modelling and/or the use of scenarios.

Most modelling and projections were also undertaken by government, although there were several private sector studies which used these methods. In total, there were 18 publications by Government, 6 by the private sector and 3 by industry groups. Similar to the review of global futures publications, non-government organisations and think tanks are poorly represented. While low representation from think tanks could be because their studies are being published in academic journals, it is unclear why non-government organisations do not appear to be publishing on the future.

Although reports covered a range of topics, a 'primary topic' was used to categorise reports. In terms of the most popular topics, energy clearly outranked other topics with 7 publications (6 of which were by Government). 3 reports by a mix of sources were found for each of the following topics: agriculture/ food; demography/ social change; employment. Government had written 2 reports on the future of the economy and 2 on defence, while the private sector had written 2 reports on technology. Climate had 2 reports, with Government and non-government as the authors, while the following were the primary topics for 1 publication each: National Security; Crime; Waste; Health; Manufacturing; Environment; and Water. See Table 4 below for more information.

TABLE 4. SUMMARY OF PUBLICATIONS REVIEWED ON AUSTRALIAN FUTURES (ORGANISED BY TIMEFRAME)

ORGANISATION TYPE	PRIMARY TOPIC	TIMEFRAME	METHOD
Government	Demography/ social change	2101	Modelling/ projections
Industry Group	Water	2056	Modelling/ scenarios
Government	Crime	2051	Data analysis
Government	Energy	2050	Modelling/ scenarios
Government	Agriculture/ Food	2050	Modelling/ projections
Government	Economy	2050	Modelling/ projections
Private Sector	Technology	2050	Data analysis
Government	Climate	2030	Modelling/ projections
Government	Energy	2030	Modelling/ projections
Government	Energy	2030	Modelling/ projections
Government	Energy	2030	Expert opinion/ synthesis
Private Sector	Technology	2030	Expert opinion/ synthesis
Government	Defence	2030	Expert opinion/ synthesis
Consultancy	Waste	2030	Modelling/ projections
Government	Employment	2025	Modelling/ projections
Government	Health	2025	Modelling/ projections
Government	Economy	2025	Expert opinion/ synthesis
Government	Energy	2025	Modelling/ scenarios
Private Sector	Employment	2025	Modelling/ projections
Private Sector	Energy	2022	Modelling/ projections
Private Sector	Demography/ social change	2020	Scenarios
Independent committee (convened by Government)	Manufacturing	2020	Expert opinion/ synthesis
Industry Group	Employment	2020	Expert opinion/ synthesis
Private Sector	Demography/ social change	2020	Synthesis
Industry Group	Agriculture/ Food	unclear	Scenarios
Academia	Agriculture/ Food	unclear	Synthesis
NGO	Climate	unclear	Synthesis
Government	Energy	unclear	Expert opinion/ synthesis
Government	National Security	unclear	Expert opinion/ synthesis
Government	Defence	unclear	Expert opinion/ synthesis
Independent committee (convened by Government)	Environment	unclear	Expert opinion/ synthesis

3.2   IDENTIFYING MEGA DRIVERS

In several of the publications reviewed, authors nominated what they saw as key trends or drivers shaping the future (also termed megatrends, megachange, crucibles and driving forces). To illustrate, Table 5 provides a brief overview of 8 publications where key trends were proposed, referred to here as mega drivers.

TABLE 5. EXAMPLES OF MEGA DRIVERS

PUBLICATION	MEGA DRIVERS
Our Future World: Global megatrends that will change the way we live (Hajkowicz et al., 2012)	Suggests six global megatrends: • *More from less:* new ways of ensuring quality of life for current and future generations within the confines of the natural world's limited resources • *Going, going….gone?*: the perilous situation of the world's ecological habitats and biodiversity, and the issue of greenhouse gas emissions and climate change • *The silk highway*: coming decades will see the world economy shift from west to east and north to south • *Forever Young*: the ageing population is an asset • *Virtually here*: what might happen in a world of increased connectivity in a virtual world • *Great expectations*: the rising demand for experiences over products and the rising importance of social relationships.
Picture the future: Australia 2030 (Siemens, 2012)	Suggests many challenges stem from four global megatrends: • Climate change • Demographic change • Urbanisation • Globalisation
Australia in the Asian Century White Paper(Commonwealth of Australia, 2012a)	Suggests that three (global and national) forces will shape the economic and social landscape of Australia: • Staggering scale and pace of the continued transformation of Asia • Ageing of Australia's population • Environmental sustainability
Global Water Futures 2050: 01. Five Stylized Scenarios (United Nations World Water Assessment Programme, 2012)	From clusteres of potential driving forces, nine dimensions are suggested as crucial for long-range global water scenarios: • Water stress • Well-being (quality of life, poverty, equity) • Population growth • Values and lifestyles • Economic growth • Technological development • Climate change • Ecosystem health • Global cooperation
What happens next? Five crucibles of innovation that will shape the coming decade (Bisson et al., 2010)	Suggests five 'crucibles' of potential innovation that will shape the next decade and beyond: • The Great Rebalancing (emerging-market economies) • The productivity imperative (productivity challenge for the OECD) • The global grid (networks and connectivity) • Pricing the planet (resource consumption and environmental sustainability) • The market state (retreat of market capitalism)

PUBLICATION	MEGA DRIVERS
Megachange: The World in 2050 (Franklin and Andrews, 2012)	Megachanges are covered under four broad themes: • People and relationships (the dynamics of demography, health and culture) • Heaven and earth (the future of faith, the planet and government) • Economy and business (the patterns of growth, innovation and markets) • Knowledge and progress (the frontier of science, space and technology)
Global Trends 2030: Alternative Worlds (NIC, 2012)	Suggests four global megatrends: • Individual Empowerment (due to poverty reduction, education, technologies, health-care) • Diffusion of Power (to networks and coalitions in a multipolar world without a hegemonic power) • Demographic Patterns (greater stability, aging, urbanisation, globalised migration) • Food, Water, Energy Nexus (increased resource demand with greater interlinkages between issues)
Strong and Secure: A Strategy for Australia's National Security (Commonwealth of Australia, 2013b).	Suggests the following seven broad global challenges, with national security implications: • Resource security and scarcity • Climate change • Changing demographics • Increasing urbanisation • Increasing online engagement • Resurgence of violent political groups • Corruption

Based on the literature reviewed, it was possible to identify eight common mega drivers, around which Section 4 is organised:

1. Climate change (mitigation and adaptation)
2. Global cooperation and conflict (trends in geopolitics)
3. Demographic change (population growth, ageing and urbanisation)
4. Economic shifts (towards emerging-market economies)
5. Resource security and scarcity (satisfying growing demand while protecting ecosystem health)
6. Virtual connectivity (global networking)
7. Values, behaviours and lifestyles (changing expectations)
8. Technology (development and application).

4   MEGA DRIVERS

4.1   CLIMATE CHANGE (MITIGATION AND ADAPTATION)

There is a lot of well-known science on climate change that won't be repeated here. Instead, some of the conclusions from the science are included. Unfortunately, no one seems to think that we will avoid 'dangerous climate change', currently defined as a 2°C average temperature increase. The International Energy Agency (2012) concludes that, given projected energy related emissions through to 2035, there will be a long term average temperature increase of 3.6 °C (IEA, 2012). Even if there were a lower rate of global economic growth in the short term, energy related CO_2 emissions would still lead to a long term average temperature increase of 3 °C. Randers (2012) is slightly more optimistic, suggesting that the global average temperature will pass the danger threshold of +2°C by 2050 but peak at 2.8°C in 2080. The bad news is that a tipping point could be exceeded beyond which "run-away" global warming occurs - with a possible collapse of civilisation as we know it in the second half of the 21st century (Randers, 2012). Should less apocalyptic but rapid changes occur, such as shifts in monsoonal rainfall in India and the rest of Asia, or the increased frequency and severity of natural disasters, instability and tension is still likely to result around the globe, especially in fragile states (Commonwealth of Australia, 2013b ; NIC, 2012).

Smith (2010), takes an alternative approach, examining the consequences of climate change for the Northern Rim countries (NORC). NORC are north of the 45th parallel and include Canada, Denmark, Finland, Iceland, Norway, most of Russia, Sweden, and some northern U.S. states. He suggests that NORC will be among the few places on Earth where crop production will likely increase due to climate change. In fact, in the second half of the 21st century, NORC is likely to experience a substantial increase in crop production as the short growing season is extended (Smith, 2010). In addition, climate change will mean that new Arctic shipping lands will be open for about two months each summer, allowing Europe direct trade between the Atlantic and the Far East. This would result in a burst of economic development in the north (Smith, 2010). Smith predicts that cities such as Toronto, Montreal, Vancouver, Seattle, Calgary, Edmonton, Minneapolis-St. Paul, Ottawa, Reykjavik, Copenhagen, Oslo, Stockholm, Helsinki, St. Petersburg and Moscow will increase in size and prominence over the next 40 years. Meanwhile, 10 new "ports of the future" will be: Alaska's Prudhoe Bay, Canada's Churchill, Iceland's Reykjavik, Greenland's Nuuk; Norway's Hammerfest, Kirkenes and Tromsø; Russia's Archangelsk, Dudinka and Murmansk (Smith, 2010).

In Australia, climate change may not deliver such a windfall, at least in the southern half of the country. Future winter rainfall is likely to be lower across the entire south-east of the country, with future mean annual runoff also decreasing by an average of 8 percent (Post et al., 2010). By 2020, the incidence of catastrophic fire weather days could almost double and by 2050 the risk of such fires will be substantially more commonplace (The Climate Institute, 2012). The number of assets exposed to sea level rise will increase exponentially (and the value at risk) due to unmitigated climate change. For example, asset exposure for infrastructure and buildings in Melbourne could grow from $2.2 billion today to $40 billion by 2050.

4.2 GLOBAL COOPERATION AND CONFLICT (TRENDS IN GEOPOLITICS)

There weren't many authors willing to speculate in detail about the future of global cooperation, although it is generally accepted that a rise in China and Asia will profoundly affect everything from the balance of military power to the centre of gravity of the global economy (Franklin and Andrews, 2012). While a diffusion of power is likely to occur, resulting in a shift to a multipolar world, a collapse or sudden retreat of US power probably would result in an extended period of global anarchy. This is because, at least in the foreseeable future, no leading power would be likely to replace the United States as guarantor of the international order (NIC, 2012). Whatever happens, in coming decades, the relationship between the United States and China will be the most important single factor to determine our strategic environment (Commonwealth of Australia, 2013a ; Commonwealth of Australia, 2013b).

For the next decade, the outlook for Australia's national security is largely positive. Major conflict is unlikely (Commonwealth of Australia, 2013b). However, low-level conflict in high-risk areas will remain a factor while strategic competition and military modernisation in the region may change the longer-term context. India and Indonesia, among other states, will be more economically and strategically influential actors in the Asia–Pacific (Commonwealth of Australia, 2013a). Meanwhile, the emergence of Asia (and a new Indo-Pacific strategic arc) as an economic and strategic centre-of-gravity will see countries from Europe and South America seeking greater strategic and economic traction in the region as well. Overall, these trends point to an environment where: strategic shocks and surprises are possible; demand for international development, humanitarian assistance and support for displaced persons will remain high; and local conflicts or heightened tensions may emerge with little warning (Commonwealth of Australia, 2013b). The bulk of Islamist terrorist presence and activity – to recruit, train, plan and attack – will remain in the Middle East, North Africa and South Asia, in states that offer permissive environments (Commonwealth of Australia, 2013a).

In terms of military engagement, factors likely to shape operations to 2030 include the shift to hybrid threats or non-state based threats. In the period to 2030, states will no longer have the monopoly on advanced weaponry, meaning the enemy could range from a major power adversary to a collection of ad hoc non-state based actors and irregular forces – even individuals and small groups (Commonwealth of Australia, 2011 ; Commonwealth of Australia, 2013b ; NIC, 2012). While state-based conventional combat operations are still a possibility, it is more likely that the armed forces will have to contend with an enemy conducting hybrid and unrestricted warfare (Commonwealth of Australia, 2011). Sophisticated enemies will be capable of coordinating a multi-dimensional campaign, attacking Australia on physical, informational and moral planes simultaneously (Commonwealth of Australia, 2011). They could incorporate a range of different modes of warfare utilising conventional capabilities, irregular tactics and formations, terrorist acts including indiscriminate violence and coercion, and criminal disorder (Commonwealth of Australia, 2011). Meanwhile, a major power adversary can be expected to employ ballistic missiles, a suite of air, sea and ground-launched precision guided weapons, advanced manned and unmanned platforms and space warfare capabilities. It may also employ offensive cyber capabilities to degrade the use of technology (Commonwealth of Australia, 2011). Such predictions are consistent with US forecasts that a greater spectrum of instruments of war - especially precision-strike capabilities, cyber instruments, and bioterror weaponry - will become more widely accessible (NIC, 2012).

The importance of unmanned air, maritime and land platforms are likely to be important, particularly for the emerging Indo-Pacific arc, a predominantly maritime environment. With stealth and the ability to loiter for extended periods, these systems have advantages for intelligence, surveillance and reconnaissance, and are proliferating among state and non-state actors (Commonwealth of Australia, 2013a). By 2050, it is predicted that drones will have replaced manned aircraft for the majority of missions (Franklin and Andrews, 2012). Also by this time, due to changes in global power and cooperation, NATO may have gone out of business as a serious defensive coalition (Franklin and Andrews, 2012). Friedman (2010) takes forecasting to another level with the prediction that 2050 could see the start of a third World War (WWIII) while rising fortunes in Mexico could see a decade long conflict with the US in 2080 (Friedman, 2010). Given that both World Wars and Mexico-US wars have occurred before, these predictions are more plausible than one might assume.

4.3   DEMOGRAPHIC CHANGE (POPULATION GROWTH, AGEING AND URBANISATION)

While the generally accepted wisdom is that the population will reach approximately 9 billion people by 2050, Randers (2012) suggests that global population growth will peak at 8.1 billion people in 2042 because of rapid decline in fertility in urban areas (Randers, 2012). This notion could have merit as it is predicted that 60% of the world's population will live in urbanized areas by 2030 and 75% by 2050 (Franklin and Andrews, 2012 ; NIC, 2012 ; Shell, 2011). As urbanisation accelerates, megacities will proliferate, increasing from 19 today to perhaps 27 by 2025 (Smith, 2010).

Larger, urban populations will require expanded security and law enforcement not least due to the increased potential for communal violence, public disorder or social unrest. Urban areas can also be vulnerable due to their high reliance on critical infrastructure (Commonwealth of Australia, 2013b). Citing the United Nations, Shell suggests that creating the infrastructure to house urban population growth will require development equivalent to building a new city for one million people every week for the next 30 years (Shell, 2011). Without such an investment (estimated at $350 trillion to 2040), as many as half the world's urban population could be living in city slums, with limited access to power for heat and light (Shell, 2011). Even in Australia urbanisation will take its toll. By 2020, the cost of urban congestion here is expected to more than double to $20.4 billion. By 2030, Australian cities will need to cope with the added pressure of 30% more people, with increasing city density placing more pressure on infrastructure (Siemens, 2012).

Nearly all future population growth will occur in developing countries, while developed countries as a whole will experience little or no population growth in this century, and much of that growth will be from immigration from less developed countries (Population Reference Bureau, 2012). Compared to the 1.7 billion people that lived in developing countries in 1950, over 8 billion (86% of the world's population) will live in these countries by 2050 (Population Reference Bureau, 2012). Nearly two billion people will face a future of low incomes, high economic vulnerability, and poor human development (Population Reference Bureau, 2012). Continued disparities in wealth and opportunities, and ethnic and religious differences more generally, are likely to affect social cohesion and cause unrest (Commonwealth of Australia, 2013b).

The relative size of different countries will also shift. Pakistan will have the sixth-largest population in the world while roughly half the planet's extra 2.3 billion people will be African (Franklin and Andrews, 2012 ; Ward, 2012). In 2050 there will be almost as many people in Nigeria as in the United States, and Ethiopia will have twice as many people as projected in the UK or Germany (Ward, 2012). Working populations will contract dramatically in developed countries, including Japan (-37%), Russia (31%) and the Eurozone (-29%) (Ward, 2012). In 2012, only Japan and Germany had matured beyond a median age of 45 years. By 2030, most European countries, South Korea, and Taiwan will have entered the post-mature age category (NIC, 2012). China will face a similar problem, with its population predicted to be older that America's and Europe's (Franklin and Andrews, 2012). As population growth slows, people age and workforce shortages occur, migration will become more globalized.

In Australia, population growth is also projected to slow, but the total population is still projected to reach 35.9 million people by 2050 (Australian Government, 2010). Structural ageing will occur, with the proportion of the population aged 65 years and over increasing from 13% to between 25-28% in 2101 – when Australia's population could reach anywhere between 33.7 million and 62.2 million (ABS, 2008). See Figure 2.

**FIGURE 2. PROJECTED POPULATION GROWTH IN AUSTRALIA TO 2101 (ABS, 2008)**
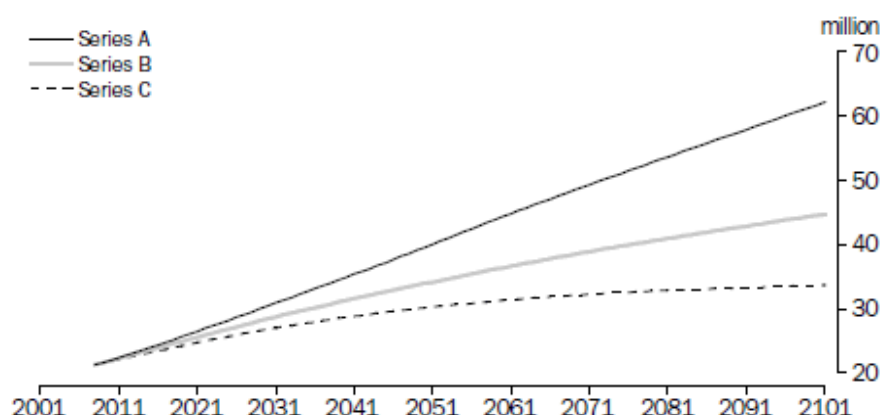
In 2025, Australia is expected to have almost 2 million new jobs compared with today, while 65 to 75% of people employed will hold a post-school qualification (Commonwealth of Australia, 2012a ; Deloitte Access Economics, 2012 ; Skills Australia, 2010). However, the proportion of working age people will still have fallen by 2050 from 5 working aged people per aged person today to only 2.7 people of working age to support each Australian aged 65 years and over (Australian Government, 2010).

One benefit of an ageing population could be a reduction in criminal offences, like offences against property, a category with a young age distribution of offenders. In a South Australian case study, structural ageing could be expected to reduce apprehension numbers for males between 2004 and 2051, with the impact increasing over time (Rosevear, 2012). Although accounting for a much smaller proportion of offences committed, structural ageing should also reduce female apprehension numbers considerably between 2004 and 2051 (Rosevear, 2012).

4.4 ECONOMIC SHIFTS (TOWARDS EMERGING-MARKET ECONOMIES)

It is widely accepted that the global economy is undergoing a major transformation as the centre of gravity shifts towards emerging-market economies. In the next decade, these economies will become powerful economic actors in their own right (Bisson et al., 2010; Ward, 2012). The future will soon see Asia become the centre of global economic activity (see Figure 3 below).

FIGURE 3. SHIFTS IN THE CENTRE OF ECONOMIC GRAVITY FROM EAST ASIA AND BACK AGAIN (COMMONWEALTH OF AUSTRALIA, 2012A)
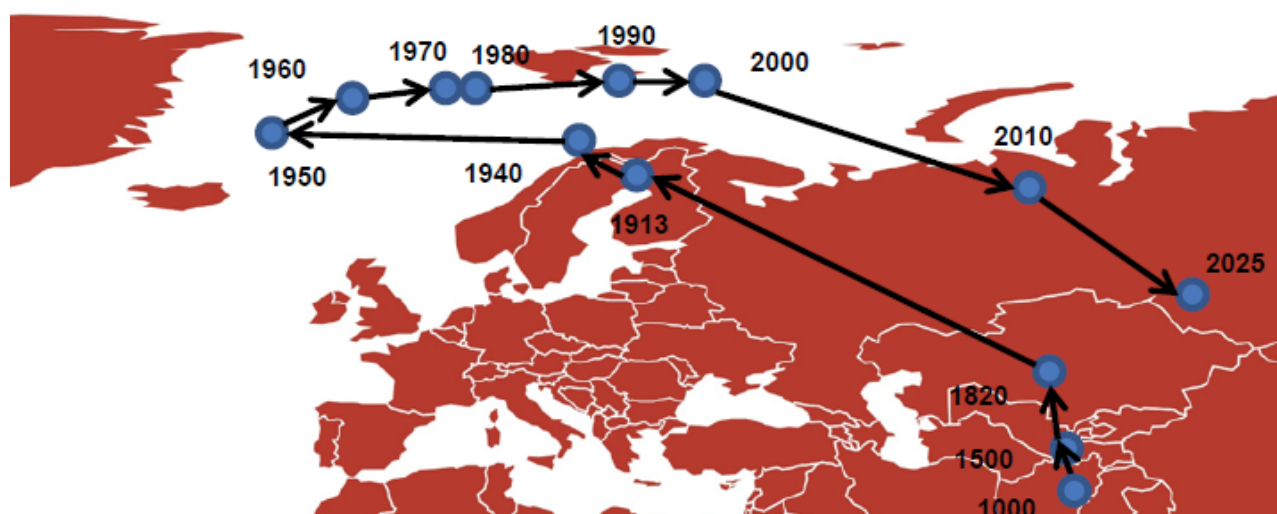
While some authors (eg. Smith, 2010) suggest that China will replace the US as the strongest economy by 2050, and that the US will experience stagnation (eg. Randers, 2012), other authors like Friedman (2010) suggest that this won't be the case. He foresees stagnation in China and a US resurgence. He also predicts the rise of economies such as Poland and Turkey. In contrast, Randers (2012) suggest that China will be a success story because of its ability to act, while other successes will include Brazil, Russia, India and South Africa. Ward (2012) forecasts the rise of some of the central Asian Republics and the emergence of parts of Africa (Ward, 2012). This is consistent with Franklin and Andrews (2012), who suggest that Nigeria could be one of the few big emerging markets growing at the pace now associated with the BRICS (Brazil, Russia, India, China and South Africa). The US National Intelligence Council (NIC, 2012) foresees that the US, European, and Japanese share of global income will fall from 56% today to 'well under half' by 2030. In a study of the largest 100 economies in 2050, Ward (2012) forecasts that the Philippines will rank 16th (up 27 places from today) and Peru 26th (jumping 20 places). While the West won't necessarily get poorer, economic growth will be impacted by demographic change and high per capita income (Ward, 2012). See Figure 4 below, based on HSBC estimates.

FIGURE 4. THE SHIFT IN CONTRIBUTIONS TO GLOBAL GROWTH (WARD, 2012)
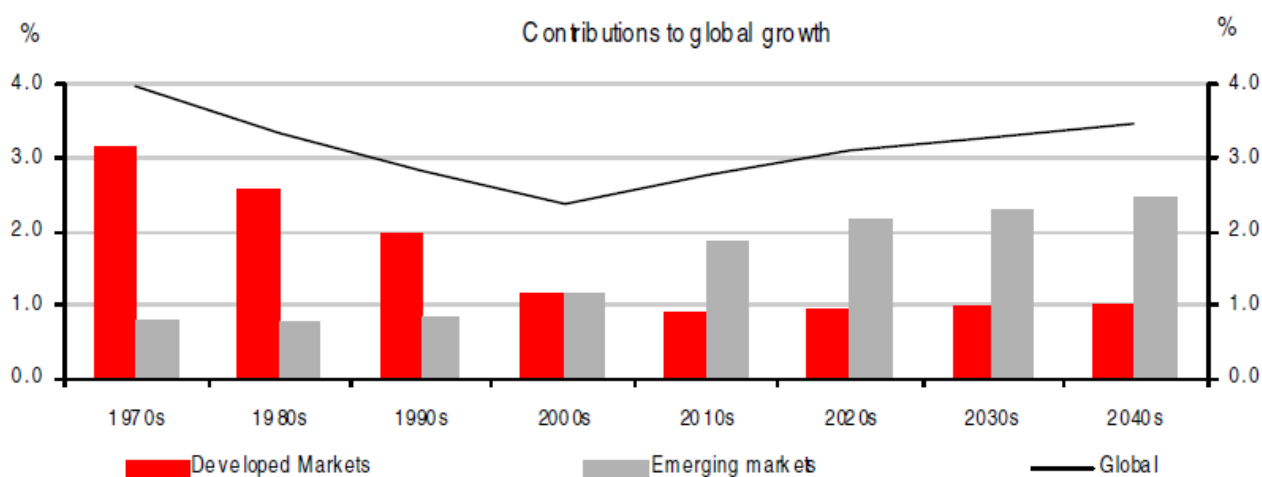
In Australia, while the past 40 years have seen annual average growth in real GDP of 3.3%, the next 40 years are projected to see growth slow to 2.7% annually (Australian Government, 2010). The International Monetary Fund predicts Australia is on track to raise its international rankings of GDP per person from 13th to 11th in the world by 2017. For Australia to reach the top 10 by 2025, Australia's labour productivity growth would need a boost of about one-half of a percentage point a year above the 'business as usual' scenario (Commonwealth of Australia, 2012a). At present productivity remains consistent with its historical 30 year average. In addition, ageing and health pressures are projected to result in an increase in total government spending from 22.4% of GDP in 2015–16 to 27.1% of GDP by 2049–50. As a consequence, spending is projected to exceed revenue by 2.7% of GDP in 40 years time (Australian Government, 2010).

On a state basis, the Australian Energy Market Operator (AEMO) predicts economic growth in Queensland is expected to remain higher than the other regions due to a positive outlook for the mining sector, increased commodity exports, and significant investment in liquefied natural gas (AEMO, 2012).Economic growth in Victoria, South Australia, New South Wales, the Australian Capital Territory and Tasmania are expected to be constrained by resource sector growth and a high Australian dollar (AEMO, 2012). Projections for Western Australia and the Northern Territory weren't included in the AEMO report, but it is forecast that there will be ongoing labour force migration from the southern states to Queensland and Western Australia due to mining opportunities, at least in the short-term.

4.5   RESOURCE SECURITY AND SCARCITY (SATISFYING GROWING DEMAND WHILE PROTECTING ECOSYSTEM HEALTH)

The challenge of meeting growing demand for natural resources whilst maintaining ecosystem health in a finite world is not a new one, but it is likely to become increasingly difficult as resource insecurity grows (Bisson et al., 2010 ; Commonwealth of Australia,

2013a). Within fragile states in Africa and the Middle East (and possibly China and India), resource shortages, potentially manifesting as higher prices for basic necessities, are likely to lead to unrest (Commonwealth of Australia, 2013b ; NIC, 2012). In regard to food, higher population and higher demand is expected to trigger an expansion in global cropland area (Foresight, 2011 ; Nellemann et al., 2009). Consistent with economic growth forecasts, the fastest growth in agricultural exports are expected to come from emerging exporters in Eastern Europe, Central Asia and Latin American countries (OECD-FAO, 2011). Per capita food consumption will also expand most rapidly in these areas, including Asia more broadly, where incomes are rising and population growth is slowing. Vegetable oils, sugar, meat and dairy products should experience the highest increases in demand.

Given this increased demand, the real value of Australian exports are expected to be 140% higher in 2050 than in 2007, with the largest increases in real value expected for beef, wheat, milk and sheep meat (Linehan et al., 2012). However, these figures are based on the assumption that agro-environmental conditions are maintained and climate change will not cause large scale disruption. In reality, longer term food security for Australia and its trade partners is likely to be threatened by climate impacts (e.g. droughts, flooding and cyclones), lack of planning controls over urban development and mining on productive land, shortages of skilled labour and underinvestment in agricultural research and development (Millar and Roots, 2012).

Global water demand is projected to increase by 55% to 2050 (OECD, 2012). Without changes to current water consumption trends, the world could face a 40% shortfall between global freshwater demand and supply by 2030 (Shell, 2011 ; The 2030 Water Resources Group, 2009). An additional 2.3 billion people could be living in severely water-stressed river basins (OECD, 2012 ; The 2030 Water Resources Group, 2009). Standard 'business-as-usual' efficiency improvements for agriculture and industry to 2030 would only address 20% of this gap (The 2030 Water Resources Group, 2009). Given looming shortages, Smith (2010) suggests that precious water resources will be tracked from outer space. He predicts that the NORCs (northern countries) will become the envy of the world for their reserves of fresh water, which may be sold and transported to other regions (Smith, 2010).

In Australia, our cities in 2056 will have a different water paradigm than exists today (WSAA, 2010). By 2026, on current population trends, it is predicted that major urban centres will have an additional demand of over 600 billion litres annually and by 2056 of over 1000 billion litres (WSAA, 2010). With the recent investment in desalination and recycled water, the additional demand could be met up to 2026, but this assumes that rainfall does not continue to deteriorate (WSAA, 2010). From 2026 to 2056, all capital cities are projected to decrease per capita consumption or maintain 2026 levels due particularly to efficiency gains made through water efficient appliances and the expected trend to increased density living (WSAA, 2010).

Energy is also a hot topic. A range of reports have examined energy demand, supply and the likely overall mix of fuels into the future. Estimates of demand are not consistent. For example, the IEA (2012) suggests that global energy demand will increase by over one third in the period to 2035 (IEA, 2012). Meanwhile, Shell (2011) suggests that global energy demand could triple by 2050 if emerging economies follow historical patterns of development (Shell, 2011). Again, Randers (2012) breaks the mould with suggestions that global energy use will reach a peak in 2040, because of continued increase in energy efficiency (Randers, 2012). However, this is unlikely given rates of growth and increased demand. With ordinary rates of supply growth, energy production would increase by about 50% - still leaving a projected shortfall of around 400 EJ/a – the size of the whole industry in 2000 (Shell, 2011). In fact, the IEA calculates that cumulative investment of $37 trillion is needed in the world's energy supply system over 2012 2035, equivalent to 1.5% of global GDP on average during that period (IEA, 2012). And despite this increased investment, it is suggested that providing universal energy access to the world's poor will continue to be an elusive goal. (IEA, 2012)

In terms of energy supply, it is clear that North America will play a greater role. Smith (2010) predicts that, in 2050, oil resources in Canada will be second only to those in Saudi Arabia (Smith, 2010). The IEA foresees North America becoming a net oil exporter by around 2030 and the United States becoming almost entirely self-sufficient by 2035 thanks to rising production of oil, shale gas and bioenergy, and improved fuel efficiency in transport (IEA, 2012). Increased oil production from difficult-to-access oil deposits could result in 'global spare capacity', at which point OPEC would lose price control and crude oil prices would significantly decline (NIC, 2012).

Radical shifts in the mix of energy sources are unlikely. The IEA forecasts that fossil fuels will remain the principal sources of energy worldwide, though renewables' share will grow rapidly from a low base (IEA, 2012). The OECD predicts that fossil fuels will supply about 85% of energy demand in 2050 (OECD, 2012). While there will be growth in renewables, Smith suggested that wind, solar and hydrogen technologies still won't satisfy global energy needs by 2050 (Smith, 2010). While in the OECD fuel substitution will see the collective share of oil and coal drop by fifteen percentage points to 42%, this shift will likely be overshadowed by the use of fossil fuels to meet the rise in energy demand in non-OECD countries from 55% in 2010 to 65% in 2035 (IEA, 2012).

In Australia, the scale and nature of change in energy systems will be affected by such factors as population and development patterns; structural changes in the economy; carbon and energy prices; technology development costs; consumer choices; varying

opportunities across regions; and state and territory government policies (Commonwealth of Australia, 2012c). Total primary energy consumption is projected to grow by nearly 35 per cent from 2007-08 to 2029-30, although there will be a decline in the energy intensity of the Australian economy (Geoscience Australia and ABARE, 2010 ; Syed et al., 2010). By 2035 renewable energy could provide as much as 40% of our electricity needs (Commonwealth of Australia, 2012c). Wind energy is projected to account for the majority of the increase in electricity generation from renewable sources, representing 12% of electricity generation in 2029-30 (Syed et al., 2010).

Growth is also expected in other renewables, including solar energy, geothermal energy and bioenergy, but again from a low base (Syed et al., 2010). Alternative transport fuel uptake will be limited in this decade but in the 2020s the contribution of alternative fuels will grow rapidly (Graham and Smart, 2011) The road sector will adopt the most diverse mix of alternative fuels (Graham and Smart, 2011). The aviation sector will focus on the development of bio-derived jet fuels to replace conventional fossil-derived sources (Graham and Smart, 2011). However, coal and oil will continue to supply the bulk of Australia's energy needs, with fossil fuels projected to underpin our energy security for several more decades (Commonwealth of Australia, 2012b ; Commonwealth of Australia, 2012c ; Syed et al., 2010).

Black coal, which includes both thermal and metallurgical coal, is projected to remain Australia's dominant energy export (Syed et al., 2010). Australian exporters of thermal and metallurgical coal, iron ore and LNG will face competition from a number of other exporting countries (Commonwealth of Australia, 2012b). In the iron ore market, Brazil is expected to remain Australia's main competitor to supply Asia's expanding steel industries (Commonwealth of Australia, 2012b).Indonesia is expected to be Australia's main competitor for thermal coal exports, but there may also be increased competition from Colombia and Mongolia to supply the growing Asia-Pacific market (Commonwealth of Australia, 2012b). The LNG trade market will see increased exports from Australia as a result of the number and scale of projects currently under construction (Commonwealth of Australia, 2012b).

In the medium-term, key risks to Australia's market share will be export developments in the North American gas market and the potential for pipelines from the Russian Federation to supply the emerging Asian markets (Commonwealth of Australia, 2012b). In terms of demand, rising energy prices will sharpen the focus on demand management and on the efficiency of market and policy settings (Commonwealth of Australia, 2012c).

We are not on track to maintain ecosystem health. With regard to biodiversity loss, Smith (2010) suggests that wildlife will suffer the greatest rate of extinction since the disappearance of the dinosaurs 65 million years ago. The OECD is more conservative, estimating that, by 2050, global terrestrial biodiversity will have declined by a further 10% (OECD, 2012). Either way the loss is significant. Franklin and Andrews (2012) are more optimistic, suggesting there could even be the rebirth of an extinct species or the discovery of alien life during this time or that efforts may be made to "re-wild" Africa, America and central Asia to recreate habitat for migrating herds of wild mammals (Franklin and Andrews, 2012).

As concerns about resource security and environmental sustainability increase, manufacturers will find that high value products and services will be differentiated from their competitors on the basis of whole-of-life – that is the innovation, design, production and end-of-life management (Industry Innovation Council, 2011). This will also ease pressures on landfill - although it may be a relief to know that there is sufficient landfill capacity for the medium term in most of the major population centres in Australia, and additional potential capacity is apparently available in those where the supply is most constrained (Hyder Consulting, 2009).

4.6   VIRTUAL CONNECTIVITY (GLOBAL NETWORKING)

The last two decades have witnessed the rise of virtual networks of unimaginable density and complexity. Money, goods, data, and people now cross borders in huge volumes and at unprecedented velocity (Bisson et al., 2010). This online connectivity and networking is only going to increase. Today there are 5 billion devices connected to the internet (including computers, phones, music devices, vehicles, home appliances, smart meters, electric vehicles, charging stations). By 2020, this number will grow to 22 billion (Siemens, 2012).

All hard surfaces could become potential interface points with computers, devices and networked technology (Ruthven, 2012). Devices and ICT systems could be controlled directly from the brain (Ruthven, 2012). Communications, including telepresence, could become the 'surrogate transport' by 2050 (Ruthven, 2012). Learning could be democratised by near-universal access to virtual Oxbridge and Harvard universities, while collective intelligence could supplement individual intelligence (Franklin and Andrews, 2012).

There will also be costs to living more of lives online. Newspapers, magazines, books, directories, radio, free-to-air TV and cable TV will be absorbed into internet distribution and substituted by online versions. Australian consumers will also need much more data storage, with monthly data allowances likely to average 200 gigabytes by 2020 and potentially 5 terabytes (5000 gigabytes) by 2030 (Ruthven, 2012). Australian households could be allocating up to 40% of the money that would have once gone to transport to telecommunications, double that of 2010 (Ruthven, 2012).

Increased online engagement creates economic opportunity and greater social interaction. However it also facilitates increased levels of malicious activity, from organised crime to state-sponsored espionage (Commonwealth of Australia, 2013b). As traditional legal systems are updated to reflect the new virtual reality, the future may see cyber police forces in place to detect, apprehend, prosecute and penalise online criminals, with a 'cyber judicial system' in place to convict and isolate criminals online (Siemens, 2012).

4.7   VALUES, BEHAVIOURS AND LIFESTYLES (CHANGING EXPECTATIONS)

Despite potential resource scarcity, Smith (2010) suggests that modern lifestyles can be maintained at "affordable prices" because of our technological base, and our proven ingenuity to solve problems that also improve the unavoidable physical tradeoffs. Perhaps this could be so if what Hajkowicz et al. (2012) foresees comes to pass – a shift in consumption patterns and behaviour, drive by rising consumer, societal, demographic and cultural demand for experiences over products and the rising importance of social relationships. Experience based consumption could become a means of maintaining economic growth and delivering quality of life whilst conserving the natural world's limited resources. Conversely, the growing number of single-adult households across the OECD could lead to reduced efficiencies and increased consumption, including additional demand for housing and urban infrastructure (OECD, 2011). Single parent families and elderly people living alone are also on the increase, with associated higher risks of poverty (OECD, 2011). Middle classes in the developing world are poised to expand substantially in terms of both absolute numbers and the percentage of the population that can claim middleclass status during the next 15-20 years. This is related to the acceleration of individual empowerment – also linked to poverty reduction, greater educational attainment, widespread use of new communications and manufacturing technologies, and health-care advances (NIC, 2012).

In Australia, our increasingly sedentary lifestyles combined with overconsumption will take a toll on the national economy. In 2025, 83% of males and 75% of females aged 20 years and over could be overweight and/or obese, totalling 16.9 million people (Victorian Department of Health Services, 2008). The increase in projected health care costs of type 2 diabetes, largely due to increases in obesity, is $5.6 billion through to 2032-2033 (Victorian Department of Health Services, 2008) .In 2020, Generation Y will be in their 40's and 50's and dominate employment, comprising 42% of the workforce (McCrindle, 2011).

Generation Z - the children of Generation X and Y - will be leaving school when the rising costs of an ageing population on health care, pensions and aged services will have pushed the Federal Budget into deficit (McCrindle, 2011). The culture and structure of the workplace will have changed permanently (Wilson, 2010). Ageing workers and female labour force participation will have driven jobs into more compressed and part-time roles while the boundaries of work and home will have largely disappeared (Wilson, 2010). Generation Z will live longer than any previous generation; they will study longer (as the most formally educated generation in history); and they will work longer - with an average of 6 careers in their lifetime (McCrindle, 2011). This too will have implications for values, behaviours and lifestyles.

4.8   TECHNOLOGY (DEVELOPMENT AND APPLICATION)

Forecasting developments in technology tends to be popular and an area where authors become bolder in their predictions. For example, there will be medical breakthroughs such as genetically targeted drugs, vaccines that do not need refrigeration during transport, stem cells that grow new tissues, and biology and robotics combining to revitalise paralysed limbs (Franklin and Andrews, 2012).The OECD foresees a bioeconomy emerging from the invention, development, production and use of biological products and processes. By 2030, biotechnology could contribute up to 2.7% of GDP in OECD countries (OECD, 2009). The sectors to benefit most will be industry and primary production, with even more significant contributions possible in developing countries.

As we head towards 2020, the convergence of nanotechnology, biotechnology, cognitive and neuroscience with ICT is expected to cause disruptive changes in manufacturing (Industry Innovation Council, 2011). These technologies are expected to support the development of new and improved industries and higher value-added products, together with improved production processes. They

are also likely to enable mass customisation (Industry Innovation Council, 2011). Franklin and Andrews (2012) suggest that manufacturing will be revolutionised by "additive" technologies while three-dimensional printing is expected to become a household technology in the near future (first generation versions are already available), allowing us to produce our own products, such as car parts, at home. The Industry Innovation Council (2011) suggests that the Australian textile industry has particular opportunities in fields such as: healthcare (eg. fibrous tissue engineering); defence (eg. lightweight ballistic protection); water, energy and environment (eg. improved filtration media); and mining (eg. converting titanium ore into titanium alloy metal).

Security and emergency services could be revolutionised by advanced detection through quantum computing, ultra high definition video, nanotechnology and artificial intelligence which allows us to monitor our environment. Technology development would also facilitate 'intelligent response' through 3D information, advanced gaming techniques and predictive modelling enables events to be prepared for head of time (Siemens, 2012). And just as learning may become democratised through online universities, foreign language skills may become redundant due to instant computer translation (Franklin and Andrews, 2012). And computer chips will be in everything.

In defence, armed unmanned systems will be available in greater variety and sophistication in years to come. Technological advances in the fields of biological sciences, materials, energy, nanotechnology, computing, sensing, simulation and quantum effects (in chemistry and physics) could impact Australia's capability advantage from a national security point of view (Commonwealth of Australia, 2013a). Space-based systems are also a critical enabler of a modern networked military capability. The evolution of counter-space capabilities and the more immediate risks to space-based systems posed by increasing space debris will mean a heightened priority for protecting the space-based systems on which Australia relies (Commonwealth of Australia, 2013a).

5   CONCLUSION

The future only exists in our imagination and yet the decisions we take individually and collectively can shape how the future unfolds. This is not just about feel-good visions, but pragmatic management. As we make plans and identify priorities and goals, we create winners and losers. We make trade-offs. The policies we put in place today will shape investments for years to come. The investments we make in the next ten years will decide our energy supply to 2050 and our cities for 2100. While some industries such as engineering and forestry are accustomed to planning for horizons of 40 to 50 years, we are not always so good at thinking for the long-term.

We need to become better at proactively making decisions and investments this decade to prepare for and take advantage of the future trends we can discern – while enhancing our capacity to successfully react and adapt in real time to new information and unexpected changes - no matter what curve balls are thrown our way.

Humans have the capacity for foresight, strategy and planning. The challenge is to identify areas where we can enhance this capacity across the system and so raise the wellbeing and experiences of the collective - nationally and globally. This ability will be called on now more than ever as powerful drivers of change interact and counteract in unpredictable ways - at scales and speeds neither the planet nor humanity has experienced before. We can't necessarily control the future, but we can at least become better navigators as it comes to pass.

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