

The development of visions and strategies for Australia's sustainable future

**Solving complex societal challenges through leveraging future
scenario planning, strategic planning and community engagement
programs**

Ian Geoffrey Chambers

**A thesis submitted for the degree of Doctor of Philosophy
at the Australian National University**

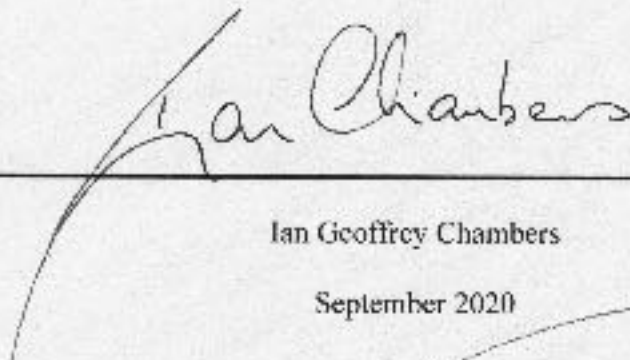
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Declaration

The work in this thesis is my own except where otherwise stated. The research for this thesis was undertaken between January 2016 and June 2020 at the Crawford School of Public Policy, the Australian National University, Canberra, Australia.

This thesis is to the best of my knowledge, original and has not been submitted in whole or part for a degree in any university.



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September 2020

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ABSTRACT

This thesis examines the impacts of a strategic and systems theory approach to addressing the complex societal challenges and opportunities Australia is currently facing - challenges and opportunities impacting not only Australia's unique ecological environment, but also its long term economic and social sustainability. Whereas the historical approach to many of these issues has been fragmented and piecemeal at both academic and political levels, a holistic systems approach provides the frameworks to leverage scenario planning, strategic planning, and community engagement models of social change.

The thesis investigates the application of this modelling approach presented in four papers that: (i) examine the preferred future that Australians want; (ii) examine the application of a sustainable economic, ecological, and social prosperity lens with respect to the development options for northern Australia; (iii) examine the impact of a strategic planning-based community intervention on attitudes towards sustainable outcomes; (iv) examine the issues involved in the development of a strategic planning based framework for transition to Australia's sustainable future; and (v) review the academic, policy, and practical implications of these findings and this framework for transition, including opportunities for further research.

The conclusions of this thesis suggest that sustainable prosperity may be achievable in Australia and would contribute significantly to the country's economic, ecological, and community well-being across key areas including energy, agriculture, land and water management, mining, education, and knowledge services. However, this future is not assured and the country's current 'business as usual' model of development is failing to leverage these economic, ecological, and social benefits.

This thesis argues that nurturing a range of management competencies and

leveraging a coordinated and integrated framework for transition to achieve sustainable prosperity can not only benefit Australia, but also be scaled and replicated internationally.

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LIST OF PAPERS

1. *A public opinion survey of four future scenarios for Australia in 2050.*

Paper I: Original article published in *Futures*: Accepted 9 December 2018;
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2. *Australia's north, Australia's future: A vision and strategies for sustainable economic, ecological and social prosperity in northern Australia.*

Paper II: Original article published in *Asia and the Pacific Journal*: Accepted 15 June 2018.

3. *Education for Sustainable Development: a study in adolescent perception changes toward sustainability following a controlled intervention – the Young Persons' Plan for the Planet Program.*

Paper III: Original article published in *Sustainability*: Accepted 8 October 2019;
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4. *Australia 2030 - Developing a strategic planning framework for transition to a sustainable, resilient and prosperous future.*

Paper IV: Original article submitted to *Sustainability* on 30 April 2020; Revisions submitted 30 July 2020: Under Review at time of submission.

5. Supplementary Information

5.1. *Australia 2030: Analysis and applications of strategic planning across a range of economic, ecological and societal settings in Australia*

5.2. *emPowering Australia's North*, in *Sustainable Land Development in Northern Australia*, Russell Smith, J., et al. 2018. Book insert focused on the sustainable energy sector in northern Australia based on Paper II.

1 INTRODUCTION

1.1 Overview

This thesis examines the impacts of a strategic and systems theory approach to addressing the complex societal challenges and opportunities Australia is currently facing. These challenges and opportunities are not only impacting Australia's unique ecological environment, but also long-term economic and social sustainability. Whereas the historical approach to many of these issues has been fragmented and piecemeal at both academic and political levels (FADTRC, 2019; GBRTFR, 2016; MDBA, 2018; Visontay, 2019), a holistic systems approach provides a range of management competencies – scenario planning, strategic planning and community engagement - to develop a framework for transition to Australia's sustainable future.

Australia provides a useful case study in which to examine the development of visions and strategies for a sustainable future for four reasons; (i) Australia has a long history of successfully addressing sustainability issues with the nations Indigenous heritage representing the longest continuous history of *sustainable prosperity* globally (R Gittins, 2015; Pascoe, 2014); (ii) Australia's current ecological, economic, and social landscapes present a broad range of sustainability challenges, as well as opportunities; (iii) theoretical modelling by Hatfield-Dodds et al. (2015) has identified *sustainable prosperity* as a feasible option for Australia's future. However, this is an option that is not inevitable as it is dependent on the successful development and implementation of appropriate public policy changes (Hatfield-Dodds et al., 2015) and (iv) Australia has demonstrated political ambivalence on issues ranging from climate change to energy policy for more than two decades (Beeson & McDonald, 2013; Cheung & Davies, 2017; Drew, 2015; McDonald, 2012; Mercer, Christesen, & Buxton, 2007).

The challenge therefore at both an academic and practical level is how to address the gap between the opportunity to achieve *sustainable prosperity* and the approach and direction that current policy choices are taking the nation (Hatfield-Dodds et al., 2015). It is this gap that this thesis seeks to address.

1.2 Theoretical frameworks underpinning this research

To address the complex societal challenges and opportunities Australia is currently facing this thesis leverages a systems theory framework. The interdependence of economic, ecological and social subsystems results in one of the most significant challenges in developing visions and strategies to achieve sustainable outcomes (Robert Costanza et al., 2015; Tuckson, 2014). Due to the complexity of addressing the three sub-systems, often ‘disconnected’ at political, policy, and academic levels (Costanza, 2014b; FADTRC, 2019; MDBA, 2018), this in itself has been described as a ‘wicked problem’ (Pryshiakivski & Sercy, 2012). Systems theory, however, in providing a common theoretical platform to address the interconnectivity of these subsystems (Boulding, 1968; Von Bertalanffy, 2010), also provides a framework within which to address the complex societal problems inherent in the ‘wicked problem’. As noted by Gough and Longhurst (2018), this commonality in theoretical foundation provides the scope to integrate these three subsystems, leverage their convergence, and facilitate desired outcomes such as the United Nations Sustainable Development Goals (SDGs) (Gough & Longhurst, 2018). This application of systems theory and the three key systems theory subsystems underpinning this research – social systems, ecological economic systems, and management systems – are discussed more fully in Paper IV, Section 2.

1.3 Academic approach and thesis structure

This thesis therefore examines perspectives on Australia's sustainable future through a strategic and systems theory lens. This approach is investigated in four papers that: (i) examine the preferred future that Australians want (Paper I); (ii) examine the impact of the application of a sustainable economic, ecological, and social prosperity lens to the development options for northern Australia (Paper II); (iii) examine the impact of a strategic planning-based community intervention on attitudes towards sustainable outcomes (Paper III); and (iv) examine the issues involved in the development of a strategic planning based framework for transition to Australia's sustainable future (Paper IV). Papers I – III are discrete research papers that examine the application of scenario planning, strategic planning, and community engagement at a national level. They have also been integrated with an examination of the relevant literature to develop a *framework for transition* in Paper IV

To address the issues of fragmentation of both current policy strategy and implementation this thesis examines Australia's sustainable future within the context of three strategic frameworks: (i) the *sustainable prosperity* model developed for Australia by Hatfield-Dodds et al. (2015); (ii) the VMOSA strategic planning model (Nagy & Fawcett, 2009); and, (iii) the United Nations Sustainable Development Goals (SDGs) (UN, 2016).

The issues of political and societal ambivalence are examined within the context of a novel behavioural change lens applied at a societal level – Motivational Interviewing (MI) (Costanza et al., 2017; Miller & Rollnick, 2012). Costanza et al. (2017) postulate that one of the reasons that society and nations have struggled to move beyond the 'business as usual' approach to sustainable development is due to 'societal addiction' to an established set of social norms and approaches to development

(Costanza et al., 2017). The authors propose a novel approach to overcoming this ‘societal addition’ through the adaptation and application of the MI change management model (Miller & Rollnick, 2012) at a societal level. The model, due to its alignment with the strategic planning model used in this thesis (Nagy & Fawcett, 2009), also proves useful for the aggregation and focus of the four papers that form the basis of this thesis. (Figure 1).

Within these frameworks, the thesis investigates the applicability of three specific and frequently applied management tools – scenario planning, strategic planning, and community engagement - the issues involved in their use, barriers to leveraging these management tools, issues raised in their implementation, and the insights that this investigation offers to social policy development.

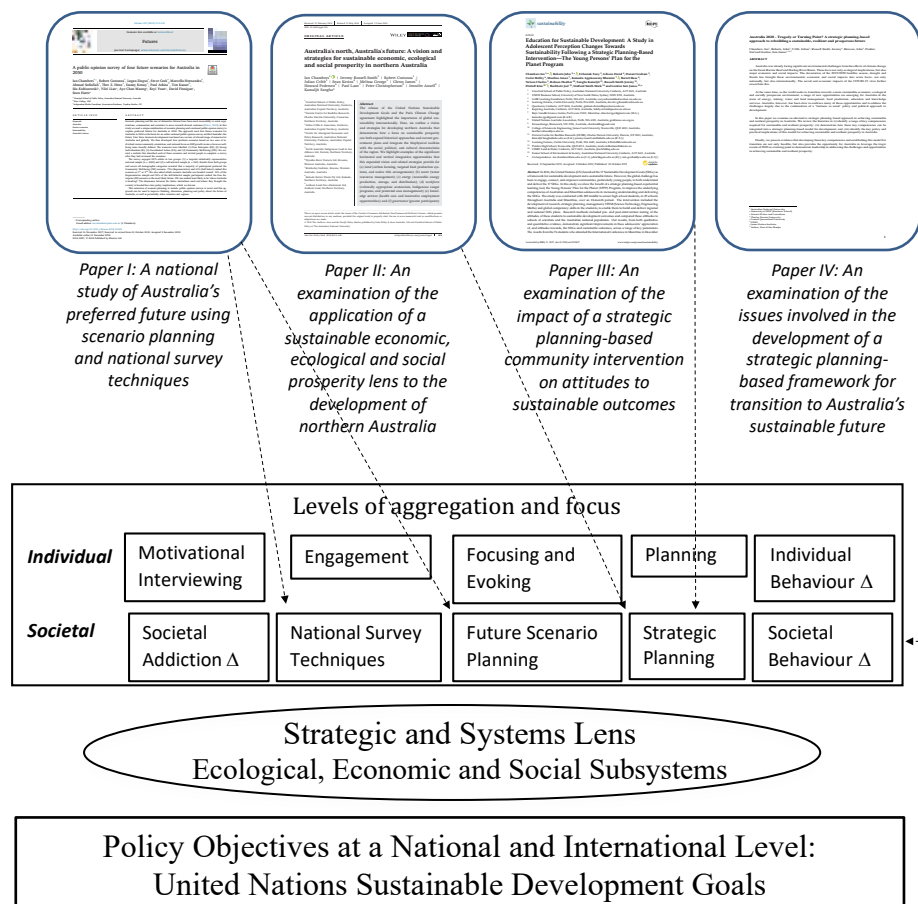


Figure 1. Theoretical inputs and structure for the development of visions and strategies for Australia's sustainable future

1.4 Research Questions

The investigation focuses on the following research questions underpinning the four papers that form the basis of this thesis.

1.2.1 ***Research Question I (Paper I): What are the preferred future scenarios for Australians in 2050?***

Both Nagy and Fawcett (2009) and Miller and Rodnick (2012) emphasise the importance of establishing a common vision in both the strategic planning and motivational interviewing (MI) methodologies (Miller & Rollnick, 2012; Nagy & Fawcett, 2009). The research in this thesis uses a novel combination of scenario planning and national public opinion surveys to both explore preferred futures and identify a preferred future scenario for Australians in 2050. The approach uses four scenarios broadly based on the scenario archetypes outlined by Dator (Dator, 2009) and Hunt et al. (Hunt et al., 2012). These scenarios were then checked against a broad range of scenarios for Australia and globally, to ensure that the four possible scenarios (Strong Individualism, Community Well-Being, Free Enterprise and Coordinated Action) were both plausible (Raupach et al., 2012) and were also representative of the Australian population base. This process, in conjunction with pre-survey testing, was used to address and minimise the issue of potential bias in scenario naming and description. Within the context of the thesis, the identification of a preferred future scenario for Australia establishes a potential common vision as well as a context for the further examination of visions and strategies for Australia's sustainable future in Papers II – IV.

1.2.2 ***Research Question II (Paper II): What insights does a sustainable economic, ecological, and social prosperity lens provide in an examination of development options for northern Australia?***

Building on the findings of Paper I, Paper II examines the application of a sustainability lens to a test sub-region – northern Australia. Northern Australia provides a useful sub-region to examine the application of visions and strategies for Australia’s sustainable future for two reasons. Firstly, historical and current approaches to developing the region have often relied on transplanting models developed in other parts of Australia, regularly demonstrated as inappropriate to the unique ecological, social, and economic landscape of the region (Allan Dale, 2014). Secondly, these perspectives have been largely based on ‘business as usual’ and ‘empty world’ assumptions of unlimited resource availability (Costanza, 2014b) as illustrated in the Australian Government’s White Paper on Developing the North (CoA, 2015), which is the current blueprint for regional development.

This research examines an alternative strategic approach to development based on leveraging the unique character of the region within the changing regional and global environment to achieve what Hatfield-Dodds et al. (2015) refer to as *sustainable prosperity* (Hatfield-Dodds et al., 2015). This alternative approach presents visions and strategies that demonstrate how a focus on *sustainable prosperity* can both expand historical approaches and current government plans and integrate the bio-physical realities with social, political and cultural characteristics of the region. The research also highlights examples of significant horizontal and vertical integration opportunities that this expanded vision provides across the key societal, economic and ecological parameters identified in the White Paper - land, water, energy, workforce, knowledge services, and governance (CoA, 2015). The use of these parameters also provides the scope for comparison with the business as usual approach outlined in the White Paper on Developing the North (CoA, 2015). Within the context of the thesis, this research examines the feasibility and impact of the sustainability scenario identified in Paper 1

in this sub-region of Australia.

1.2.3 Research Question III (Paper III): *What is the impact of a strategic planning-based community engagement intervention on attitudes towards sustainable outcomes in a subset of Australian and Mauritian populations (adolescent students in senior high school)?*

The launch of the 17 Sustainable Development Goals (SDGs) by the United Nations (UN) in 2016 provided Australia, as one of the 193 signatory nations, with both a national and global strategic framework for a sustainable future (SDGs, 2016). One of the key success factors identified by both the United Nations (UN, 2016) and Patole (Patole, 2018) in their implementation is community engagement in the strategic planning process. Community engagement is also identified as important in the strategic planning (Nagy & Fawcett, 2009) and motivational interviewing (Miller & Rollnick, 2012) processes.

The research leverages the SDGs to examine the impact of a novel application of a *strategic planning* and *community engagement*-based intervention and experiential based learning tool (the Young Persons Plan for the Planet Program) in understanding and delivering sustainable outcomes (the UN SDGs) in middle to senior high school students. The adolescent community sub-group was chosen as this sub-group has historically been a challenge to engage in sustainable futures (BBC, 2019), as well as being the inheritors of this future (Ki-moon, 2016). The target participants were 300 middle to senior high school students, in 25 schools throughout Australia and Mauritius over an 18-month period. Mauritius was chosen alongside Australia in this study to allow cross cultural and geographical comparisons of outcomes.

To test the full impact of the intervention, and also the positioning of this community subgroup within the broader Australian population, Research Question III

was divided into four sub-questions. These examine: (IIIa) the impact of the intervention on participant attitudes to sustainable outcomes; (IIIb) the impact of a variation in motivational framing on participant attitudes to sustainable outcomes; (IIIc) the consistency of results of this community subgroup with the national survey on preferred futures addressed in Paper 1; and, (IIId) the consistency of the results of this subgroup of adolescents to a subgroup of scientists.

Research Sub-question III.a: What is the impact of a strategic planning-based community intervention on awareness, understanding, motivation, action orientation, and engagement towards sustainable outcomes in this subset of the Australian and Mauritian populations? Sub-question III.b: What is the impact of alternative motivational framing of the global context (opportunities, threats, neither, both) on plans for achieving sustainable outcomes in the subset of adolescent Australians?

Research Sub-question III.c: What are the preferred scenarios in 2050 for the subset of adolescent Australians and how do these results compare to the preferred scenarios for the national population? and, (ii) Research Sub-question III.d: What are the attitudes to climate change of the subset of adolescent Australians and how do these results compare to the preferred scenarios for the national population and a subset of scientists?

Within the context of the thesis, this research therefore examines the feasibility and impact of leveraging two key management tools embedded in a *strategic planning-based community engagement* intervention on attitudes to a set of nationally and globally accepted sustainable outcomes – the UN SDGs. Building on the findings of Papers I and II, this research also provides the context to examine in Paper IV, an alternative strategic planning-based approach to developing a *framework for transition* to Australia's sustainable future.

1.2.4 Paper IV: Research Question IV: What are the issues involved in the development of a strategic planning-based framework for transition to Australia's sustainable future?

With the Covid-19 pandemic reshaping our world, this research examines the opportunity Australia has to reimagine, and develop, an alternative to the 'business as usual' approach to development. This research examines an alternative strategic planning-based approach to developing a *framework for transition* for rebuilding a sustainable, resilient and prosperous future. The methodology reviews the literature to: (i) leverage three management competencies – scenario planning, strategic planning and community engagement (examined in Papers I – III) - in building this *framework for transition*; (ii) examine how these management competencies can be integrated into a strategic planning-based framework; and (iii) identifies the key policy and practical implications of this framework. Finally, the research presents indicators that demonstrate that establishing this framework and developing these management competencies is feasible and provides the opportunity for Australia to leverage the events of 2020 as a pivot to demonstrate leadership in addressing the challenges and opportunities in achieving a sustainable and resilient future.

1.5 Supplementary Information

In addition to the four papers that form the basis of this research the supplementary information section provides examples of the extension of two of these papers: (i) Paper IV in a more detailed Supplementary Information section; and (ii) Paper II in a book insert entitled *emPowering Australia's North*.

Finally, the academic, policy, and practical implications of Papers I – IV are reviewed in Section 7: Summary and Discussion.

2.1 A PUBLIC OPINION SURVEY OF FOUR FUTURE SCENARIOS FOR AUSTRALIA IN 2050 (PAPER 1)

Research Question I: *What are the preferred future scenarios for Australians in 2050?*

Contribution to the aim of the thesis: This research presented here contributes to answering this research question through examining a methodology to identify a potential vision for Australia. The research achieves this through the novel use of a future scenario planning methodology and national survey techniques to identify a preferred future scenario for Australia (Community Well-being) and identifies the constancy of this preferred future vision with sustainable outcomes.

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Chambers, Ian: Conceptualisation, Formal Analysis, Funding Acquisition, Investigation, Methodology, Writing - original draft, Writing – review and editing;

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David Finnigan: Writing – review and editing; and,

Sean Harte: Writing – review and editing;



Statement of Contribution

This thesis is submitted as a Thesis by Compilation in accordance with https://policies.anu.edu.au/ppl/document/ANUP_003405

I declare that the research presented in this Thesis represents original work that I carried out during my candidature at the Australian National University, except for contributions to multi-author papers incorporated in the Thesis where my contributions are specified in this Statement of Contribution.

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A public opinion survey of four future scenarios for Australia in 2050



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ABSTRACT

Scenario planning and the use of alternative futures have been used successfully to assist organisations, communities and countries to move towards desired outcomes (Dator, 2009). In this study we used a unique combination of scenario planning and a national public opinion survey to explore preferred futures for Australia in 2050. The approach used four future scenarios for Australia in 2050 as the basis for an online national public opinion survey entitled *Australia: Our Future, Your Voice*. Scenario development was based on a review of a broad range of scenarios for Australia and globally. We then developed four synthesis scenarios based on two axes of individual versus community orientation, and national focus on GDP growth versus a focus on well-being more broadly defined. The scenarios were labelled: (1) Free Enterprise (FE); (2) Strong Individualism (SI); (3) Coordinated Action (CA); and (4) Community Well-being (CW). We created a website that described each of these scenarios and invited people to complete a survey after they had reviewed the scenarios.

The survey engaged 2575 adults in two groups: (1) a targeted statistically representative national sample (n = 2083) and (2) a self-selected sample (n = 492). Results from both groups and across all demographic categories revealed that a majority of participants preferred the Community Well-being (CW) scenario. 73% (Representative) and 61% (Self Select) ranked this scenario as 1st or 2nd. We also asked which scenario Australia was headed toward. 32% of the Representative sample and 50% of the Self-Selected sample participants ranked the Free Enterprise (FE) scenario as the most likely future. CW was ranked least likely to be 'where Australia is heading?' The dissonance between the future Australians want and where they thought the country is headed has clear policy implications, which we discuss.

This extension of scenario planning to include public opinion surveys is novel and this approach can be used to improve thinking, discussion, planning and policy about the future of Australia, as well as potentially other countries and regions.

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1. Introduction

Australia, like all countries, is faced with choices about its future. Should Australia pursue an approach that continues to focus on economic growth, or should Australia focus more on conserving the environment, increasing social equity and improving community well-being? Is there a balance that can be established between what are often perceived as competing goals, and what should be the role of government in achieving this balance?

The use of public opinion polls to gauge preferences and attitudes is common, however, they are usually focused on the next election or on short-term, specific policy choices. Who is the best party to govern? Do we support one leader or the other? What is the preference regarding same sex marriage? Further, although politicians often campaign on their “vision for the future of the country”, these visions are often criticised as being ‘vague sound-bites’ and ‘short-term’ focused. Australians are rarely asked perhaps the most important questions: What type of future would Australians like to see for the country, and, as importantly, do Australians believe they are heading in that direction?

Within this context Scenario Planning (SP) provides an approach that ‘helps see beyond short term political horizons’ (Inayatullah, 2009) and that addresses these longer term issues. SP has been used effectively in informing decision making by exploring and constructing possible futures based on existing social, environmental, economic and cultural drivers (Costanza et al., 2015). Although used successfully in other regions and countries to navigate the path through an uncertain future, in determining national future scenario preferences, SP has primarily utilised focus group approaches. These focus groups have been based on national leadership representation, as seen in South Africa (Kahane, 2004), or alternatively a broader community audience as utilised in Hawaii (Dator, 2009) and New Zealand (Taylor et al., 2007). Similar approaches to determining and achieving desired future outcomes have also been used in both organisational change (1987, Ansoff, 1978; Mintzberg & Lampel, 1999; Bradford, Wright, Bart, Cairns, & Van Der Heijden, 2005) and societal behaviour change (Costanza et al., 2017).

The example of the use of scenario planning in South Africa demonstrates the impact this approach can have on future planning, policy development and transition and is therefore relevant to the situation in Australia.

Scenario Planning was used in South Africa in the early 1990’s to facilitate the transition from Apartheid to the Rainbow Nation (Kahane, 2004). The approach was based on: (i) the identification of particular influential and uncertain focal points and drivers in South Africa (O’Brien, 2000) in this case, national governance options and potential outcomes that could result following the elections; and (ii) the use of these drivers for the development of four plausible scenarios or stories that reflected the alternative futures being faced by South Africa.

The benefits of the use of scenario planning at a very practical level in this very volatile period in the South Africa’s history is captured in a popular joke at the time. Faced with the country’s daunting challenges after considerable disharmony and hardship, South Africans joked that they had two options: a practical option and a miraculous option. ‘The practical option was that we would all get down on our knees and pray for a band of angels to come down from heaven and fix things for us. The miraculous option was that we would continue to talk with each other until we found a way forward together’ (Kahane, 2004). Scenario planning provided the practical framework for the ‘miraculous’ option. In addition to identifying the key parameters / drivers impacting the future in South Africa and developing four plausible scenarios based on these key parameters, two additional scenario planning tools were utilised to facilitate the transition process; these included identification of a preferred scenario by participants and utilisation of this preferred scenario to form the basis for a national conversation and strategic planning process on how this preferred future or scenario could be achieved (Dator, 2009; Kahane, 2004).

In Australia, scenario planning has already been used in a number of regional contexts (Costanza et al., 2015) but to date not on a national level. One recent regional example was in the Westernport Bay Region in Victoria as part of a community consultation process. The key parameters were built around current trends of development, construction of a major international container port, and economic and environmental factors, including consideration of tourism and ecosystem services (VNPA, 2014). These were distilled into four plausible scenarios and used to inform policy-making regarding development in the region.

In order to address the larger question of the preferred future for Australia we extended the traditional use of scenario planning to include public opinion survey methodologies. The approach utilised both the identification of key drivers for Australia and then used these drivers to identify four alternative plausible future scenarios for Australia in 2050. Two forms of national survey were then conducted where respondents were asked a series of questions relative to these four scenarios which included (i) their preferred scenario (ii) where they thought Australia is now and (iii) where they thought Australia is heading (Dator, 2009). The purpose of this approach was to both support a national discussion on what Australians want for their future and to guide government, business and community in decision making and governance relative to the preferred futures.

The first section of this paper describes the methods used in preparing the four future scenarios for a web-based national public opinion survey. The second section outlines the survey and public engagement methodology. The third section provides the results of the survey of public preferences for the four scenarios and an analysis of these results. Finally, in section four, we discuss some implications of these results for governance and policy.

1.1. Developing SCENARIOS FOR AUSTRALIA

In looking at the development of scenarios for Australia it is useful to further review the background and broader application of scenario planning.

Schwartz (1996) defined scenario planning as a process for matching perceptions of the future with decisions that have to be taken, thereby providing an important tool for setting public policy both within Australia and internationally. Ringland and Schwartz

(1998) emphasised the usefulness of scenario planning as a tool to manage the uncertainty of the future, a situation faced in Australia due to both national and international trends and drivers. The importance of the use of these drivers in establishing the scenario options is identified by O'Brien, who highlighted that scenarios are essentially 'stories that consider how alternative futures relate to particular focal issues that may unfold from a combination of highly influential and uncertain drivers, and their interaction with more precise driving forces' (O'Brien, 2000).

Within the public policy context, Coreau, Pinay, Thompson, Cheptau, and Mernet, (2009) highlighted that scenarios 'are not predictive models, but deal with hypothetical futures from a strategic perspective, rather than tactical' (Coreau et al., 2009). Coreau also noted that scenarios do not predict a single outcome, but a cumulative impact. Most importantly in the public policy context, as Australia faces a range of choices for the future, Amer, Daim, and Jetter, (2013) highlight how scenario planning stimulates strategic thinking and helps overcome thinking limitations by creating multiple futures. The importance of scenarios in academic research was emphasised by Ramirez, Mukherjee, Vezzoli, and Kramer, (2005) who outlined how scenarios 'help challenge existing assumption, identify novel lines of enquiry, and enable new research opportunities to emerge'.

For the specific development of alternative scenarios for Australia, Dator (2009) and Hunt et al. (2012) provided useful frameworks by identifying four key scenario archetypes: (i) Continued Growth / Market Forces (a growth archetype), (ii) Discipline / Policy Reform (a discipline/restraint archetype), (iii) Transformation / New Sustainability Paradigm (a transformational archetype) and (iv) Collapse / Fortress World (an archetype where the world become fragmented, inequitable, and head towards temporary or permanent social collapse).

1.2. Four scenarios for Australia in 2050

In outlining the development process for the four scenarios, it is important to identify at the outset the theoretical and epistemological position of the authors. The survey was developed at The Crawford School of Public Policy, Australian National University as part of an ecological economics program that embodies a trans-disciplinary, systems oriented approach.

To ensure that scenarios were fully representative of Australia's population base, the four specific scenarios for Australia were developed broadly based on the four scenario archetypes outlined by Dator (2009) and Hunt et al. (2012). These were then checked against a systematic review and synthesis of a broad range of Australian and global scenario studies to identify both key drivers and national scenario content (Costanza et al., 2015). Based on this analysis the Australian scenarios were structured around two key parameters: (i) individualism versus community orientation and (ii) a business as usual / GDP growth development approach versus a broader economic, ecological and social well-being development approach. The public debate leading up to the 2016 Federal Election on issues such as the environment and climate change (Cox & Lee, 2015; Mitchell, 2015), freedom of the individual versus community interests (The Guardian, 2015), tax equality and gun laws (Gittins, 2015), demonstrated the practical application of these axes / drivers to the debate in Australia. These parameters were then used to generate four potential scenarios for Australia's future in 2050.

Within this process it was noted that one of the challenges faced in using national public opinion survey methodologies would be the minimisation of any potential bias in both naming and describing the scenarios. The generic naming descriptions used by Dator (2009) and Hunt et al. (2012) such as Collapse / Fortress World and Transformation / New Sustainability Paradigm highlighted this potential for bias to be perceived in scenario names and descriptions.

A further review of scenario names and descriptions used in other regional and national studies further highlighted this as a potential problem that needed to be addressed. Examples such as 'Catastrophe' in the Australia's Futures study (Cork et al., 2015), 'Fruits for a Few' in the New Zealand study (Taylor, 2015), and 'Lame Duck' in the South African scenarios (Kahane, 2004) also highlighted the potential to lead the respondents to prefer certain scenarios over others because of their names (Costanza, 2014). Although the use of these names was perhaps not problematic for these limited group studies as they were developed by the participants and therefore had appropriate significance for the outcomes. However as national survey participants would not have this background in the development and significance of the alternative scenarios, naming and scenario descriptions were identified as a potential area of bias that required addressing if SP was to be used in a national public opinion survey.

Therefore, for this national public opinion survey where the objectives were to both determine preferred future scenarios for Australia and to promote an open national dialogue on each of these preferred futures, a methodology was developed to minimize potential bias in scenario naming and descriptions. First, we named scenarios based on what we perceived as plausible alternative futures for Australia given the key parameters in each. Second, to minimise potential bias where negative outcomes were included in descriptions, we used existing research used as the basis for the description content (e.g., potential outcomes for the Great Barrier Reef under each scenario (Bohensky, Butler, & Costanza, 2011)). Third, drivers such as economic, ecological and social outcomes were standardised under generic key headings: Governance, Economy, Community, Individual well-being, Natural environment and Built infrastructure. Finally, the names and description terminology for this Australian survey were then pre-tested with a focus group to ensure the scenario naming and descriptions that we developed were indicative of the basic characteristics of the scenario but minimised any unintended bias (Harte et al., 2015).

This methodology resulted in the four scenario names chosen to describe the options: (1) Strong Individualism, (2) Community Well-Being, (3) Free Enterprise, and (4) Coordinated Action. The parameters, scenario names, and brief descriptors are summarised in Fig. 1.

Each scenario was then translated into a single page description of Australia in 2050. Finally, to increase participant 'experience' and 'engagement' in these scenarios (Dator, 2009), each scenario description was translated into a short story (O'Brien, 2000) in the form of '2050 News Brief'. The intent was to maximise accessibility of the scenarios to a broad range of participants in the national survey context, while minimizing the amount of time necessary for participants to understand each scenario. These Scenario



Fig. 1. Australia: Our Future, Your Voice survey matrix.

Descriptions and associated scenario ‘2050 News Reports’ are included in Appendix A.

2. Public survey and engagement

This research was conducted using two public survey sampling techniques: (i) a national statistically representative sample and (ii) a self-selected sample. The two survey sample methodologies were used to provide the opportunity to (i) compare and contrast the results of the nationally representative sample (more indicative of a national compulsory referendum result as used for the Australian republic referendum) to a self-selected sample (more indicative of the voluntary postal survey used in the Australian same sex marriage survey) (Bickers, 2017; Medhora, 2017) and (ii) to encourage inclusiveness and engagement in the national debate generated by the self select engagement process.

2.1. representative survey (national statistically representative sample)

This survey was conducted using a closed website where participants could engage in the survey. To achieve statistical robustness, a random sample of 2083 participants was sourced from the ADP market research national database. This was normalised to reflect a demographically representative sample. Sample size of $n > 2080$ has a maximum sampling variance of $\pm 2.85\%$ for the total sample at a 99% confidence level.

2.2. Self-Select Survey

This survey was conducted using a publicly accessible website combined with a national promotion campaign entitled ‘Australia: Our Future, Your Voice’. The national survey was promoted through a range of public communications mechanisms, including (i) a national press release, (ii) a national radio interview broadcast on ABC Radio National, (iii) direct contact to a cross section of 30 national organisations inviting the participation of their membership, and (iv) invitations to participate to students and staff in a national university (The Australian National University). A total of 492 participants took part in the Self-select Survey, which was substantially lower than the Representative Survey. The Self-select sample size of $n > 480$ has a maximum sampling variance of $\pm 4.455\%$ for the total sample at a 95% confidence level.

2.3. The ‘Australia: our future, your voice’ survey

Both surveys were conducted using the *Australia: Our Future, Your Voice* web based survey. The survey aimed to determine both information regarding public participant scenario preferences and participant characteristics; it is included in Appendix B. The survey was constructed based on a questionnaire framework developed to elicit (i) a simple ranking of scenarios from most to least preferred, and estimates of how ‘satisfied’ participants expect they would be in each of the scenarios (intended to supplement the preference ranking by giving an estimate of strength of preference for each scenario) (Dator, 2009), as well as (ii) demographic questions (postcode, gender, voting intention, age, highest level of education, household income and country of origination). Demographic data provided the opportunity to understand the comparative demographics of both the Representative and Self-select samples. The survey also included (iii) a shortened and adapted form of the Aspiration Index (Grouzet et al., 2005), which can be answered by people with a wide range of backgrounds and educational levels, as well as (iv) a short measure of well-being known as the Flourishing Scale (Diener et al., 2010). Finally the survey included (v) a short measure of participant motivation to take part in the survey (Where did you hear about this Survey?). This was of particular relevance for Self-select Survey participants.

The inclusion of both participant scenario preferences and demographics is a core objective of the research. The inclusion of participant motivation to take part in the survey was to test correlations between any organisational affiliations and preferences. The inclusion of participant goals, values and well being indicators requires further explanation. Individual goals and values are strongly associated with preferences for the future and are therefore potentially significant drivers of scenario preferences. We were therefore interested in not only exploring patterns of preferences among the general public for different scenarios and participant demographics, but also testing relationships between preferences and different types of personal goals and values.

The Aspiration Index, a well-validated goal and values measure, was used to explore this relationship. This provided a number of further benefits to the research. (i) Validation: Measuring goals provided an opportunity to validate that participant preferences for different scenarios reflect general patterns of valuing rather than idiosyncratic features of the scenarios themselves. (ii) Ability to generalise: Inclusion of goal measures allowed us to generalise our findings. Goals appear to influence responses on a large range of societal and environmental issues, including social inequality, racism, gender relationships, human rights and environmental degradation. It is important in the ongoing evolution and application of living scenarios to be able to relate the specific scenario narratives to more general patterns of intrinsic (personal growth, affiliation, community feeling) and extrinsic (financial success, image, popularity) values (Grouzet et al., 2005). (iii) Tailoring: Understanding the relationship between goals and values, and their relationship to scenarios, is important in the application of scenario planning moving forward. It enabled us to understand how to tailor scenarios and communications so they are readily accessible to varying population segments whose goals may vary widely. Similar visions for the future, for example, can be expressed in different ways in order to better relate to people with different aspirations. This was seen as important in the ongoing evolution of the use of living scenarios in public policy development and implementation. (iv) Application: In responding to a values questionnaire, participants are essentially reporting on affective (emotional) responses across a range of contexts. As highlighted by Schwartz, ‘values reflect desirable, trans-situational goals, which vary in importance and that serve as guiding principles in people’s lives’. While values can be abstracted from any given situation, they are inextricably linked to emotions and desires that influence behaviour and become important in the potential application of this research moving forward.

The benefits of understanding participant goals and values and their relationship to preferred futures therefore provided further frameworks for the evolution of living scenarios and their contribution to both developing and implementing public policy and achieving publicly desired outcomes.

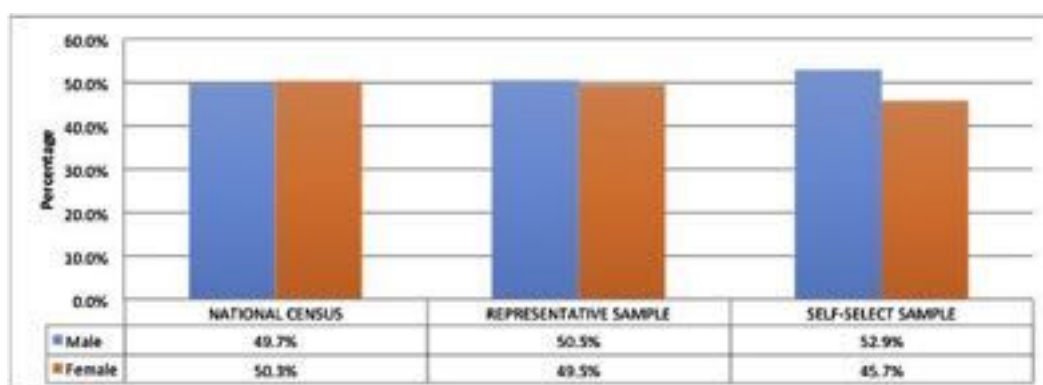


Fig. 2. Gender Distribution.

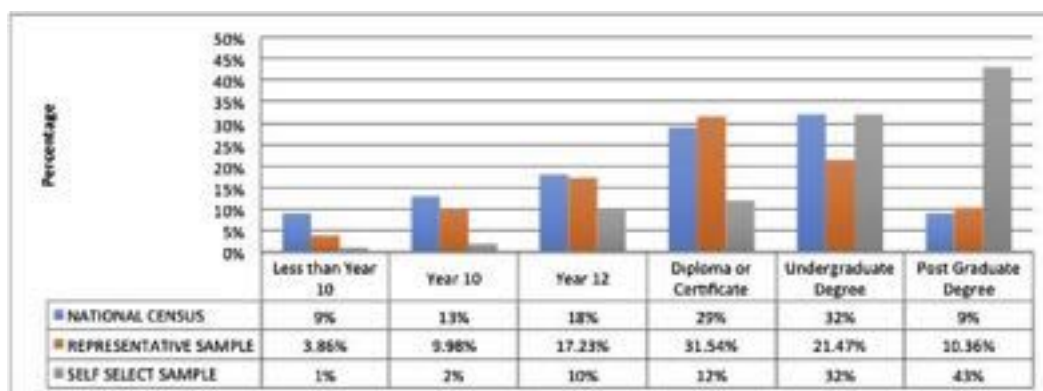


Fig. 3. Education Levels.

3. Results

3.1. Demographic results

3.1.1. Gender distribution

Fig. 2 demonstrates that the demographics of the Representative sample were comparable to the National Census Data in both male and female participant populations. It was noted, however, that in the Self-select sample male representation was 7.2% higher than female representation.

3.1.2. Age, education and salary distribution

Comparisons were made to Australian Census data against factors such as gender, education level, age, and salary range for both the Representative and Self-select samples. The Representative Sample was quite comparable on these factors, except for undergraduate education, which was slightly lower than the National Census Data, as seen in Fig. 3.

Also of note when reviewing educational levels was that the Self-select sample had much higher participation rates by participants with postgraduate education levels than both the National Census Data and the Representative Sample. An explanation for this could be the invitation to a university population to participate in the Self-select sample. This would also explain the higher 25–34 years age range compared to the National Census Data, as seen in Fig. 4.

The other demographic characteristic of note in the Representative sample was a higher concentration of participants in the \$25,000 to \$74,000 salary range compared to the National Census data (Fig. 5). This may reflect a characteristic of participants who form part of the ADP research database.

3.2. Political alignment

In the Representative Sample, a slightly lower percentage of Liberal Party aligned participants was observed, although other party affiliations were comparable to the 2013 Election Data (Australian Electoral Commission, 2013). In both samples it was noted that participants who responded as politically non-aligned were relatively high compared to the election results. In the Self-select sample, the most obvious differences were a much higher percentage of Green Party aligned participants. A lower representation of the Liberal, National Party, and Labour aligned participants was also observed (Fig. 6). These results provided a useful contrast to the Representative sample and therefore the opportunity to examine the potential differences in scenario preference results between the

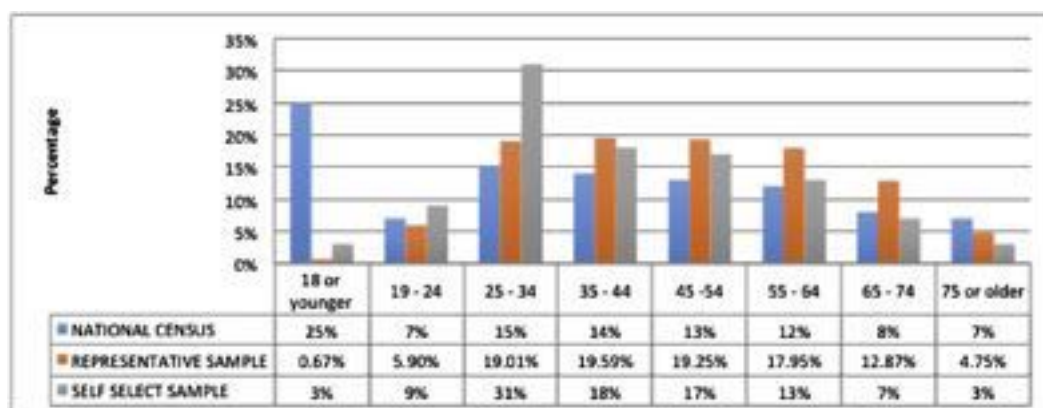


Fig. 4. Age Range Levels.



Fig. 5. Salary Range Levels.

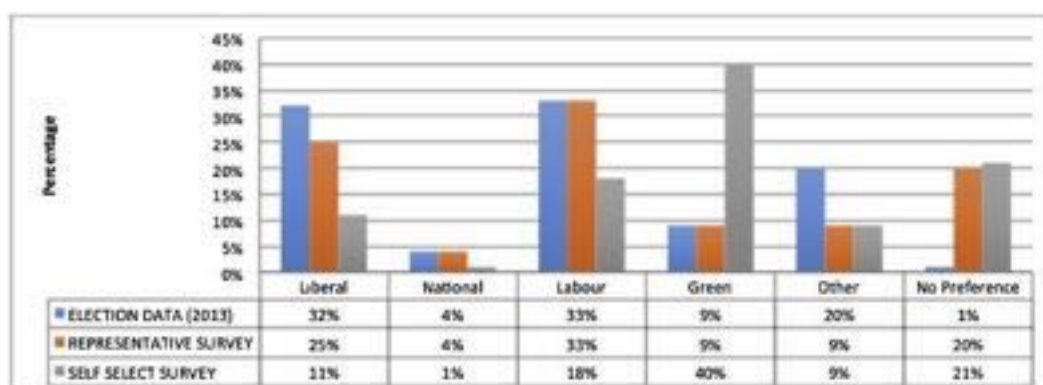


Fig. 6. Political Alignment.

two survey samples.

3.3. Scenario preferences

3.3.1. Representative sample

3.3.1.1. Preferred scenarios. Participants were first asked to rate their preference for each of the scenarios, from Most Preferred (1) to Least Preferred (4). The results are illustrated in Fig. 7 and were reviewed using three methodologies (i) ‘first past the post’ (ii) a combination of first and second preferences, and (iii) the Borda method (Fishburn, 1971).

Using (1) a ‘first past the post’ methodology, the most preferred scenario was Community Well-being scenario (951 / 46%), scoring more than twice that of the second most preferred scenario, Free Enterprise (430 / 21%). Coordinated Action (397 / 19%) was the next most preferred scenario, followed by Strong Individualism (305 / 15%). Coordinated Action scored most strongly as a second preference at (32%), followed by Community Well-being (27%), Strong Individualism (25%), and Free Enterprise (15%).

The next analysis methodology involved combining the first and second preference scores. Of the 2083 responses in the survey, Community Well-Being scored most strongly at 73% when first and second preferences were combined (46% as first preference, 27%

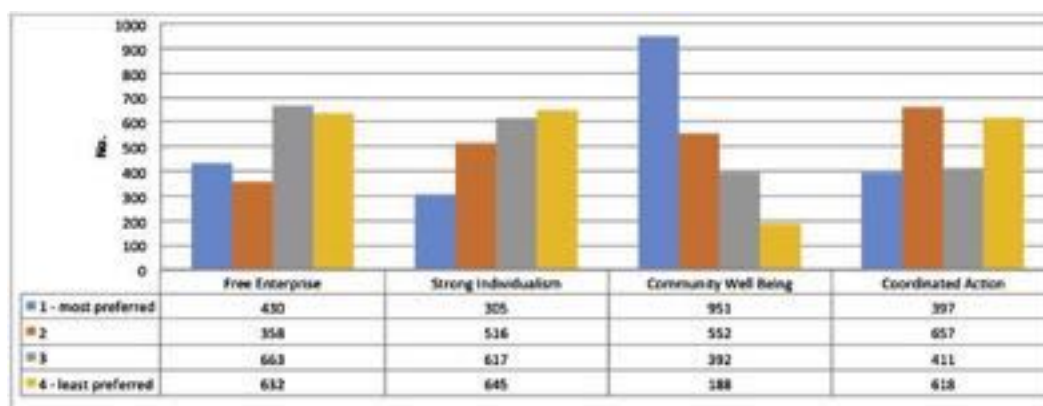


Fig. 7. Preference for future scenarios.

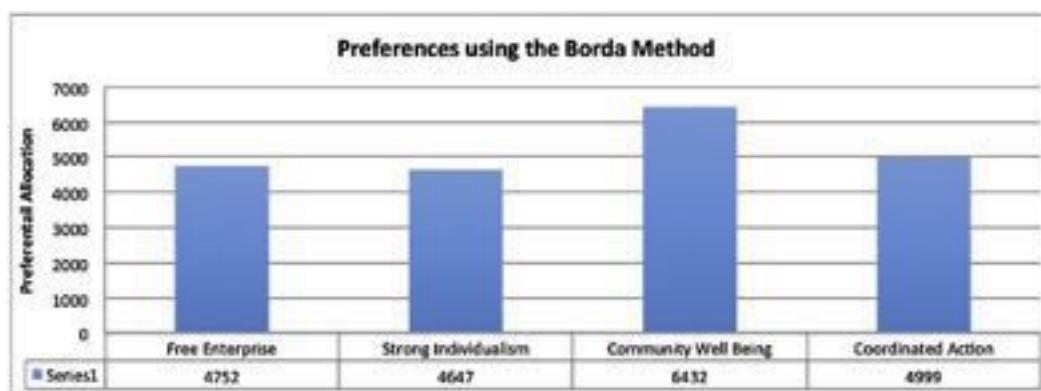


Fig. 8. Preferred Scenarios Analysis using the Borda Method.

as second), followed by Co-ordinated Action at 51% (19% as first preference, 32% as second), and Strong Individualism at 40% (15% as first preference, 25% as second). The weakest scenario using this analysis was Free Enterprise at 38% (21% as first preference, 17% as second),

The final methodology used was the Borda scoring method. This enabled all of the preferences to be incorporated into a single result using a preferential voting method for allocation of results. A simple application of this methodology was used to calibrate first to fourth preferences: n , $n-1$, $n-2$ and $n-3$. The Most Preferred result was scored at four (4) with $n = 4$ as there were four possible results. The second preference was scored at $n-1 = 3$, descending to the least preferred scenario which scored at $n-3 = 1$. Using this preferential allocation methodology based on the total number of points, the strongest participant preference was again Community Well-being (6432 / 31% of total), followed by Coordinated Action (4999 / 24% of total), Free Enterprise (4752 / 23% of total), and Strong Individualism (4647 / 22% of total) (Fig. 8).

The results demonstrate two key outcomes. First, participants in the Representative Survey clearly preferred the Community Well-being scenario, regardless of the methodology used. Second, strong participant support was still clearly evident for each of the other scenarios, although Strong Individualism had consistently weak support.

These findings do not provide an unambiguous way forward. However in policy formation it does highlight the divergence of preferences across the Australian public and therefore the importance of an approach to development that achieves an appropriate balance across economic, ecological and social outcomes. The results also provide some evidence that the attempts to minimise inherent bias in the survey through generic naming and scenario descriptions appeared to have been relatively successful.

3.3.1.2. Scenario satisfaction levels. The next area of analysis concerned participants' expectations about how satisfied they would be living under each scenario; they chose between Very Dissatisfied, Dissatisfied, Neutral, Satisfied and Very Satisfied for each scenario. Again the strongest preference was for the Community Well-Being scenario with over 60% of participants indicating they would be either Satisfied or Very Satisfied living in this scenario. Community Well Being was followed by Coordinated Action (50%), Free Enterprise (33%) and Strong Individualism (32%). When Dissatisfied and Very Dissatisfied results were reviewed, the highest dissatisfaction results were for the Strong Individualism scenario (31%), followed by Free Enterprise (30%), Coordinated Action (13%) and Community Well Being (9%) (Fig. 9).

3.3.1.3. Australia's future. Three additional questions were asked of participants regarding Australia's future. First, respondents answered 'Which scenario do you think other Australians would prefer?'. The highest percentage of participants thought other Australians would prefer the Community Well-Being scenario (52%), followed by Coordinated Action (19%), Free Enterprise (15%) and Strong Individualism (13%). This indicated consistency between the most preferred participant scenario (CW) and the scenario

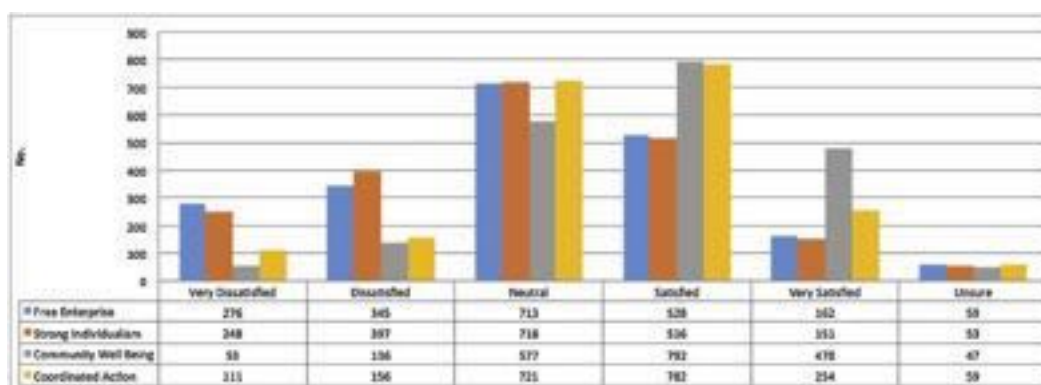


Fig. 9. 'How satisfied would you be living in one of these scenarios?'.

the majority of participants perceived other Australians would prefer (CW).

A clear consistency was also observed between the results to the first three questions. Community Well-being was the most popular first preference, the most popular scenario in which participants would be most satisfied living, and the scenario perceived by participants as the most popular preference for other Australians.

An apparent disparity in the study was participants' responses to the following two questions 'Where is Australia now?' and 'Where is Australia heading?' For 'Where is Australia now?' the highest number of participants perceived Australia to be in the Free Enterprise (38%) followed by Strong Individualism (26%). For 'Where is Australia heading?' the highest number of participants perceived Australia to be heading towards Free Enterprise (32%) when followed by the Strong Individualism scenario (30%).

There was therefore a clear dissonance between the results of these two questions and the strength of the representative sample participants' first preference for Community Well-being using all analysis measures. The perception by a majority of participants that Australia was not currently in, or heading towards, their preferred scenario (Community Well-being) could potentially explain some of the disenchantment with the political, social and economic systems observed in Australia.

3.3.1.4. Aspirations and life satisfaction. We also tested how participants' personal Goals and Aspirations were related to their scenario preferences. The key relationships noted were between first preference scenario choices and the Aspiration Index measure of preference for Intrinsic (personal growth, affiliation, community feeling) and Extrinsic (financial success, image, popularity) values and the life satisfaction measure.

First, we observed that participants with first preferences for Community Well-being and Coordinated Action valued intrinsic aspirations more highly than those who chose Free Enterprise and Strong Individualism. It was also observed that this trend was reversed for participant preferences for Free Enterprise and Strong Individualism. Participants who preferred Free Enterprise and Strong Individualism placed stronger priority on extrinsic aspirations than did those with scenario preferences for Community Well-being and Coordinated Action (Fig. 11).

Regrading the life satisfaction index, those who chose Free Enterprise as their first preference scored higher on the life satisfaction scale than did those who chose Community Well-being (Fig. 12). The converse relationship was also observed. Those who chose Community Well-being as their first preference scored lower on the life satisfaction index than those who chose Free Enterprise. These results raise the question as to whether there is a link between this result and the answers to the questions 'Where Australia is now?' and 'Where Australia is heading?' (Fig. 10). Is the fact that life satisfaction is higher for those with first preference for the Free Enterprise scenario a result of their perception that this is where Australia is now and where Australia is heading? And conversely, is the life satisfaction of those who chose Community Well-being as their preferred scenario lower because they perceive Australia to be heading in a different direction (towards the Free Enterprise and Strong Individualism scenarios)? This result further raises the question of whether this lower level of personal life satisfaction extends to a societal level. Though it is not within the scope of this study to answer these questions, this finding does suggest the opportunity for further research in this area.

3.3.2. Self-select sample

3.3.2.1. Scenario preferences. As noted in the introduction, the value of conducting of a Self-select Survey in parallel to the Representative Survey was to provide the opportunity to examine differences between responses of participants who self-selected to participate and those from a national statistically representative random sample. This is of relevance in Australia due to the fact that both approaches are frequently used to determine Australians' preferences and subsequent public policy. For example, a Self-select survey approach was used to determine and set public policy in the Australian Same Sex Marriage postal survey (Bickers, 2017; Medhora, 2017) whereas a representative sample survey is more indicative of the participatory referendum approach used to determine public policy on Australia as a republic in 1999.

It is therefore of interest to note that of the 492 responses to the Self-select Survey, a similar result for the highest preference to that of the Representative Survey was observed. In the Self-select survey 47% selected Community Well-being as their first preference and 14% as their second preference. However, the preferences for other scenarios in the self-select survey were somewhat different

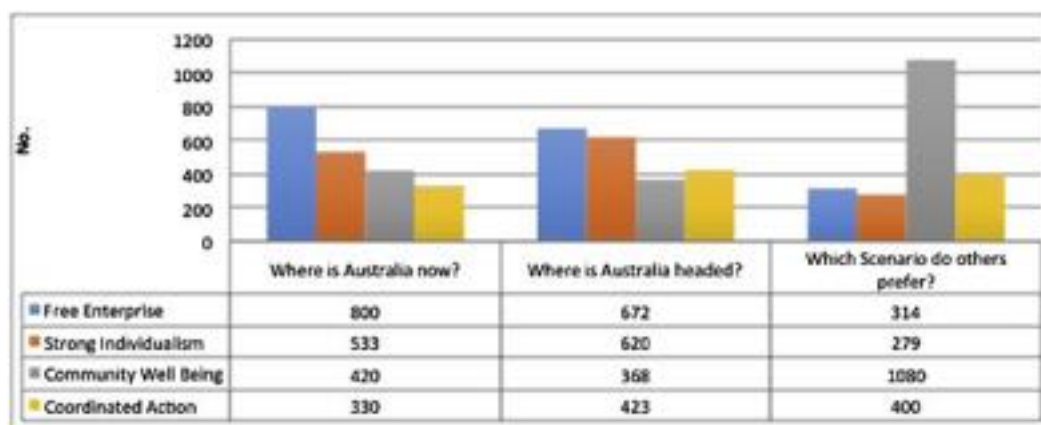


Fig. 10. Participants preferences and responses on (a) where Australia is now, (b) where Australia is heading, and (c) which scenario others prefer.

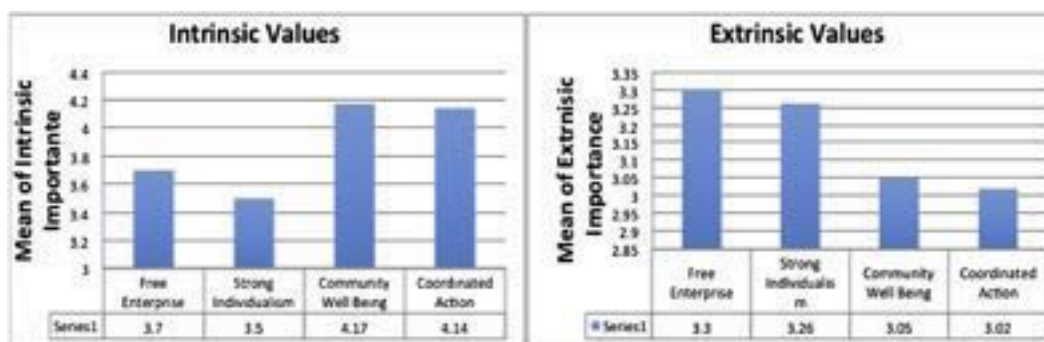


Fig. 11. Comparison of scenario preferences with intrinsic and extrinsic values.



Fig. 12. Comparison of scenario preferences with life satisfaction parameters.

than in the Representative Survey. Coordinated Action was the second most popular choice, with 15% selecting it as first preference and 38% as second preference. Next was Strong Individualism, with 5% as first preference and 10% as second, and finally Free Enterprise with 5% as first preference and 6% as second (Fig. 13). This reversal of secondary results might be explained by the much higher Green politically aligned participants in the Self-select sample than in the Representative sample, as noted in Fig. 6.

3.3.2.2. Scenario satisfaction levels. These results were also reflected in the pattern of responses to the questions ‘How satisfied would you be living in one of these future scenarios’. The most popular choice for first preference was Community Well-Being and second preference was Coordinated Action (Fig. 6). This was a similar result to that seen in the Representative Survey (Fig. 14 Fig. 14)

3.3.2.3. Australia’s future. When asked ‘Where is Australia now?’ the highest number of Self-selected participants chose the Free Enterprise scenario (45%), a similar pattern to that noted with the Representative sample. This result was also observed for the question ‘Where is Australia headed?’ When asked this question, the highest percentage of participants selected Free Enterprise (51%), with Community Well-being (5%) scoring the lowest result (Fig. 15). The greater extremes in these results compared to the Representative sample could be potentially explained again by the higher Green party aligned representation in the Self-select sample compared to the Representative Sample (Fig. 6).

The responses to the question ‘What scenario do you think others prefer?’ were similar in pattern to the Representative Sample. The self-selected sample did however again demonstrate slightly greater extremes, as seen in Fig. 15. This result could represent a difference between Representative and Self-select surveys. In these two surveys methodologies a stronger perception that others have

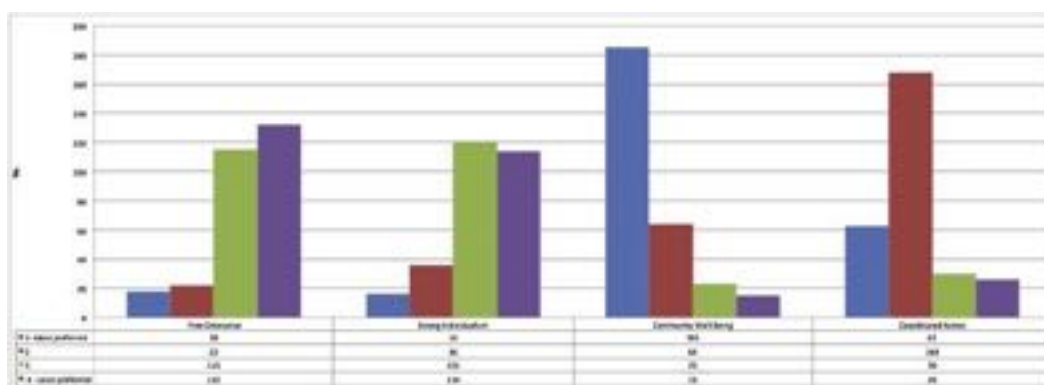


Fig. 13. Preference for future scenarios.

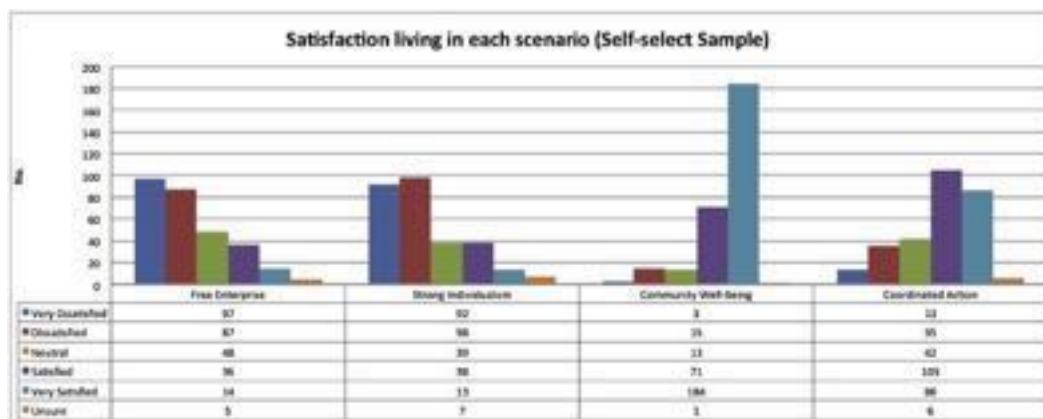


Fig. 14. 'How satisfied would you be living in one of these scenarios?'.

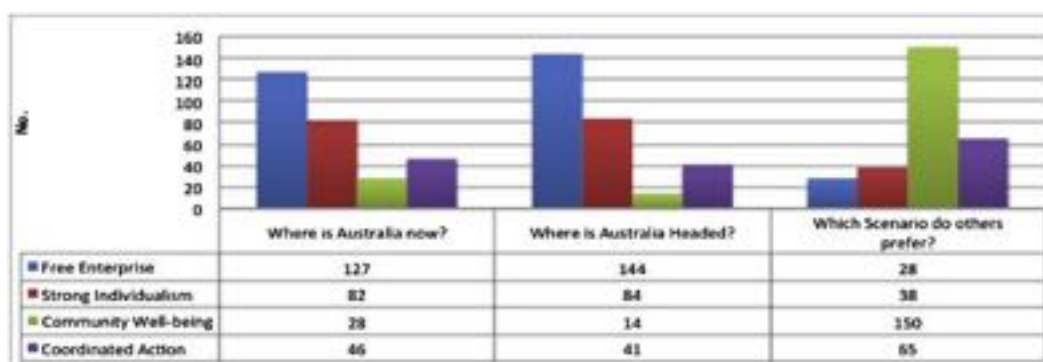


Fig. 15. Australia's future responses.

similar views to participant views was observed in Self-select survey population compared to the Representative survey population. It is recognised that the sample size of the Self-select survey was relatively small. However given that both Self-select surveys and national referendum surveys have been used to set public policy in Australia, this differential could also be relevant for further research.

3.3.2.4. Political alignment. To further explore potential key drivers behind the greater extremes observed in the results from the Self-select Survey compared to the Representative Survey, Self-select participants who recorded their political alignment as Liberal/National Party and as Green Party were compared on the following three questions: (i) Where is Australia now? (ii) Where is Australia heading? (iii) Which scenario do others prefer?

The results of this analysis revealed that Liberal/National Party affiliation participants had a lower perception of Australia being currently in the Free Enterprise (19%) scenario and a stronger perception that Australia was in the Coordinated Action (31%) scenario compared to the Representative sample, who perceived Free Enterprise at 38% and Coordinated Action at 16%. When Green Party aligned participants responded to the same questions the highest number responded that Australia was now in the Free Enterprise (40%) scenario compared to the overall Self-select sample results of 45% perceiving Australia in the Free Enterprise scenario (Fig. 15). The small sample size of these populations however precludes any confident conclusions from these observations (Fig. 16).

The most contrasting result observed between the Self-select survey and the Representative survey was the answer to the question of which scenario others prefer. The Liberal / National Party aligned participants were most likely to believe that others preferred Strong Individualism and Free Enterprise, whereas the Green Party aligned participants believed that Community Well-being was most preferred by others (Fig. 15). These results raise the question of whether Self-selecting participants have a greater perception that other Australians have similar views to themselves. Although this was not an area of specific focus in this research and the small sample sizes of both the Liberal / National Party and Green Party aligned samples limits drawing any firm conclusions, the results further highlight the opportunity for additional research in this area (Fig. 17).

3.4. General feedback and methodology

An open-ended question was included in both surveys, thus providing the opportunity for the researchers to gain feedback on both the survey itself and a greater understanding of the participant scenario preferences. Over 50% of participants answered the open-ended question in the survey. Many included comments on the survey itself, as well as information about how they heard about the

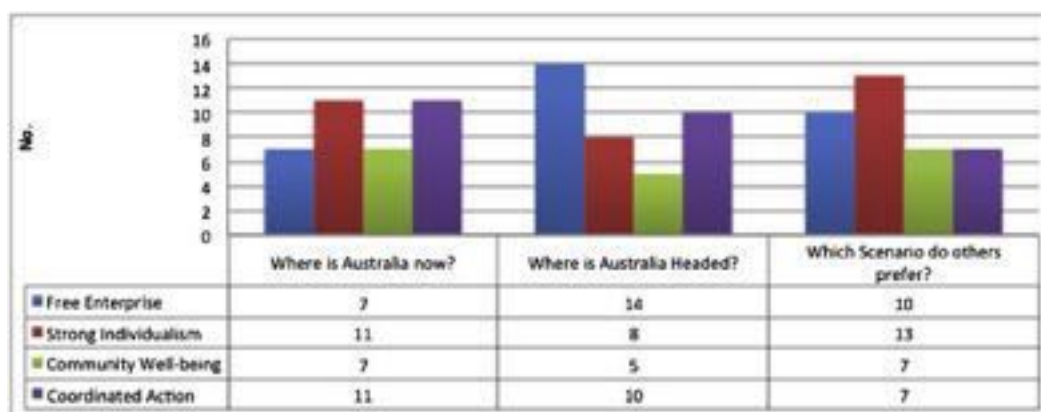


Fig. 16. Liberal / National aligned participants preferences and responses on (a) where Australia is now, (b) where Australia is heading, and (c) which scenario others prefer.

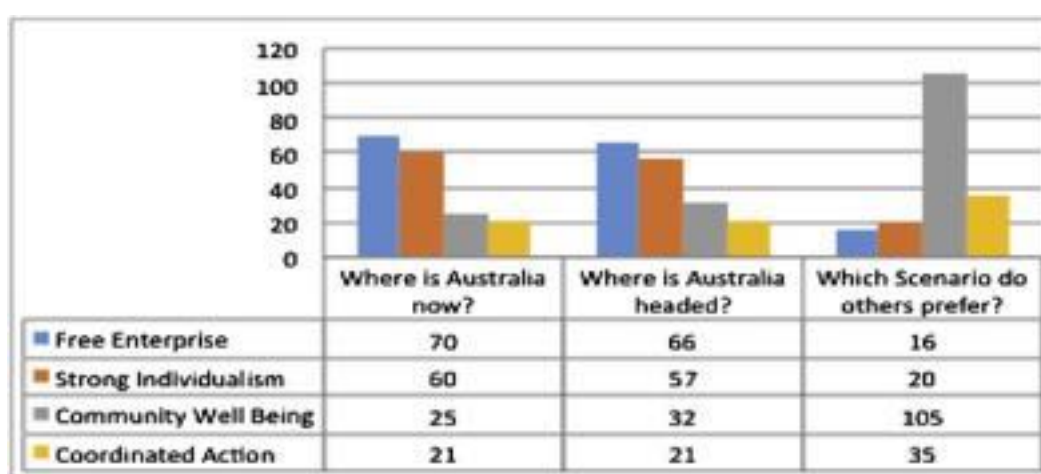


Fig. 17. Green aligned participants preferences and responses on (a) Where Australia is now? (b) Where Australia is heading? and (c) Which scenario others prefer?.

survey. Both validation and criticism of aspects of the survey approach were received. The concerns about the survey itself were regarding the ‘characterisation’ of the scenarios themselves. This is useful feedback and highlights the issues identified above concerning research using scenarios and scenario descriptions. As highlighted at the outset, these open-ended responses reinforced: (i) the importance of researchers undertaking all possible measures to ensure that scenarios and their descriptions are plausible (ii) that potential issues of inherent bias are addressed and (iii) the importance of using established research when including forecasts of important events, as was done in the current survey when providing alternative descriptions of Great Barrier Reef scenario outcomes (Bohensky et al., 2011).

The use of the open-ended question in the survey also allowed for feedback on the language, concepts and descriptions involved in the scenarios. Only a small number of participants reported problems with comprehension or level of detail. The majority of participants who commented in the open ended question reported that they were comfortable with the scenario planning approach, the scenario descriptions, and the underlying parameters of the scenarios. Overall, the feedback indicated that within the groups surveyed, meaningful engagement was achieved.

The amount of information on each scenario was also a point of discussion among participants. The presentation of the scenarios in bullet point format, across a range of key economic, social, business, political, and environmental factors, and with a ‘news story’ to capture the key elements of each scenario, was used by the researchers to achieve a balance between content, accessibility, and time required by the participants. This strategy was validated by the positive participant feedback received on this approach in the open-ended question in both the Representative Survey and the Self-select Survey. This positive feedback supported the value of the use of national surveys based on scenario planning approaches to provide a format for facilitating a national discussion on desired futures and building a broad consensus, as well as a mechanism for determining public preferences and resultant public policy.

Developing the *Australia: Our Future, Your Voice* survey therefore highlighted a number of challenges. Any attempt to use scenario planning to contribute to an informed national conversation and debate about Australia’s future necessitates trade-offs between depth of engagement, comprehension, and rates of response. These impacts can however be potentially minimised using the survey methodologies and materials that leverage previous national and international research and that are pretested to minimise any potential descriptive bias.

4. Conclusions

In reviewing the results of this study five points emerge as key findings.

First, although the results of the Representative and Self-select Surveys showed some differences, the areas of consistency highlighted a number of key trends that can be tested further. The consistent first preference for a scenario that focused on the pursuit of Community Well-being was evident using all analytical methodologies and across both sample populations. The observation that this finding was not dependent on political alignment demonstrates a broadly shared preference for a more community-oriented and sustainability focused future for Australia compared to a more individualistic society and GDP-driven economy. Further, intrinsic vs. extrinsic value orientation was identified as a key predictor of scenario choice. Although the survey demonstrated clear preferences for specific scenarios, scenario preferences were well represented across all of the scenario options. This highlights the need for policy makers to address the requirement for balance in addressing the scenario parameters. It also raises questions about the use of the simple ‘sound-bite’ approaches to political campaigning such as ‘Jobs and Growth’. This study demonstrates that the Australian political and social landscape is clearly more complex than can be addressed with simplified approaches.

Second, and perhaps the most important observation in this research, was the discrepancy between both sample participant preferences for where they would like Australia to be and the future scenario in which they would be most comfortable living on the one hand, and Australia’s current situation and the perceived direction that Australia is heading on the other hand. This finding suggests that it is important for future research to explore and further understand this discrepancy.

Third, although the results from the Representative and Self-select samples were by and large similar, there was some evidence that participant preferences and perceptions differed across several areas. This raises questions about the use of the different public survey methodologies (self-select survey methodologies versus more representative referendum survey methodologies) to determine policy and legislative changes on issues such as same sex marriage and Australians republic preferences.

Fourth, this study demonstrated the viability and opportunities for researchers and policy makers to combine scenario planning with national survey methodologies to help determine national preferences and address the complexity of understanding and managing social change.

Finally, the majority preference for Australia’s future direction, combined with the strength of the results for each of the alternative futures, highlights the importance of an informed national debate on both Australia’s future direction and how to address the apparent discrepancy between the type of future the majority of Australians would prefer and where they perceive the country is currently heading.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.futures.2018.12.002>.

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2.2 A PUBLIC OPINION SURVEY OF FOUR FUTURE SCENARIOS FOR AUSTRALIA IN 2050 (PAPER 1)

Contribution to Paper II: The research presented in Paper I: (i) demonstrates that future scenario planning can be successfully combined with national survey techniques to achieve national engagement in the identification of preferred futures and a preferred scenario; and, (ii) provides validation of the Hatfield-Dobbs et al. (2015) modeling that identified a dissonance between the preferred future *sustainable prosperity* outcomes and the current policy choices in Australia (Hatfield-Dodds et al., 2015). The findings in Paper I therefore provide a framework for this vision and potential dissonance to be tested using a geographical lens. To achieve this, Paper II leverages this framework in northern Australia through the comparison of a *business as usual* approach, as outlined in Federal Government White Paper on Developing northern Australia (CoA, 2015), to the *sustainable prosperity* approach to development in Australia (Hatfield-Dodds et al., 2015).

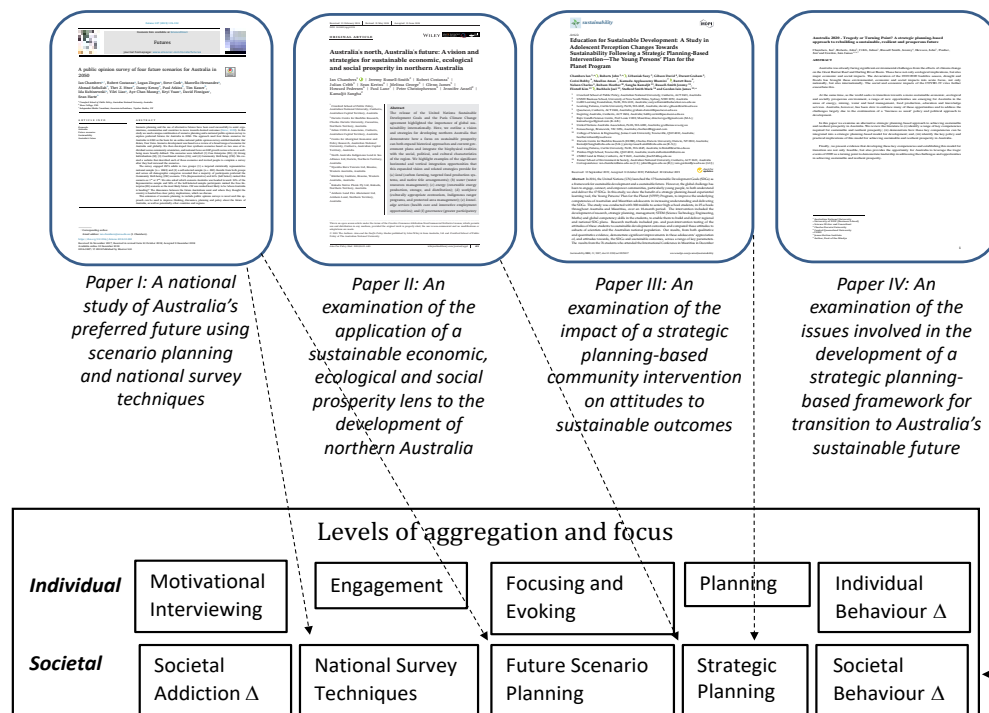


Figure 2. Levels of aggregation and focus for Papers I and II in the development of visions and strategies for Australia's sustainable future

3.1 AUSTRALIA'S NORTH, AUSTRALIA'S FUTURE: A VISION AND STRATEGIES FOR SUSTAINABLE ECONOMIC, ECOLOGICAL AND SOCIAL PROSPERITY IN NORTHERN AUSTRALIA (PAPER II)

Research Question II: *What insights does a sustainable economic, ecological and social prosperity lens provide in an examination of development options for northern Australia?*

Contribution to the aim of the thesis: This research contributes to the aim of the thesis through the use of strategic planning methodology to (i) develop a comparison of the current *business as usual* approach as outlined in Federal Government White Paper on developing northern Australia (CoA, 2015) to the *sustainable prosperity* approach to development in Australia (Hatfield-Dodds et al., 2015), and, (ii) identify potential strategies to achieve this within this sub-region. The findings documented in this paper demonstrate that a *sustainable prosperity* approach in this sub-region of Australia is viable and further, it expands the economic opportunities compared to *business as usual*, as well as contributing to positive ecological and social outcomes.

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Author Contributions

Chambers, Ian: Conceptualisation, Formal Analysis, Funding Acquisition, Investigation, Methodology, Writing - original draft, Writing – review and editing;

Russell-Smith, Jeremy: Conceptualisation, Funding Acquisition, Methodology, Supervision, Writing – review and editing;

Costanza, Robert: Conceptualisation, Funding Acquisition, Methodology, Writing – review and editing;

Cribb, Julian: Writing – review and editing;

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George, Melissa: Writing – review and editing;

James, Glenn: Writing – review and editing;

Pedersen, Howard: Investigation, Writing – review and editing;

Lane, Paul: Writing – review and editing;

Christopherson, Peter: Writing – review and editing;

Ansell, Jennifer: Writing – review and editing; and

Sangha, Kamaljit: Writing – review and editing.

Statement of Contribution

This thesis is submitted as a Thesis by Compilation in accordance with https://policies.anu.edu.au/ppi/document/ANUP_003405

I declare that the research presented in this Thesis represents original work that I carried out during my candidature at the Australian National University, except for contributions to multi-author papers incorporated in the Thesis where my contributions are specified in this Statement of Contribution.

Title: AUSTRALIA'S NORTH, AUSTRALIA'S FUTURE: A VISION AND STRATEGIES FOR SUSTAINABLE ECONOMIC, ECOLOGICAL AND SOCIAL PROSPERITY IN NORTHERN AUSTRALIA

Authors: Chambers, Ian: Conceptualisation, Formal Analysis, Funding Acquisition, Investigation, Methodology, Writing - original draft, Writing - review and editing; Russell-Smith, Jeremy: Conceptualisation, Funding Acquisition, Methodology, Supervision, Writing - review and editing; Costanza, Robert: Conceptualisation, Funding Acquisition, Methodology, Writing - review and editing; Cribb, Julian: Writing - review and editing; Kerins, Sean: Writing - review and editing; George, Melissa: Writing - review and editing; James, Glenn: Writing - review and editing; Pedersen, Howard: Investigation, Writing - review and editing; Lane, Paul: Writing - review and editing; Christopherson, Peter: Writing - review and editing; Ansell, Jennifer: Writing - review and editing; and Sangha, Kamaljit: Writing - review and editing.

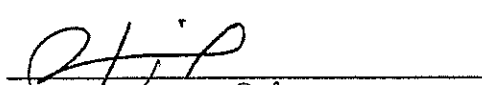
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Date

Australia's north, Australia's future: A vision and strategies for sustainable economic, ecological and social prosperity in northern Australia

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Abstract

The release of the United Nations Sustainable Development Goals and the Paris Climate Change agreement highlighted the importance of global sustainability internationally. Here, we outline a vision and strategies for developing northern Australia that demonstrate how a focus on sustainable prosperity can both expand historical approaches and current government plans and integrate the biophysical realities with the social, political, and cultural characteristics of the region. We highlight examples of the significant horizontal and vertical integration opportunities that this expanded vision and related strategies provide for (a) *land* (carbon farming, targeted food production systems, and native title arrangements); (b) *water* (water resources management); (c) *energy* (renewable energy production, storage, and distribution); (d) *workforce* (culturally appropriate ecotourism, Indigenous ranger programs, and protected area management); (e) *knowledge services* (health care and innovative employment opportunities); and (f) *governance* (greater participatory

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governance). We found that realisation of even 10% of these emerging opportunities over the next 10 years alone could result in economic growth worth over AUD 15 billion and 15,000+ jobs for northern Australia as well as the further ecological and social benefits derived from a sustainable prosperity strategy.

KEYWORDS

ecological sustainability, northern Australia, sustainability, sustainable development, sustainable prosperity

1 | INTRODUCTION

Northern Australia is a land of unique ecosystems, ancient and ongoing cultures and cultural knowledge systems, significant resources, and a sparsely distributed but uniquely talented population (Commonwealth Scientific and Industrial Research Organisation, 2013a, 2013b). Innovations in technology have resulted in increased access to services and resources for some (Russell-Smith, 2016), while at the same time, many of the opportunities presented by global sustainability agendas within the domestic and national policy settings have diminished for others. This is particularly relevant for the region's Indigenous (Aboriginal and Torres Strait Islander) peoples and has resulted in significant inequities and lost opportunities for the region.

Historical and current perspectives on developing northern Australia have often relied on two key approaches: (a) transplanting models developed in southern Australia and other regions, which have regularly been demonstrated to be inappropriate to the unique ecological, social, and economic landscape of northern Australia (Dale, 2014), and (b) perspectives largely based on “business as usual” and “empty world” assumptions of unlimited resource availability (Costanza, 2014). These approaches are illustrated by the Australian Government's *White Paper on Developing the North* (referred to hereafter as the *White Paper*), the current blueprint for development (Commonwealth of Australia [CoA], 2015). However, these assumptions are no longer valid in a world of finite and diminishing resources that have resulted in the global Sustainable Development Goals (SDGs, 2017) agenda. In this paper, we review an alternative approach to development based on leveraging the unique characteristics of the north within the changing regional and global environment to achieve what Hatfield-Dodds et al. (2015) refer to as “sustainable prosperity.” We recognise that northern development policy is an area that has historically attracted much attention, often with conflicting visions and strategies. To achieve our objective, we therefore review (a) a novel framework for development in northern Australia based on achieving sustainable prosperity; (b) a SWOT (Strengths, Weaknesses, Opportunities, Threats) Analysis of the region's key economic, ecological, and social characteristics; (c) a review of the key regional and global environment trends impacting northern Australia; (d) an alternative vision and strategies for sustainable prosperity in northern Australia; (e) policy implications to achieve this vision and resultant strategies including governance and financial constraints; and (f) potential economic, ecological, and social outputs of the application of this sustainable prosperity framework in northern Australia.

2 | A FRAMEWORK FOR ACHIEVING SUSTAINABLE PROSPERITY

As a starting point for establishing our development framework for sustainable prosperity, we reviewed the six key focus areas addressed in 2015 *White Paper* and categorised these into core resources (land, water, and energy) and key support structures (governance, infrastructure and investment, and workforce; CoA, 2015). An alternative development framework was then created based on these core resources and support structures to achieve sustainable prosperity. Strategies were then reviewed within this structure to test the Hatfield-Dodds et al. (2015) assumption that sustainable prosperity can be achieved through policies that leverage regional and global opportunities to achieve a stronger alignment and balance between economic, ecological, and socially sustainable outcomes (Figure 1). This was also based on the assumption that economic growth cannot be decoupled from ecological and social impacts (Ward et al., 2016), however, that a balanced approach with appropriate policy and implementation could achieve a goal of sustainable prosperity in the region. This approach then allows the opportunity to not only expand initial work developed in the *White Paper* but also compare strategies against the criteria of sustainable prosperity and highlight the importance of appropriate and well-implemented policies in achieving this outcome.

3 | UNDERSTANDING NORTHERN AUSTRALIA'S UNIQUE ECONOMIC, ECOLOGICAL, AND SOCIAL ENVIRONMENT

A significant criticism of historical approaches to the development of northern Australia has been a reliance on transporting models from other regions. The unique nature of the northern ecological, social, and economic landscape has often resulted in these approaches being either

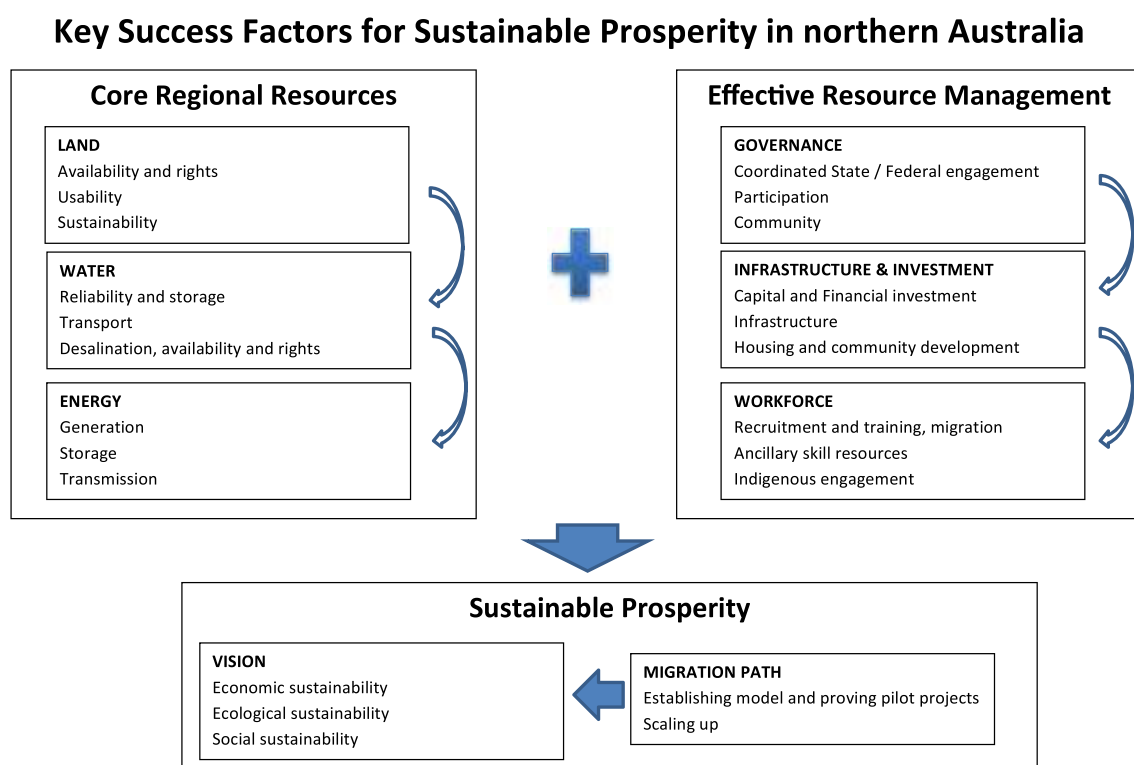


FIGURE 1 Development framework for sustainable prosperity in northern Australia

unsuitable or unsustainable (Dale, 2014). Successful and sustainable development therefore can only occur if strategies are leveraged within the context of the North's unique ecological, social, and economic environment (Northern Australia Land and Water Taskforce, 2009). We have therefore used a SWOT Analysis to capture the region's unique ecological, social, and economic characteristics (Picton & Wright, 1998). The full SWOT Analysis is available in Data S1 and highlights a number of key themes and strategic opportunities: (a) to address the need for climate resilience and adaptation; (b) to deploy key infrastructure capabilities (e.g., energy, water, and communications); (c) to leverage the development of human resources; and (d) to “value-add” to raw products such as iron and cattle. This analysis also highlights the requirements for a more highly coordinated and regionally based self-governance structure to achieve the required balance between economic, ecological, and social outcomes (Dale, 2014).

Though beyond the scope of this paper to address all areas identified in the SWOT Analysis, we have examined examples of strategies that are either already operating and could be expanded or could be developed based on the unique characteristics of the North and the regional and global context in which it operates.

4 | UNDERSTANDING THE REGIONAL AND GLOBAL CONTEXT

There are two key factors that drive the regional and global context within which northern Australia operates: (a) *geography*—the proximity to South East Asia presents significant opportunities for the North due to access opportunities to resource, food, tourism, education, and energy markets, and (b) *global trends*—the increasing trends towards the achievement of a greater balance between ecologically, socially, and economically sustainable outcomes in reviewing the international political, business, and social context. These trends are reflected in the emergence of societal progress measures such as the Genuine Progress Indicator and the development of the United Nations (UN) SDGs (2017). These trends also bring significant “waves of opportunity” as captured in Figure 2 (Chambers & Humble, 2012).

Taking advantage of these opportunities requires a significant policy shift from the historical business as usual approach as displayed in the *White Paper*, to a much broader investment vision, strategy, and policies (Hatfield-Dodds et al., 2015) based on the unique attributes of northern Australia.

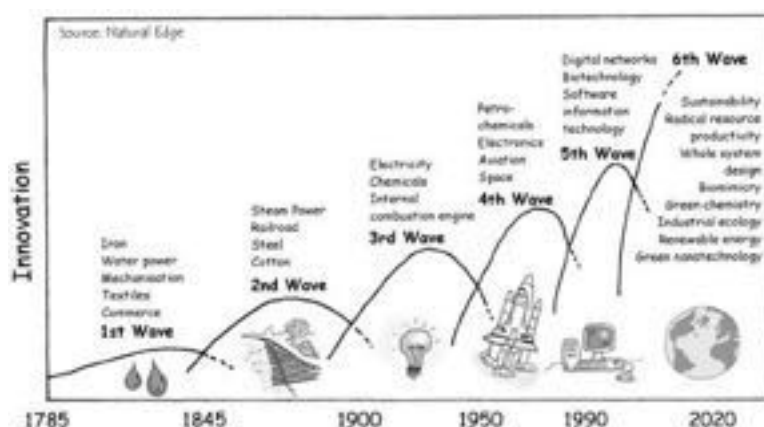


FIGURE 2 Leveraging emerging eco-economy opportunities. Copyright © 2005, The Natural Edge Project

5 | DEVELOPING A VISION FOR NORTHERN AUSTRALIA

Costanza highlights the critical importance of establishing a vision or overarching goal as a key component of any successful development strategy. Yet this is regularly overlooked even on agendas as broad as the UN SDGs (Costanza, 2014). This oversight is often due to the perceived complexity of determining this vision. However, Raskin et al. (2002) as well as Costanza (2014) have identified scenario planning (SP) as an approach that has been successfully applied to determine preferred futures in other regions and countries.

A notable example was the use of SP to develop a broader vision in South Africa to facilitate the transition from apartheid to the preferred future of “all in this together” (Kahane, 2004). Since then, SP has continued to be used successfully in a range of regional and national settings to identify preferred futures and support strategies to achieve these futures (Costanza et al., 2017). SP was therefore the approach adopted in this paper to determine a preferred vision for northern Australia.

In a national survey conducted in 2016 to determine the preferred future Australians aspired to, a demographically representative sample of over 2,000 participants was asked to indicate preferences across four potential future scenarios for Australia (Chambers et al., 2017). These scenarios were Strong Individualism, Free Enterprise, Coordinated Action, and Community Well-Being (Figure 3).

The results of the survey showed a clear preference by the majority of Australians (70%) for the Community Well-Being scenario when asked “What is your preferred future scenario?” The parameters of this scenario align closely with the objective of sustainable prosperity. However, when asked “Where is Australia now?” participants perceived Australian society currently

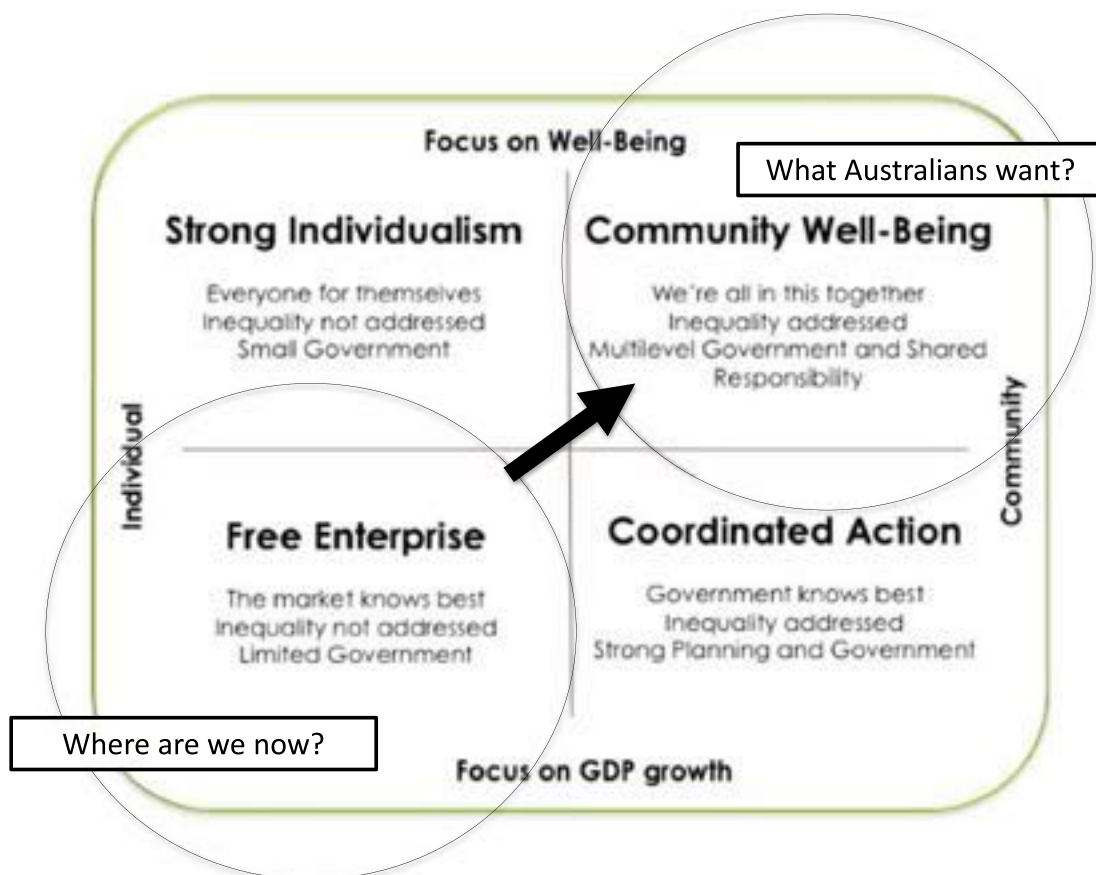


FIGURE 3 Australia: Our Future, Your Voice Survey (2016)

operating in the opposite quadrant that aligns more closely with the *White Paper* (CoA, 2015). This preferred vision for Australia's future therefore provides not only an alternative vision to the “business-as-usual” approach articulated in the current *White Paper* but also a vision that is endorsed by the majority of Australians.

To determine whether this approach could contribute to our identified goal of sustainable prosperity, we tested examples of strategies and their potential contribution to economically, ecologically, and socially sustainable outcomes in northern Australia.

6 | STRATEGIES FOR ACHIEVING SUSTAINABLE PROSPERITY IN NORTHERN AUSTRALIA

6.1 | Land sector

Land is a core asset underpinning successful sustainable development because it provides basic human survival requirements—food, shelter, water, and a supporting environment. Currently, the main land use in northern Australia is extensive, free-range beef cattle pastoralism. However, as industry assessments indicate, most regional pastoral enterprises are currently neither economically (profitability) or environmentally (ecologically) sustainable (McLean, Holmes, & Counsell, 2014) and therefore do not fit with the objective of sustainable prosperity. Sustainable prosperity in the land sector therefore requires alternative land use options that leverage economic, ecological, and social sustainable opportunities. Three strategies provide examples of alternative land use approaches that address regional and global trends within the unique economic, ecological, and social environment of northern Australia.

6.1.1 | Carbon farming

Carbon farming provides an example of a strategy that addresses the opportunity presented by the emerging carbon trading market. The opportunity not only leverages the unique landscape characteristics of the North but also provides economic “hedging” that can redress the historical “boom and bust” nature of the northern economic and ecological systems (Dale, 2014). This is best exemplified in the case study of savannah fire management (Russell-Smith, Yates, Edwards, Murphy, & Whitehead, 2015).

The annual monsoon rains bring to the north over 60% of the nation's annual rainfall (CoA, 2015). The result is rapid growth of both native and introduced grass species followed by long dry flammable periods. Fires lit throughout this flammable dry period have the potential, if left unmanaged, to significantly impact pastoral enterprises and natural ecosystems alike (Russell-Smith & Whitehead, 2015). However, Indigenous communities have been managing this boom and bust ecological cycle successfully for thousands of years by simply “cleaning up” flammable vegetation through the undertaking of prescribed fire management early in the dry season. This results in less likelihood of vegetation being ignited later in the season under more severe fire-weather conditions. A similar approach is taken in the southern regions of Australia by rural fire services to manage build-up of ground fuels.

An economic opportunity presents itself in the rapidly emerging carbon offsets market driven by global initiatives to address the threats of climate change, and profit by doing so. The differential between reduced greenhouse gas emissions under early season “cool fire” burning compared with later season “wildfires” is substantial and can be leveraged for economic as well as community well-being benefits.

The economic value of this “carbon farming” opportunity is substantial based on the current Australian Government-regulated value of a carbon offset price of ~\$12 per tonne CO₂-e (Australian Government Clean Energy Regulator, 2016). “Voluntary” markets typically offer substantially higher prices. Existing carbon farming projects, of which there are currently over 80 registered and operating in the North (Emissions Reduction Fund, 2017), are already generating between \$10 and \$20 million annually based only on greenhouse gas emission offsets. These annual revenues could be significantly expanded by (a) extension to additional regions (currently estimated at a total land area 4 times that already developed) and (b) incorporating carbon sequestration that would increase offset by a further 5 to 10 times (Russell-Smith, 2016). Based on the carbon trading market, combining these approaches could potentially realise in excess of AUD 2 billion over the next 10 years.

Implementing this approach also provides further ecological, social, and economic benefits to northern Australia. These include feral animal and weed control; cultural site and habitat maintenance; mine site rehabilitation; and regional employment opportunities. It also builds on the substantial community investment already being made to support regional Indigenous ranger groups and management of Indigenous Protected Areas (Altman & Kerins, 2012). (Further discussion of this opportunity is available in Data S2.)

6.1.2 | Diversifying pastoral enterprises

Economic activity on pastoral land in the north is largely marginal, often with return on investment as low as 1% (McLean et al., 2014). These low returns are impacted by four key drivers: (a) limited potential of the majority of pastoral enterprises due to generally poor soils and pastures; (b) seasonal water availability; (c) limited infrastructure; and (d) distant and volatile markets (McLean et al., 2014; Russell-Smith et al., 2015). Based on these factors, it is estimated that only 20% of the northern savannahs are suitable for agricultural development (Northern Australia Land and Water Taskforce, 2009). Based on the objective of sustainable prosperity, the immediate opportunities therefore are to develop and implement strategies that (a) direct funding and resources to pastoral land with high productive potential and, in other regions, address the significant rehabilitation issues associated particularly with riparian zones and ecologically significant water bodies; (b) diversify and expand the range of opportunities on high potential land by increasing opportunity to develop “value add” products, ecosystem services, and nature-based tourism; (c) address issues of consistent water supplies (see Section 6.2); and (d) ensure secure and low-cost energy (see Section 6.3).

6.1.3 | Rehabilitation of mining land

The North is characterised by significant spent or noneconomic mining leases. Throughout Australia, it is estimated that there are up to 50,000 spent mining sites. Rehabilitation costs have been estimated at over AUD 17.8 billion (Barker, 2015). Lapsed mining sites also hold significant health threats and ecological challenges. Addressing these challenges however holds significant economic opportunities.

Mining companies hold fund reserves for site rehabilitation, whereas state and territory governments hold mining securities for mine rehabilitation. However, these funds are rarely fully deployed for site rehabilitation (Dale, 2014). Key barriers to this fund deployment are a combination of regulatory policy, human resources, expertise, and governance. Current legislation to ensure effective rehabilitation activities is weak. This is as a result of either insufficient funds

being allocated to address the rehabilitation of leases or corporate structures being utilised to enable companies to avoid the liabilities of rehabilitation when the time comes to rehabilitate (Dale, 2014). The Redbank and McArthur River mines in the south-west Gulf of Carpentaria region of the Northern Territory provide examples of the extent of the challenges. These examples however also demonstrate the financial, workforce, social, and ecological opportunities presented by a robust and coordinated rehabilitation strategy and policy (Kerins & Green, 2016). Realisation and implementation of as little as 15% of the estimated mining rehabilitation costs over the next 10 years and translation of these into business opportunities would establish a mining rehabilitation industry of over AUD 2 billion. It would also create significant employment opportunities as well as the ecological and social benefits to regional communities (Kerins & Green, 2016; Rouche & Judd, 2017).

The immediate opportunity is therefore to conduct a national inquiry and audit into all mining sites to establish Australian standards of mine closure, determine the gap between existing mine rehabilitation status and existing bonds, and forecast costs of rehabilitation. From this, site by site rehabilitation and performance management and reporting plans can be developed and be included in company balance sheets. From these management and reporting plans state and federally coordinated jurisdictional planning, management and implementation structures can be put in place (Rouche & Judd, 2017). This would provide the framework and structure under which these business opportunities could be developed.

6.2 | Water

The unique nature of the North's "boom and bust" water supplies results in the region having the highest rainfall in the country yet significant challenges in storing and harnessing these supplies over the extended dry season. These challenges remain one of the significant factors limiting the development in the North. However, reframing these challenges with the objective of sustainable prosperity highlights the opportunity to combine Indigenous knowledge, smart ecosystem water management techniques, and emerging technologies to address these issues. This in turn can facilitate expanded development opportunities for agriculture and related value add industries.

6.2.1 | Smart water storage

Historically, approaches to water storage such as large-scale dams that have largely been imported from outside the region and only met with only limited success (Cendón et al., 2010). The alternative is to leverage Indigenous knowledge and develop strategies that mimic and replicate natural systems and management approaches that already exist, only on a larger scale.

The *White Paper* approach to water storage and management focuses on establishing a feasibility study on the potential for three major dam systems in the North (CoA, 2015). The limitations of this approach are (a) the lack of suitable storage landforms in areas of high water demand; (b) the high levels of water loss through evaporation due to generally shallow storages (at times over 100%); and (c) the high cost of dam building. These factors make these facilities uneconomic as well as wasteful and ecologically damaging (Cendón et al., 2010; Larson, Gibbs, & Quiggin, 2014).

Water storage through the use of underground aquifers ("water banking" or aquifer recharge) provides an alternative strategy that overcomes these challenges (Schwartz, 2015).

Rather than investing in high cost and low efficiency dam facilities, largely unsuited to the region, the opportunity is to expand the use of underground water storage. It is cheaper to build and operate, more ubiquitous, avoids evaporative losses, and has the added benefit of cleansing contaminated water. Initial mapping studies of the northern landscape highlight that a “mosaic approach” combining recharge and reextraction of water from a large network of aquifers is both feasible and promising.

Further, leveraging this opportunity facilitates the extension of pastoral leases to include growing of stockfeed and horticultural crops through the use of recharged aquifer water storage to irrigate crops. This would enable the development of high-value products and services significantly increasing export returns, employment, and social benefits, while having minimal impact on the environment. Aquifer recharge also has the advantage of very low capital costs compared with dam construction and thus represents a significant saving of public expenditure (Larson et al., 2014).

6.2.2 | Marine ecosystems

Achieving sustainable prosperity in the North requires not only a review of strategies to address “life on land” but also “life under water” (SDGs, 2017). Though it is beyond the scope of this paper to examine the entire northern coastline, a case study of the Great Barrier Reef highlights the limitations in our current business as usual approach. However, it also highlights key strategies that can be potentially applied not only to the Great Barrier Reef region but also to other coastal regions in the North such as Ningaloo in north-west WA and other coral reef zones.

The Great Barrier Reef currently contributes AUD 6 billion to the Australian economy, over 60,000 jobs, and is a world heritage listed ecosystem (Great Barrier Reef Water Task Force—Final Report, 2016). However, these existing contributions to the ecological, social, and economic prosperity of the North are currently under threat. The key threats identified by the Great Barrier Reef Marine Park Authority in order of priority are (a) climate change; (b) continued declining water quality from catchment run-off; and (c) loss of coastal habitats from impacts of fishing of threatened species (Great Barrier Reef Marine Park Authority, 2014).

The first, climate change, is a global issue in which the region and Australia can only play a part. However, the other two major threats are within regional and national control. Within this context, Bohensky et al. (2011) identified a range of strategies that could be deployed based on assessment of four long-term potential scenarios for the Great Barrier Reef (to 2100). These are summarised in Figure 4.

Strategies identified covered both a global approach to climate change and regional management of the issues of declining water quality and coastal habitats. The importance of the interconnectedness of these strategies is captured in Figure 5 (Great Barrier Reef Water Task Force—Final Report, 2016).

The challenge is that although we know the issues, as well as many of the solutions, at a regional level, success in implementing these strategies has been extremely limited (Great Barrier Reef Water Task Force—Final Report, 2016). For example, management approaches addressing dissolved organic nitrogen have only resulted in a decrease of 17% relative to the 2009 baseline, compared with a 2018 target of 50% (Great Barrier Reef Water Task Force—Final Report, 2016).

Significantly, the key barriers to success in this and other key initiatives were identified as primarily management issues: (a) complexity (governance, reef science, bureaucracy, and program delivery); (b) poor communication and engagement (science communication, inconsistent narrative, and misunderstanding); (c) fragmentation (policy, delivery, governance, funding, extension, monitoring, and communication; Great Barrier Reef Water Task Force—Final



FIGURE 4 Four possible scenarios and alternative strategies for the Great Barrier Reef

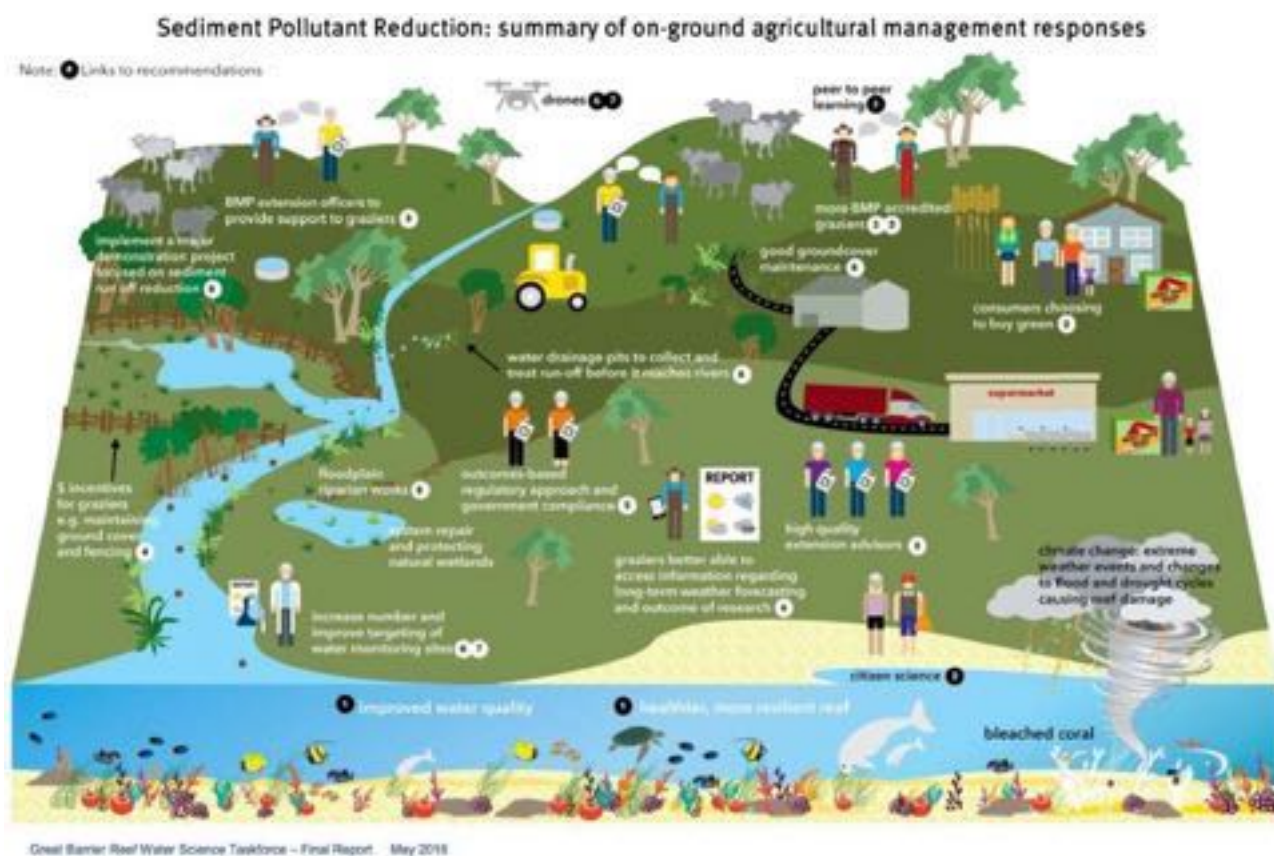


FIGURE 5 Great Barrier Reef Water Task Force—Final Report (2016)

Report, 2016) not ecological or technical. This highlights the opportunities provided by improved management and governance to achieve a preferred scenario of Best of Both Worlds. Improved governance strategies and the key policy initiatives required are summarised in Table 2. (Further discussion is available in Data S3.)

6.3 | Energy

The large distances, diverse population spread, and limited supplies of energy resources have resulted in the supply of low-cost energy being another significant factor limiting the development of the North. However, the emergence of new renewable, storage, and transmission technologies, combined with global trends toward sustainable development, has opened up fresh opportunities.

Historically, energy supplies have been available in southern and eastern Australia due to large coal deposits that have powered the growth of industry and cities throughout most of Australia's recent industrial history. In the North however, the historical gap in ready energy supplies has limited the ability to similarly vertically integrate, resulting in products of its extractive industries having to be transported and processed elsewhere. For example, bauxite from Weipa is shipped to New Zealand to be turned into aluminium using hydropower. The region is also completely dependent on imported oil for most of its industries, transport, and communities. This not only limits development opportunities but also exposes the entire region to supply, cost, and security risks. The provision of low-cost energy to the North could therefore significantly expand economic, workforce, and community development opportunities (Australian Renewable Energy Agency, 2016).

The worldwide trend to reduce fossil fuel consumption in favour of renewable energy is changing everything (Garvey, 2017). With the markets for Australian fossil fuel energy products potentially contracting, the converse is also true, with the demand for Australia's broad range of renewable energy resources having the potential to expand rapidly as these resources are also exportable. From a national perspective, this is strategically important. Development of these capabilities has the potential to offset any decline in international fossil fuel demand and prices. It can therefore play an important role in diversifying the national economy against any downturn in fossil fuel exports.

Northern Australia can play a key role in this potential transition and diversification due to its natural endowment of renewable energy resources, including one of the highest intensity solar regions in the world, and its close proximity to the Asian market. Solar alone, using existing solar panel technology leveraged with high-voltage direct current (HVDC) long-distance transmission technology, is sufficient to not only supply national energy requirements but also generate substantial exports into the Asia-Pacific region (Blakers, Luther, & Nadolny, 2012; Figure 6).

Australia is also ranked in the top three nations for wind resources (Drew, 2015). Combined with Australia's other renewable energy sources (tide, wave, and geothermal) and the increasing range of storage capabilities (hydro, battery, and thermal), the development of cost effective and efficient long-distance transmission has the potential to be substantial game changer. This is not only for the North but also for Australia and the rapidly expanding Asian energy market.

6.3.1 | Developing a “national energy superhighway”

Australia already has the longest geographically connected power system in the world. However, the 2017 Finkel Report on security of the Australian electricity market identified that

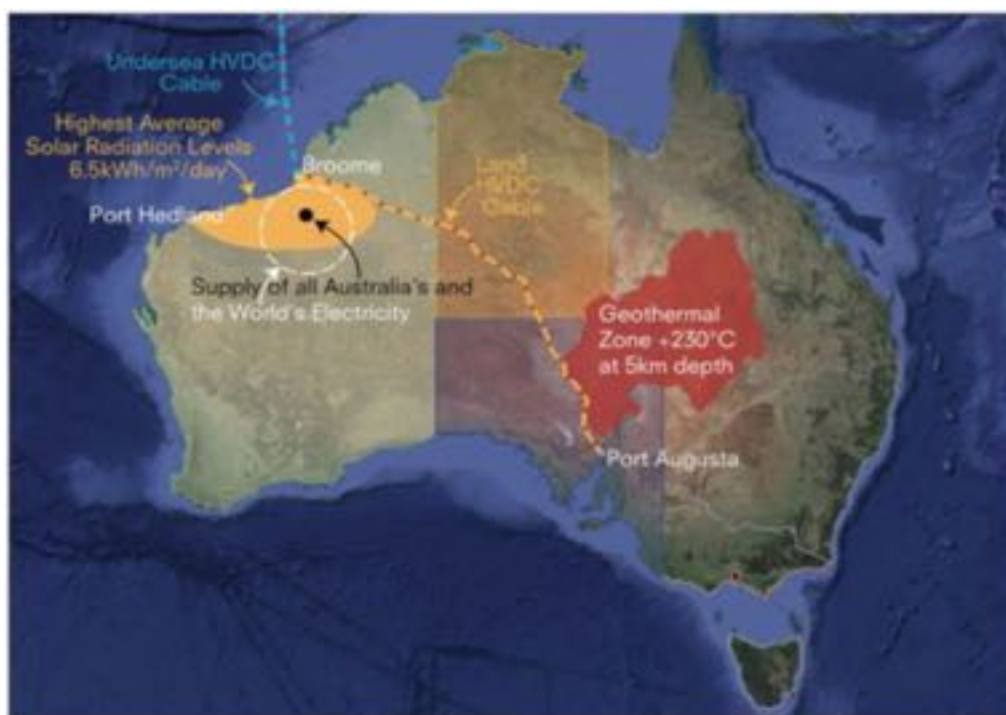


FIGURE 6 Australia's solar energy opportunities in the north alone could power the global market. HVDC: high-voltage direct current

the lack of full connectivity as significantly limiting Australia's ability to capitalise on its huge geographical and physical diversity in energy sources (Finkel, Moses, Munro, & Effency, 2016). A strategy that combines the existing range of energy sources with the unique weather patterns and landscapes therefore provides the cornerstone for consistent, secure, and sustainable energy supplies across Australia. It can also provide a potential competitive advantage internationally (Drew, 2015). The Finkel Report also highlighted that the successful development of energy opportunities lies not in governments trying to “pick winners” or favouring one type of energy sector over another but in developing the infrastructure that allows all types of energy to be integrated and to compete on a level playing field (Finkel et al., 2016).

The advent of HVDC long-distance cable transmission now allows the establishment of this full connectivity both cost-effectively and efficiently (World Nuclear Association [WNA], 2017). HVDC loses as little as 3.5% per 1,000 km, compared with 30–40% losses using the standard AC overhead cables that make up the Australian grid (WNA, 2017). HVDC cabling can be strung overhead or buried in a trench, alongside optic fibre and other services. It is also submersible and is currently used to link the Victorian and Tasmanian energy grids. Under development for more than 80 years, there are now almost 200 HVDC lines in use worldwide spanning distances up to 3,000 km or more. Many developing and newly industrialised countries, such as Brazil, China, India, Mongolia, and Russia, are well ahead of Australia in their adoption of this technology, placing Australia currently at a global competitive disadvantage in power supply (WNA, 2017).

By starting in the population-dense south-east, the “national energy superhighway” could collect energy traffic from coal, gas, wind, solar, hydro, and any other local energy sources (including private solar roof panels), with spur lines from the south (wind from the Bight) and north (Queensland coal and gas). Crossing central Australia would allow the leveraging

of the extensive solar thermal and photovoltaic sources in the cloudless centre and the emerging hot rock geothermal opportunities. These have the benefit of supplying the 24-hr “base load” that could be further complimented by hydro storage in the North (Blakers et al., 2012) and thermal storage in South Australia (Latimer, 2018). The “highway” would then extend across from the Pilbara region, to link up with Northwest Shelf gas, tidal, solar, wind, wave, and ocean current resources as they develop, before crossing to Timor and then into Asia (Figure 6). Horizontal integration of geographically diverse energy sources through this “energy superhighway” also brings the benefits of economies of scale to energy sources. Connecting sources that may currently not be economically viable as standalone operations, such as potential geothermal opportunities in central Australia, can potentially become viable when connected and integrated into the national system.

6.3.2 | Connecting to the ASEAN “super-grid”

An energy superhighway strategy utilising the North as a hub provides the opportunity to not only connect the south-east of Australia to the north-west but also access South East Asian energy markets through HVDC. Blakers et al. have highlighted the opportunity to establish HVDC connectivity to the Association of Southeast Asian Nations (ASEAN) super-grid. This would link Australia to Indonesia then through to Malaysia, Thailand, and Vietnam and could ultimately deliver power directly into industrial southern China (Figure 7). Costs of transmission from Australia to the super-grid are offset by the higher output of energy sources such as Australia's high intensity solar regions in the Pilbara region (Blakers et al., 2012).



FIGURE 7 Australian connection to the existing and planned Association of Southeast Asian Nations “super-grid.” HVDC: high-voltage direct current

The ASEAN super-grid replicates the approach already being developed in Europe (WNA, 2017). Linking into this ASEAN super-grid would then provide Australia with a similar competitive advantage to energy rich European and ASEAN countries based on the significant renewable energy export opportunities this would provide (Drew, 2015). These benefits are substantial. Commitments already made on climate action by the rapidly growing ASEAN market counties are targeting 20% renewable energy supply by 2050. Supplying 50% of this would be worth AUD 35 billion to the Australian economy. This is equivalent to over 60% of the current GDP contribution of fossil fuels such as coal (Thirlwell, 2017). Over the next decade, this would equate to AUD 13.1 billion in the ASEAN market and AUD 4.4 billion for the Indonesian market alone.

Connecting to the ASIAN super-grid to an Australian energy superhighway via a hub in northern Australia therefore would enable Australia to (a) leverage the diverse range of national energy sources available; (b) transition to the new renewable energy economy; and (c) diversify the economy against the risk of reduced demand for existing fossil fuels such as coal (Drew, 2015).

6.3.3 | Opportunities for vertical integration

A national energy superhighway strategy also provides the North with the power needed to vertically integrate and kick-start major industrial value add developments in food (beef, fish, fresh fruit and vegetables, and processed food) and minerals (iron, steel, aluminium, copper, manganese, graphite, etc.) processing. This vertical integration can thus provide the foundation for the development and growth of northern cities and even remote communities (for whom new industries such as “cloud” server farms would then become economic). The advantage of the energy superhighway strategy also lies in creating a level playing field on which all energy resources can compete equally to be the most efficient supplier, thus providing Australia, as well as the Asia, power at the most competitive prices.

6.3.4 | The cost of connection

The cost of building an HVDC line can be estimated as approximately AUD 2 million per kilometre plus AUD 200 million for each converter station from recent European contracts. This is consistent with the estimate by Pilbara Solar to build the 2,400-km HVDC network connection to Indonesia at a cost of AUD 7.2 billion at current prices. An EPA proposal has already submitted (Vorrath, 2017). The cost of connecting the eastern grid from the Pilbara region to an eastern hub in Port Augusta is estimated at AUD 6 billion based on costs of similar existing and planned land-based HVDC cable in Europe (WNA, 2017). This is less than 20% of estimated cost of either the National Broadband Network (AUD 45 billion) or the Stealth Submarine Contract (AUD 50 billion). It is comparable with the AUD 5.6 billion annual subsidies currently being provided to the fossil fuel industry (Gordeljevic, 2017). Therefore, a refocus of less than 25% of the Australian annual fossil fuel subsidies over the next 10 years would fund both a national energy superhighway and connection of the full range of Australia's energy capabilities to the lucrative and expanding Asian energy markets.

An energy superhighway investment strategy therefore provides (a) key horizontal and vertical integration opportunities for the North; (b) energy security for Australia; and (c) significantly expanding and diversifying Australia's energy export opportunities.

6.3.5 | Benefits to Indigenous and remote communities

The benefits of the renewable energy trends and technologies can also provide social and economic further benefits to Indigenous and remote communities. Solar technology combined with battery storage is now a viable substitute for current diesel-powered energy supplies for remote Indigenous communities. This both reduces ongoing costs to these communities, thus increasing their viability, as well as reducing their carbon footprint (Indigenous Business Association, 2017). An example is the Daly River project, which will provide renewable energy to over 20 remote communities. The project will save over AUD 100 million in diesel fuel costs over the lifetime of the project. At a cost of AUD 55 million, this represents a 90% return on investment over the project's lifespan (Frydenburg & Scullion, 2017). This strategy also has the benefit of reducing capital outflow and dependency on outside energy supplies.

Equally significant are the economic opportunities opened up by a national energy super-highway and ASEAN super-grid for the current Indigenous Advancement Strategy. In the Pilbara region, an important potential renewable hub site, Pilbara Solar, one of the companies seeking to develop both solar and wind production capabilities, as well as the HVDC cable connection to the ASEAN super-grid is 25% owned by the Yamatji Maripa Aboriginal Corporation (Vorrath, 2017).

6.3.6 | Australia as an alternative transport fuel supplier

North Australia is also totally dependent on imported fuels for transport, making it extremely vulnerable to oil prices, fluctuations in supply, and energy security. The global trends towards reducing the use of fossil fuels will potentially increase the vulnerability of the North to these changes. In addition to the vertical integration opportunities, the building of an Australian energy superhighway offers the benefit of leveraging the resources of the North to horizontally integrate through the production of alternative clean transport fuels.

Production of alternative land transport and aviation fuels from algal biofuel is a rapidly emerging technology for which the North is ideally suited (Pilburra Development Commission, 2018). At current yields, it is estimated that Australia's entire transport fuel supply could come from 600,000 ha of pondage. This is the equivalent of a single northern cattle station. Consortia such as the Asian Renewable Energy Hub are also looking at production of other transport fuels such as hydrogen using renewable energy (Milne, 2018).

Further economic, ecological, and social benefits can also be realised through the by-products of biofuels. Development of the biofuel industry allows the spin-off of subsidiary industries for which this region is also ideally suited. By-products are suitable for (a) fish, allowing for the further development of the aquaculture industry; (b) meat for livestock production; and (c) novel health foods made from the protein, carbohydrate, and micronutrient content of algae after the oil has been extracted. It has been estimated that the current aquaculture industries, including "high-value" barramundi, prawn, and mud crab, are annually worth AUD 1 billion alone. This will continue to grow significantly due to the increased efficiencies of aquaculture over other food production, increased global and national demand for sea foods, and limitations on supply of catch supply (Kierath, 2017). The long-term global supply of current aquafeeds has been identified as both uneconomic and unsustainable (Tacon & Merian, 2008). Therefore, the provision of the low-cost feeds that algae culture can supply has been identified as a viable important alternative (Towers, 2013) that northern Australia would be in an ideal position to supply. The further benefit is the opportunity to supply stock feed to the regional pastoral

industry, accelerating the move from low-value export cattle, to high-value meat, food products, and services.

Adopting an alternative fuel supplier strategy would therefore provide (a) national self-sufficiency and security in transport fuels; (b) a secure, renewable supply of fuel for defence, emergency services, and health care; (c) a net gain of AUD 44 billion to the Australian economy by replacing foreign oil purchase mainly from the Middle East (Department of the Environment and Energy, 2016); (d) significant spin-off industries in food, stockfeed, textile fibres, plastics, and fish aquaculture; and (e) an estimated 50,000 regional jobs (Murphy, 2013).

6.4 | Governance

To date, unsuccessful and largely uncoordinated development of the North can be attributed to inconsistent decision-making. This has been due to the vertically based governance system combined with a lack of understanding of the region's unique ecosystems (Dale, 2013). The challenge therefore for the successful implementation of any vision and strategy for northern Australia is the effective management of this “vertically divided” governance mix across the region (Dale, 2013). This is particularly relevant for achieving sustainable prosperity. This objective is dependent on cross regional coordination to leverage global opportunities such as the renewable energy market, coupled with the requirement to make tough choices on policies that both mobilise technology and reduce pressure on the environment (Hatfield-Dodds et al., 2015). These challenges are also exemplified in the coordinated approach required to addressing the crises facing the Great Barrier Reef.

Current governance however is based on historical circumstances spanning multiple state, territory, regional, and federal jurisdictions. From an ecosystem perspective, this involves the artificial conception of “State divisions” covering the jurisdictions of Western Australia, Northern Territory, and Queensland. These divisions are further exacerbated by the role of the Federal Government, which effectively creates a fourth player. The requirement therefore is for an integrated and coordinated model of governance in the North that addresses the diverse political landscape and addresses the historical limitations (Dale, 2013). This is therefore a key success factor for the successful deployment of economical, ecological, and social strategies to achieve sustainable prosperity.

6.4.1 | Achieving governance consistency across the North

The first step, as outlined by Dale, is the establishment of consistency in state and federal regulation across economically, ecologically, and socially sustainable principles and practice. The platform for this is already in place in the North's joint Federal/State leadership forums; however, current management approaches are often framed by three competing agendas: (a) desire for major new greenfield economic development; (b) efforts to preserve internationally and nationally significant conservation landscapes; and (c) Indigenous land and resource use rights and aspirations (Dale, 2013).

These three agendas can however complement each other at local, regional, and national levels through a cohesive governance approach based on systematic reform to achieve “genuine bipartisan, cross-jurisdictional cooperation on policy development and investment priorities” (Dale, 2013). The development of this governance approach would provide the framework to achieve “an exciting new economic, social and cultural dynamic in the north” (Dale, 2013), as exemplified by the strategies outlined in this paper.

This “top down” approach can be further complemented through the strengthening of Indigenous-led and regional and local governance systems (Kerins, 2013). For example, Indigenous communities can establish corporate bodies, which are capable of joint decision-making reflective of community clan and kinship structures. These structures then provide the opportunity to leverage finances and investment, and the development of economic, ecological, and social sustainability opportunities, as seen in the Pilbara Solar project (Vorrath, 2017), but equally in education and Indigenous cultural development (Kerins & Green, 2016).

6.5 | Infrastructure and investment

The range of investment and infrastructure initiatives to support the development of the North in the *White Paper* are comprehensive and include roads, aviation, and water storage and management totalling over AUD \$1 billion over the next 10 years. Expanding the scope to include economically, ecologically, and socially sustainable development allows this type of expenditure to be both more focused and more strongly linked to economic, as well as ecological and social benefits. It also allows the investment to be leveraged across a broader range of economic opportunities, significantly increasing the return on these investments.

Examples of the economic growth opportunities relative to infrastructure costs across the three key core resource areas of land, water, and energy from a sustainable prosperity approach for the North are provided in Table 1.

Expanding the vision and strategies to achieve sustainable prosperity in the North addresses the limitations in the current *White Paper* approach by (a) focusing on energy as a core requirement for sustainable prosperity; (b) leveraging existing industries through value-added capabilities and leveraging emerging market and technology opportunities; and (c) expanding economic opportunities through vertical and horizontal integration.

It is also recognised that there are financial constraints in expanding the vision and strategies for the North to achieve sustainable prosperity. However, as highlighted in this paper, many of these can be largely addressed through (a) removal of infrastructure costs from nonproductive assets (pastoral industry); (b) reallocation of resources freed by this improved focus to additional opportunities created by a sustainable prosperity vision and strategies (energy transport infrastructure); and (c) leveraging the private funding opportunities created by this expanded vision (carbon farming). (Further discussion of these opportunities is available in Data S4.)

6.6 | Workforce

A key focus of this paper has been to outline the economic opportunities that are available through the rapidly developing sustainability economy. These include renewable energy, ecosystem services, carbon farming, value-added pastoral agriculture, and aquiculture. Each of these areas provides significant employment and workforce growth opportunities as noted in the strategy examples outlined in this paper.

6.6.1 | Carbon farming and ecosystem services

In examining the requirements of the sustainable development approach to the North, people power and expertise in many of these areas are already in place. Carbon farming and ecosystem services management is already in place through Indigenous land management expertise and cultural knowledge and has been so for thousands of years. The spread of Indigenous

TABLE 1 Growth/cost reduction opportunities by reframing development from “business as usual” growth model to “sustainable prosperity” model in northern Australia

Core resource	White Paper infrastructure cost	Sustainable prosperity infrastructure cost	Employment growth opportunities	Revenue growth opportunities	Comments
1.0 Land					
1.1 Carbon farming/ecosystem services		AUD 120 million	500 jobs	AUD 2 billion	Potential revenues over the next 10 years
1.2 Pastoral industry (roads)	AUD 100 million	AUD 20 million			AUD 80 million cost savings
1.3 Mining rehabilitation			500 jobs	AUD 3.5 billion	Based on realisation of 20% of rehabilitation costs over the next 10 years
1.4 Aquaculture industry			Further research required	Further research required	
2.0 Water					
2.1 Mosaic underground water management	N/A	Further research required	Further research required	Further research required	
2.2 Great Barrier Reef (integrated management approach)			6,000 (based on potential to lose 10% of current jobs)	AUD 0.6 billion (based on potential to lose 10% of current AUD 6 billion)	Based on loss of 10% of current contribution to economy and employment market
3.0 Energy					
3.1 Renewable energy (export)		Infrastructure costs currently covered by private investment	3,000 FT during construction, 400 operations	AUD 4.4 billion (Indonesia) AUD 13.1 billion (ASEAN)	Revenues based on 10% of 2025 Indonesian and ASEAN energy markets Employment based on the Pilbara Energy Hub estimates only will increase with Pilbara Solar

(Continues)

TABLE 1 (Continued)

Core resource	White Paper infrastructure cost	Sustainable prosperity infrastructure cost	Employment growth opportunities	Revenue growth opportunities	Comments
3.2 Renewable energy (domestic)		AUD 6 billion	As above	As above	Costs of establishing national energy superhighway (Pilbara— Port Augusta). Could be privately funded.
3.3 Renewable energy (oil substitution products)			5,000 jobs	AUD 4.5 billion	Based on realisation of substitution 10% of Australia's oil imports and job growth estimates
Total			15,000 jobs	AUD 15 billion	Totals have been based several conservative assumptions: 1. Realisation of 10% of market opportunities over the next 10 years 2. Renewable energy export market to Indonesia only 3. 10% losses included based on potential decline of the GBR

Note. GBR: Great Barrier Reef.

communities across large parts of the North results in these people power capabilities already being readily available in situ.

6.6.2 | Knowledge services

The *White Paper* outlines the strong position in which Australia already operates in knowledge and education services as an innovator and leader (CoA, 2015). An expanded vision and associated strategies for the North's development incorporating not only sustainable economic but also ecological development, and social well-being, further enhance the scope and application of these capabilities. This includes areas already mentioned in the *White Paper* such as international education, tropical health care and medical research, aged care, natural sciences, and carbon management. A broader vision and scope however expand the range of opportunities in knowledge services to areas such as renewable energy and energy transfer expertise, carbon trading and management, aquaculture, and remote services provision and management.

Commercialisation of this knowledge, an area where Australia has been historically weak (Drew, 2015), provides further opportunities, as do partnerships with other countries to develop these opportunities.

6.6.3 | Renewable energy services

The vast opportunities in the renewable energy sector not only offer the opportunity to develop secure and sustainable energy resources for Australia and the region but also provide the opportunity to develop skills and expertise in these areas that are transferable nationally and internationally.

6.6.4 | Value add pastoral services

Value-added pastoralism provides further employment opportunities by increasing the efficiencies in the pastoral industry as well as reducing its environmental footprint. This enables a more efficiently focused yet expanded workforce through diversification across a range of value-adding industries such as meat processing, storage, and transport.

6.6.5 | Aquaculture

Strategic opportunities have also been noted in this paper for the development of the aquaculture industry in the Pilbara and Gulf regions with the concurrent development of an Australian energy superhighway.

6.6.6 | Mining rehabilitation

Mining rehabilitation provides another important strategic opportunity for Australia to lead the world in this developing market (Rouche & Judd, 2017) and, at the same time, increasing employment and community well-being in the North. The immediate employment opportunity is to refocus the 12,000 lost mining jobs since 2012 to mining site rehabilitation (Rouche & Judd, 2017).

TABLE 2 Key strategy policy implications to achieve sustainable prosperity in northern Australia

Objective	Strategy	Policy implications
Land	Carbon farming and ecosystem services	Native title and Indigenous land - Expand Indigenous ranger programs to address and expand the carbon farming and ecosystem services management opportunities. - Expansion of native title to afford property rights over land and fisheries to leverage sustainable economic and community well-being opportunities. - Ensure consistency of tenure arrangements for carbon/biodiversity in the landscape.
	Pastoral land	- Identify and focus resources on “high potential” pastoral leaseholds. - Allow feed grain development on high potential pastoral leaseholds. - Develop and implement “mosaic water storage and irrigation systems” on high potential pastoral leaseholds. - Harmonise key tenure related practices across jurisdictions and establish “whole of government” point of contact for tenure resolution. - Adopt consistent principles to improve flexibility and diversify land use especially on pastoral and Indigenous lands.
	Mining site rehabilitation	- Conduct a national inquiry and audit all mining sites to establish Australian standards of mine closure, determine the gap between existing mine rehabilitation status and existing bonds, and forecast costs of rehabilitation. - Establish site by site rehabilitation and performance reporting plans to be included in company balance sheets. - Establish state and federally coordinated jurisdictional management coordination.
Water	Smart water storage	Land-based water ecosystems: Expand the northern Water Feasibility Study to include the option of mosaic aquifer water storage options as an alternative strategy to the <i>White Paper on developing the North</i> large-scale dam construction and transport option. A cost/benefit analysis of these two options can then be established, and a preferred option determined.
	Sustainable marine ecosystems	- Ocean-based water ecosystems: Management of the threats and opportunities for the Great Barrier Reef through a national multiscale, cross agency, and cross community approach that integrates national, state and regional government, business, and community management responses for the GBR region that account for the interaction of land and water economic and ecological systems. - Proactive national and international support for global initiatives on addressing climate change. - Examine application of the above approaches to other coastal ecosystems in the North.

(Continues)

TABLE 2 (Continued)

Objective	Strategy	Policy implications
Energy	National energy superhighway	Establishing a feasibility study of the Australian energy superhighway.
	Renewable energy export	Establish feasibility study to support a national energy superhighway and ASEAN super-grid connectivity, including technology, capital and government, business partnership options, economic and community well-being costs, and benefits.
	Alternative transport fuel supplier	Establish a feasibility study to support a development program for by-product industries in the Pilbara and Gulf Regions, that is, aquaculture and pastoral industries.
Governance	Governance consistency	- Implement systematic governance reform to achieve cohesive governance to achieve genuine bipartisan, cross-jurisdictional cooperation on policy development, and investment priorities. - Strengthening of Indigenous-led and local governance systems to enable Indigenous and local communities to achieve economic and community autonomy.
Infrastructure and investment	Rationalise White Paper 2015	Review and update the <i>White Paper for the Development of the North</i> infrastructure and investment recommendations to leverage cost and revenue benefits presented to support sustainable prosperity strategies.
Workforce	Ecosystem services	Expand the Ranger Network in the North to leverage the opportunities for carbon farming and other ecosystem services
	Knowledge services	Expand scope of knowledge services to include partnership knowledge transfer opportunities and commercialisation
	Renewable energy services	Develop renewable energy generation and transport industries through the north and into the South East Asian markets
	Value add pastoral development	Develop “value-added” pastoral industries through focus on development of high potential pastoral leaseholds, freeing up limitations on growing stock feeds, and through development of mosaic water storage and irrigation systems
	Aquaculture	Support development of the aquaculture and fisheries industries in the Gulf and other appropriate regions through the provision of low-cost energy and communications facilities
	Mine rehabilitation	Leverage employment opportunities presented by the development of the mining rehabilitation industry.
	Workforce planning	Establish coordinated state/federal workforce planning and implementation to support sustainable prosperity outcomes.

Note. GBR: Great Barrier Reef; ASEAN: Association of Southeast Asian Nations.

6.6.7 | Workforce planning

Key to managing expansion of these existing and new industries is effective workforce planning. This is made more critical due to the potential geographical spread of the economic opportunities as well as the technological and skills base required to support these opportunities. However, as seen in the cases of both the mining rehabilitation industry and carbon farming, many of the human resources are already in place and skilled in the areas. Harnessing these capabilities however becomes a critical component in the development strategies for the North, with skills, sourcing, and recruitment approaches identified with associated timelines. (Further discussion of this opportunity is available in Data S5.)

7 | POLICY IMPLICATIONS

Achieving successful sustainable prosperity in Australia is not predestined, but it is achievable (Hatfield-Dodds et al., 2015). As demonstrated in this paper, nowhere is this more applicable as in northern Australia. Success therefore needs to be based on well-developed and implemented policy that supports the realisation of the strategies and opportunities as identified in the case study examples in this paper. To facilitate this, a summary of each of these strategies and their relevant policy implications are identified in Table 2.

8 | CONCLUSION

It has often been an assumption that a model that pursues sustainability and community well-being objectives will compromise the economic objectives and opportunities of a region or country. However, as seen in this paper, the rapidly developing global sustainability economy, and trends driven by challenges posed by climate change and the UN SDGs, has resulted in this assumption no longer being appropriate in the North, or anywhere in the world. Further, proximity to rapidly growing South East Asian markets and abundance in sustainable energy sources, land, resources, and expertise indicate that North Australia is ideally positioned to leverage these opportunities.

The *White Paper* vision and strategies are limited in that they are based on an empty world model of development (Costanza, 2014), a model based on the assumption of unlimited availability of resources that has failed the North in past decades (Dale, 2014). The philosophy of “build it and they will come” no longer applies in a highly competitive and rapidly changing world. North Australia, however, has the opportunity to change this way of thinking and achieve sustainable prosperity. This paper demonstrates that this can be achieved by moving beyond the historical business as usual approach and pursuing a vision, strategies, and policies that leverage both emerging global trends and the North’s unique location, cultures, resources, and ecosystems.

Leveraging the experience of the past with current and rapidly emerging technologies and global trends therefore provides significant opportunities to build sustainable economic, ecological, and social prosperity that will benefit the North as well as all Australians.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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3.2 AUSTRALIA'S NORTH, AUSTRALIA'S FUTURE: A VISION AND STRATEGIES FOR SUSTAINABLE ECONOMIC, ECOLOGICAL AND SOCIAL PROSPERITY IN NORTHERN AUSTRALIA (PAPER II)

Research Question II: *What insights does a sustainable economic, ecological and social prosperity lens provide in an examination of development options for northern Australia?*

Contribution to Paper III: The findings of Paper II demonstrate that the application of a strategic planning approach to *sustainable prosperity* in the sub-region of northern Australia is: (i) viable; (ii) expands the economic opportunities compared to *business as usual approach*; (iii) contributes to positive ecological and social outcomes; and (iv) highlights the importance of engagement in the strategic planning process in achieving sustainable outcomes. Paper III develops these findings further through the examination of the impact of a strategic planning-based community engagement intervention on attitudes in a community subgroup of senior high school adolescents to sustainable outcomes – the United Nations Sustainable Development Goals (SDGs).

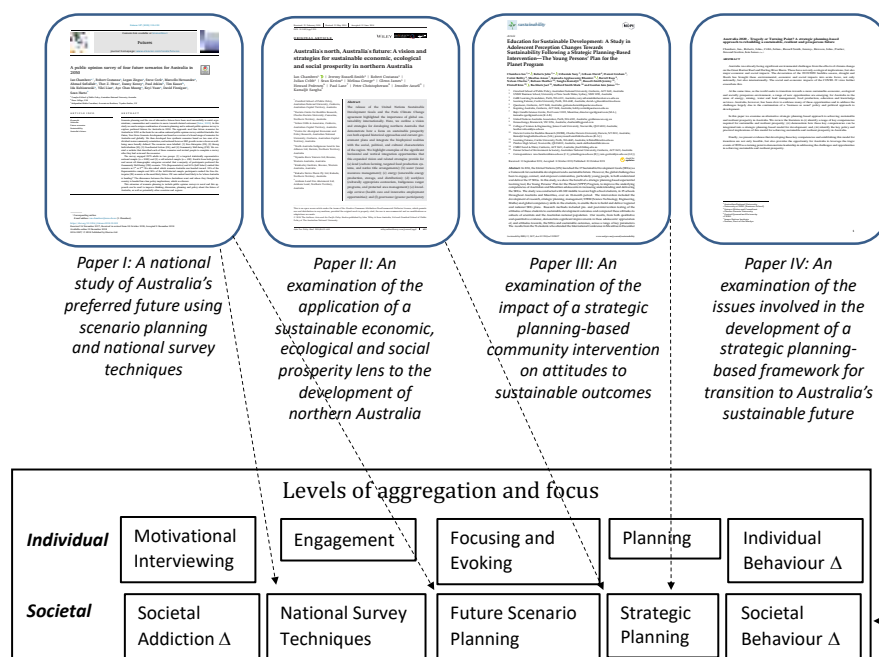


Figure 3. Levels of aggregation and focus for Paper III in the development of visions and strategies for Australia's sustainable future

4.1 EDUCATION FOR SUSTAINABLE DEVELOPMENT: A STUDY IN ADOLESCENT PERCEPTION CHANGES TOWARD SUSTAINABILITY FOLLOWING A STRATEGIC PLANNING-BASED INTERVENTION – THE YOUNG PERSONS’ PLAN FOR THE PLANET PROGRAM (PAPER III)

Research Question III: *What is the impact of a strategic planning-based community intervention on attitudes towards sustainable outcomes in a subset of Australian and Mauritian populations (adolescent students in senior high school)?*

Contribution to the thesis: This research paper examines the impact of a strategic planning-based community engagement intervention on attitudes to sustainable outcomes in a community subset of adolescents. The findings demonstrate that a strategic planning-based community intervention could successfully *engage, connect and empower* an adolescent community segment in achieving these outcomes, as well as contributing to the development of a *sustainable future* mindset. These findings are important both in addressing the challenges of engaging young people, as well as the achievement of the paradigm shift to a sustainable future mindset.

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Statement of Contribution

This thesis is submitted as a Thesis by Compilation in accordance with https://policies.anu.edu.au/npl/document/ANUP_003405

I declare that the research presented in this Thesis represents original work that I carried out during my candidature at the Australian National University, except for contributions to multi-author papers incorporated in the Thesis where my contributions are specified in this Statement of Contribution.

Title: EDUCATION FOR SUSTAINABLE DEVELOPMENT: A STUDY IN ADOLESCENT PERCEPTION CHANGES TOWARD SUSTAINABILITY FOLLOWING A STRATEGIC PLANNING-BASED INTERVENTION – THE YOUNG PERSONS' PLAN FOR THE PLANET PROGRAM

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Article

Education for Sustainable Development: A Study in Adolescent Perception Changes Towards Sustainability Following a Strategic Planning-Based Intervention—The Young Persons' Plan for the Planet Program

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Abstract: In 2016, the United Nations (UN) launched the 17 Sustainable Development Goals (SDGs) as a framework for sustainable development and a sustainable future. However, the global challenge has been to engage, connect, and empower communities, particularly young people, to both understand and deliver the 17 SDGs. In this study, we show the benefit of a strategic planning-based experiential learning tool, the Young Persons' Plan for the Planet (YPPP) Program, to improve the underlying competencies of Australian and Mauritian adolescents in increasing understanding and delivering the SDGs. The study was conducted with 300 middle to senior high school students, in 25 schools throughout Australia and Mauritius, over an 18-month period. The intervention included the development of research, strategic planning, management, STEM (Science Technology, Engineering, Maths) and global competency skills in the students, to enable them to build and deliver regional and national SDG plans. Research methods included pre- and post-intervention testing of the attitudes of these students to sustainable development outcomes and compared these attitudes to subsets of scientists and the Australian national population. Our results, from both qualitative and quantitative evidence, demonstrate significant improvements in these adolescents' appreciation of, and attitudes towards, the SDGs and sustainable outcomes, across a range of key parameters. The results from the 76 students who attended the International Conference in Mauritius in December

2018 demonstrate significant improvements in mean levels of understanding, and attitudes of the students towards the SDGs awareness (+85%), understanding/engagement (+75%), motivation (+57%), and action orientation/empowerment (+66%). These changes were tested across a range of socio-demographic, geographic, and cultural parameters, with consistent results. These findings have significant implications for the challenge of sustainable education and achieving community engagement and action towards the SDGs in Australia and Mauritius, particularly for young people. As the intervention can be replicated and scaled, the findings also highlight the opportunity to extend both the research and this type of experiential learning intervention across both broader geographies and other generation and community segments.

Keywords: sustainability; sustainable development; education; UN SDGs; management education

1. Introduction

1.1. Addressing the Challenge of Community Engagement in Delivering the United Nations Sustainable Development Goals (SDGs) and Sustainable Outcomes

The shape of tomorrow's world will depend on ways in which young people engage with decisions that are being made today. With the launch of the Sustainable Development Goals (SDGs) in 2016, the United Nations (UN) established the first global framework to 'end poverty, protect the planet and ensure prosperity for all' [1]. With 194 countries signing up to this framework, the UN SDGs, therefore, provide the global agenda for a sustainable future. Whilst this is a major step forward in the collective agenda of sustainable development, the challenge is, and will continue to be, how to engage, connect, and empower communities to deliver these Goals.

A review of the implementation of the precursor of the SDGs, i.e., the Millennium Development Goals (MDGs), highlighted the limited success in the achievement of the stated goals [2]. The ability to 'think global, act local', and to engage and empower individual countries and communities to become engaged and empowered to deliver these goals, proved to be a challenge, even with the more limited scope of the MDGs as compared to the SDGs [2]. A key criticism of MDG deployment was the ability to engage at the level of the community or 'individual citizen'. In effect the MDGs were often perceived by communities and individuals as 'imposed from outside', and, therefore, lacking applicability at a local level, with communities often not having a general understanding of what was trying to be achieved and how they could be involved in delivering on the Goals [2]. Three key challenges, therefore, remain for the successful implementation of the SDGs i.e., (i) Education for sustainable development [3] (ii) community engagement: To demonstrate applicability of the SDGs to local economic, ecological, and social contexts; and, (iii) community empowerment: To take action to implement the activities that will fulfill the Goals [4].

Developing global goals, and cascading these from an international level to national, regional, and local deployment, has a long history in the conduct of global corporations through the development and application of global competencies and strategic planning [5]. The global success of many of these corporations provides an opportunity to learn from their experience and leverage key competencies, such as strategic planning and global competencies [6], in delivering outcomes for the SDGs.

In this study, we assess the impacts of a global competency and strategic planning-based intervention and experiential learning tool, the Young Persons' Plan for the Planet Program ('the Program'), in addressing the objectives of community engagement and empowerment with middle to senior high school students.

1.2. Adolescent Engagement for a Sustainable Future Earth

Recent climate demonstrations, across the world [7] have highlighted that today's youth want their voices to be heard in determining the future trajectory for the planet. Key, therefore, in the implementation of the SDGs will be the young people who will inherit the planet from the negotiators who developed the Goals [8]. Adolescents, however, are one of the more challenging demographic segments to engage, at both community, and political levels [8]. This is often driven by their sense of disenfranchisement from society, which is increasing over time [9,10]. However, adolescents can also be change agents, driving innovation and political movements that flow through to broader society [10,11]. A further reason for choosing adolescents to test this intervention was the potential to develop an education program to equip future political, business, and community leaders with the skills to deliver on this agenda of global sustainable development.

1.3. Education for Sustainable Development

The United Nations Educational, Scientific and Cultural Organization (UNESCO) has identified Education for Sustainable Development (EFSD) as a key support mechanism underlying the successful delivery of the SDGs [12]. The Organisation for Economic Co-operation and Development (OECD) [13], and the Global Education at Asia Society (CGEAS), note the significance of key global competency skills in the delivery of the SDGs, and their achievement by 2030 [14]. In developing global competencies, four domains have been identified by CGEAS: (i) Investigate the world: Investigate the world beyond the immediate environment; (ii) Recognise perspectives: Recognize own and others perspectives; (iii) Communicate ideas: Communicate ideas effectively to diverse audiences; and, (iv) Take action: Translate ideas into appropriate action to improve conditions [14]. These four domains were incorporated, therefore, into the core of the Young Persons' Plan for the Planet (YPPP) Program approach. Within these four domains, five additional key competencies were identified as having the potential to contribute successfully to EFSD, and were incorporated, therefore, into the development of the program: (v) A systems approach to the 17 UN SDGs [15]; (vi) STEM skills (Science, Technology, Engineering, Mathematics) [16]; (vii) Strategic Planning [17]; (ix) Challenge-Based Learning [18]; and, (x) a Sustainable Mindset [19].

1.3.1. A Systems Approach to the Sustainable Development Goals

A key consideration in addressing and delivering the SDGs are their scope and depth. As an example, the Bill and Melinda Gates Foundation Global Challenges focused on the first six SDGs [20]. Others advocate a more holistic and systems-based approach, addressing all of the 17 SDGs simultaneously because the individual SDGs are interconnected [15]; for the same reason, a strategic planning approach would advocate addressing all 17 SDGs. Education for sustainable development also takes a holistic and systems-based view of sustainability [21]. The YPPP Program was designed, therefore, to support students in taking a systems-based view of the SDGs by addressing all 17 of the SDGs and their interconnectivities.

1.3.2. STEM (Science, Technology, Engineering, and Mathematics) Skills

STEM learning and skills have been identified as key components in the broader education system and have an important role to play in education for sustainable development [16]. Of particular importance is the development of the scientific method and research skills for investigating the world-enabling students to move beyond opinions to science-based facts in developing and delivering solutions [16], the key role of design and digital technology skills, in achieving sustainable development, is also recognized, and, therefore, also incorporated into the program [16].

Designed as a STEM learning journey and incorporating CARMA (Contextual, Authentic, Relevant, Meaningful, and Applicable), a contemporary program developed at one of the inaugural participating schools (Kent Street Senior High School, Western Australia), the program focused on preparing and

providing students with the 21st Century skills identified as being required for Australia's future 4IR (Fourth Industrial Revolution) workforce [22] and the educational reforms currently being implemented in Mauritius [23]. As part of the program students were encouraged, therefore, to develop an acute awareness of both biophysical and societal global issues that require STEM understandings, skills, processes, and scientific knowledge to solve. For this reason, the program also provided an external learning experience integrated with the traditional curriculum through CoRE (Centre of Resources Excellence) [24] and Global Competency [12] learning model methodologies. This enabled, in a real-world context, the interconnectivity of the SDGs to be appreciated and acknowledged as the program invited students to explore and interrogate the SDGs within the students' own local, regional as well as national contexts. The program encouraged students to engage in high-level discovery, exploration, inquiry, and investigation to identify and present a diverse array of potential articulations of the SDGs in their region. Working collaboratively within a student centered or directed learning system, students were encouraged to recognize the relevance, meaningfulness, and purpose of the SDGs and their impacts on their own lives. The collection and management of research data, within the program, was also designed to instill a sense of responsibility, and ultimately a need and desire to problem solve.

1.3.3. Strategic Planning

As noted already, by cascading strategic planning capabilities and competencies, from international to regional and local levels, corporates achieved significant success in meeting their global objectives [5]. These capabilities include the ability to plan and succinctly communicate this plan through strategic planning processes such as VMOSA (Vision, Mission, Objectives, Strategies, Actions) [25] and VOSAM (Vision, Objectives, Strategies, Actions, Measures) [26].

A significant challenge for the delivery of the 17 SDGs is also prioritization—the ability to focus on the most urgent and important areas both within individual SDGs and across the SDGs as a whole. To address this requirement, additional strategic planning tools, including the Pareto Principle (80:20 Rule) and Urgency/Importance Matrices [27] were incorporated into the program. To facilitate communication, participants were encouraged to develop further strategic planning and global competencies such as leadership, teamwork, interpersonal, and media communication within the program.

1.3.4. Challenge-Based and Action Learning

In the education environment, the importance of challenge-based, action, and experiential learning is emerging as of critical importance to address the complexities of the current global context [1,28]. The applicability of this learning approach, to the complexities and interconnectivities of the 17 SDGs, has been identified as critical to the successful delivery of the SDGs - a challenge that has been described as a 'wicked problem' [29]. Figueiro and Raufflet highlight that the inclusion of action and experiential-based learning in education for sustainable development has the potential to 'increase student motivation and critical thinking skills' in management curricula [1]. The use of management tools such as strategic planning as the framework for this experiential learning and the delivery of the SDGs, however, is novel. Challenge-based, action, and experiential learning approaches were, therefore, key components of the program design. Although the use of challenge and action-based learning has been highlighted as a useful methodology in management teaching on sustainability, the use of management training skills such as strategic planning as the basis for challenge-based and action learning is novel. [1].

1.3.5. Achieving a 'Sustainable Mindset'

Successfully delivering the SDGs will require significant changes across a range of biophysical, social, cultural, and economic systems [15]. Further, Meadows highlights that one of the most important leverage points for systems change is a paradigm mindset shift [30]. As highlighted by

Costanza et al. [31] the paradigm mindset shift required will be the transition from a ‘business as usual’ mindset to what has been termed a ‘sustainable mindset’ [19]-both individually and as a society. Furthermore, Costanza et al. note that Scenario Planning can also be effective in achieving this key system change leverage point [31]. The program, therefore, included the development of scenario planning and visioning competencies that could further support this paradigm mindset shift.

1.4. Developing the Young Persons’ Plan for the Planet Program

These key competencies, described above, were integrated and developed into a strategic planning-based intervention and experiential educational framework entitled the Young Persons’ Plan for the Planet Program (YPPP, the program).

The integrated program design involved six key phases of the SDG Plan development illustrated in Figure 1.

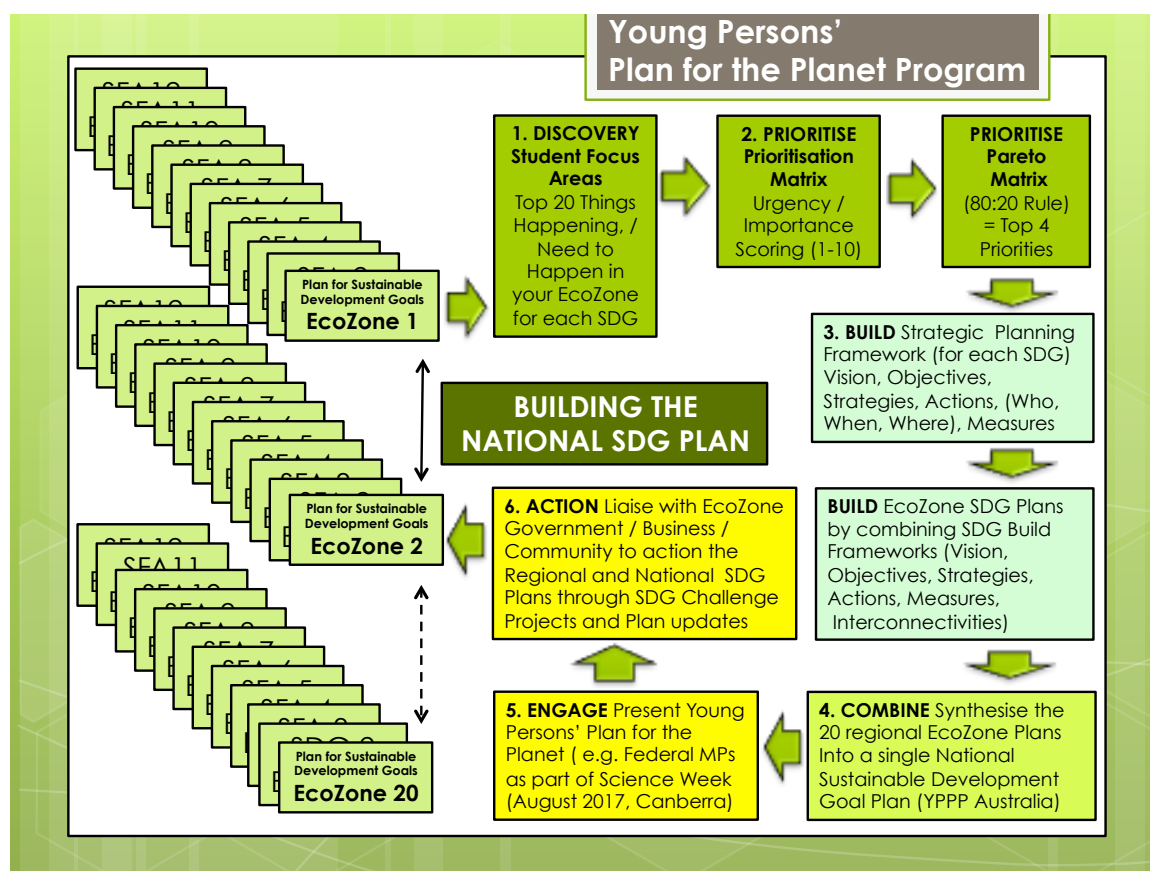


Figure 1. The six phases of the Young Persons’ Plan for the Planet (YPPP) Program intervention.

These key phases were (i) Discovery: In this phase, participants were asked to examine the SDG they or their team had been assigned to, and identify key initiatives that were already happening or initiatives that participants identified as needed to happen, to deliver on each SDG in their EcoZone (see definition of Ecozone below); (ii) Prioritise: Using strategic planning tools, participants were then asked to prioritise these initiatives and identify the top priorities for their EcoZone; (iii) Build: Again using strategic planning tools, participants were invited to build a one page vision and strategic Plan for their SDGs for their EcoZone; (iv) Combine: Participants were then invited to combine their individual EcoZone plans into a regional SDG Plan. These regional Plans were then synthesized by the students into a national Plan and published as either the Young Australians’ and Young Mauritians’ Plan for the Planet (Available in Supplementary Information). Participants completed the synthesis process utilising strategic planning and management tools; (v) Engage: Participants were invited to

present the national SDG Plans to relevant politicians and community leaders (Figure 2); and, (vi) Action: In 2018 the program was expanded to include the development and delivery of SDG Challenge Projects in priority areas of the regional and national SDG Plans.



Figure 2. Australian students presenting the Young Australians' Plan for the Planet to the national Science Minister at Parliament House, Canberra in 2017.

The overall approach of the program, therefore, focused on facilitating a learning process that aimed to develop students' social and emotional enterprising skills (e.g., prioritization, organization, communication, and self-confidence). These have been identified as mandatory intra- and interpersonal attributes essential in the development of the necessary technical skills required to engage effectively with the SDGs and their interplay and operationalisation within a region [32].

The program also focused on the facilitation of high-level cognitive and critical thinking, interpretation and evaluation of data and their respective scenarios, as well as key STEM skills. The integration of these outcomes, within the program design, into a holistic Plan aimed at understanding, confidence, and empowerment for students engaged in the strategic planning-based pedagogy. The overall program design was based on the work by Scoullos (2013) who outlined the key learning components of education for sustainable development: (i) Interdisciplinary and holistic, (ii) learning centered and participatory, (iii) values-driven, promoting critical thinking, and exploring all interested sides, (iv) forward looking and promoting medium and long-term planning, and (v) locally relevant, encourages multilateral collaborations among schools, local actors, and authorities, scientific communities, the private sector and NGOs, and (vi) revealing global issues and connections as part of everyday life [33,34].

1.5. Research Questions

We tested how this strategic planning-based pedagogy and experiential educational framework (the program) affected attitudinal changes of adolescents towards the SDGs and sustainability outcomes, based on the following research questions.

- (i) What is the impact of a strategic planning-based intervention (YPPP Program) on awareness, understanding, motivation, and action orientation towards the SDGs and sustainable outcomes, in an adolescent subset of the Australian and Mauritian population?
- (ii) What is the impact of a strategic planning-based intervention (YPPP Program) and alternative motivational framing of the global context on plans for achieving sustainable outcomes and the SDGs in an adolescent subset of the Australian population?
- (iii) What is the impact of a strategic planning-based intervention (YPPP Program) on the preferred scenarios for Australia in 2050 for a subset of Australian adolescents, and how do these results compare to the preferred scenarios of the national Australian population?
- (iv) What is the impact of a strategic planning-based intervention (YPPP Program) on the attitudes to climate change of Australian adolescents, and how does this compare to a subset of scientists and the attitudes of the national Australian population?

Section 2 of this paper describes the methodology used to test the impact of the Young Persons' Plan for the Planet Program on a subset of the adolescent population in Australia and Mauritius. Section 3 provides the results of this research and an analysis of these results. Finally, in Sections 4 and 5, we discuss some of the implications and conclusions from these results for education for sustainable development, and the opportunities for further research.

2. Research and Methodology

2.1. Target Segments

2.1.1. Selection of Australia and Mauritius for the Study

To test the application of these key components of education for sustainable development it was important to identify a set of diverse economic, ecological, and social contexts in which the students lived. The intervention was initiated in Australia, which provided complex ecological issues and a highly multicultural society with diverse social structures, living across a range of geographies, from highly urbanized to highly agricultural environments [35]. Mauritius offered a valuable comparison of the application of the program and provided a cultural contrast with three principle languages (Creole, French, and English), compared with one principle language (English), in Australia. The countries also provided a mixture of developed and developing economic, ecological, and social contexts. The geographical proximity of the two test environments allowed for participant interaction over the study period, increasing co-learning opportunities.

Australia and Mauritius were divided into regions, entitled EcoZones (Ecological, Economic, Social Zones), based on an aggregation of Local Government Areas (LGAs), with each school allocated the development of a 'strategic plan' to deliver the SDGs for their specific EcoZone. For Australia, fourteen schools covered fifteen different EcoZones mapped against state, territory, and local government boundaries (Figure 3). For Mauritius, ten schools covered the nine existing regional districts. Once the EcoZone SDG Plans were completed, students were tasked to synthesise these regional EcoZone SDG Plans into National SDG Plans: The Young Australian and the Young Mauritians' Plan for the Planet.



Figure 3. The 20 EcoZones for Australia.

2.1.2. Selection of Schools as the Location of the Intervention

Testing the program within schools provided a consistent and accessible environment covering the full range of geographic, social, and cultural contexts. The sample represented in both the Australian and Mauritian case studies included government, private, and independent schools. The program was targeted at middle to senior high school students, and the intervention was extracurricular, which ensured that no curriculum changes were required. This allowed the program, and associated research, to be rapidly deployed and effectively managed.

The school environment also facilitated the engagement and support of key stakeholders such as national Science Centres (Australia-Questacon, Inspiring Australia; Rajiv Gandhi Science Centre-Mauritius), the United Nations (Information Centres and regional associations), and national and regional universities (Australian National University, University of NSW, University of Technology, Sydney, James Cook University, Charles Darwin University, Curtin University (Australia and Mauritius) and Charles Telfair Institute (Mauritius)).

2.2. Timeframes

The programs were launched in Australia as the Young Australians' Plan Program for the Planet in February 2017, and in Mauritius, as the Young Mauritians' Plan for the Planet Program, in February 2018. Both programs operated over the full school year and were voluntary extra-curricular activities. There was no cost to participating schools, removing the risk of resources as a constraint on students' opportunity to take part in the program.

2.3. Funding and Sponsorship

Initial funding and resources for the program and research were provided by a range of government, business, and community sponsors: The Australian Research Council, Australian National University, Questacon and Inspiring Australia, the Rajiv Gandhi Science Centre, the University of NSW, University of Technology (Sydney), James Cook University, Charles Darwin University, Curtin University, and the Mauritius Commercial Bank. Other key stakeholders included the United Nations Information Centre (Canberra), Future Earth (Australia and Asian Regional Hub), and the Foundation for Young Australians. In Mauritius, 700 copies of the Young Mauritians' Plan for the Planet were sponsored by the Mauritius Commercial Bank (MCB) and distributed to Mauritian Members of Parliament and all libraries and secondary schools in the country. This potentially had a significant impact, as three

months later the program was covered on national television (available in Supplementary Information) and teachers reported that *'everyone in Mauritius is now talking about the SDGs'*.

2.4. Quantitative Research Design

The impact of the program was evaluated using a series of quantitative and qualitative measures. For quantitative evaluation, four surveys were conducted at the commencement and conclusion of the program testing adolescent attitudes to a range of sustainable outcomes and program impacts: (i) SDGs / Sustainable Future Earth Survey: Administered before and after the intervention in Australia; (ii) Future Scenarios Survey: This Survey had previously been administered nationally and so provided comparisons between the adolescent population subset and the national population [36]; (iii) Climate Change Survey: This survey had previously been administered to both a subset of scientists and also to the Australian population. This, therefore, provided an opportunity to compare the results of the Australian adolescent subset to these two other populations; (iv) TOBN Survey: Australian schools were also randomly assigned four pre-intervention Focus Area Briefs (Threats, Opportunities, Both, Neither), to determine whether these areas of focus influenced the outcomes of both the YPPP deliverables (SDG Plans), and on adolescent perceptions; and, (v) Program Evaluation Surveys: A series of Intervention Impact Surveys (Program Evaluations) were administered to both Australian and Mauritian students at the conclusion of the program; these Surveys and Briefs are included in Supplementary Information. Surveys (i)–(iv) were based on pre/post assessment design. Survey (v) was based on the post survey assessment design. The definition of 'attitudes' was based on the work of Milford and Duckitt (2010) and Bergman (2015) and was focused particularly on changes in student awareness, motivation, and intention to act [37,38].

2.5. Qualitative Research Design

To compliment the Quantitative Research, Qualitative Research was conducted using both face-to-face interviews and focus groups.

2.5.1. Focus Groups

Focus groups were conducted following the delivery of the program to further explore adolescents' perceptions of the SDGs and sustainable outcomes before and after their participation in the program. These focus groups included a simple one-page knowledge assessment questionnaire (included in Supplementary Information) to open up discussion on which specific aspects of the intervention were significant for participants.

2.5.2. United Nations (Information Centre, Canberra) and Media Interviews

As part of a national conference following the program, students were invited to take part in face-to-face interviews on their understanding of the SDGs and the impact of the intervention. These interviews were conducted independently by the UN Information Centre (Canberra), and provide part of the Qualitative feedback. There was also significant media interest in the program, in which the participants provided feedback on their perceptions of the SDGs, a sustainable future Earth and the impact of the YPPP Program. An example of this Media Coverage is included in Supplementary Information.

3. Results

3.1. Quantitative Research Outcomes

3.1.1. Program Evaluation Surveys

3.1.1.1. Program Evaluation Survey (Online)

At the completion of the Year 1 Program (2017) students were invited to complete an online Program Evaluation Survey. Perhaps the most indicative were the answers to the following open-ended question: ‘In your own words, what do you think were the main benefits to you in taking part in the Young Australians’ Plan for the Planet Program?’

- Gave me a better understanding of what needs to be achieved in the world to create a better world.
- It gave us a voice and as though we have achieved something bigger than us. It also gave us good connections for future.
- Plan for the Planet has raised my awareness for the need to take care for the environment.
- The empowerment that the program gave us. To be more than teenagers and students—and instead to make a difference in the world.
- The full survey is included in Supplementary Information.

3.1.1.2. Program Evaluation Survey

For the 2018 program, which covered both Australia and Mauritius, students who attended the International Conference in Mauritius in December 2018, were asked to rate on a one (low) to 10 (high) scale both (a) key knowledge and awareness factors regarding the SDGs and sustainability; and, (b) the impact of key enablers, before and after the program. All of the 76 students who attended the final day of the International Conference in Mauritius in December 2018 responded to the survey. The results demonstrate a significant ($p < 0.01$) increase in mean rates of understanding, and attitudes of the students towards the SDGs in awareness (85% increase), understanding/engagement (75% increase), motivation (57% increase), and action orientation/empowerment (66% increase) (Figure 4).

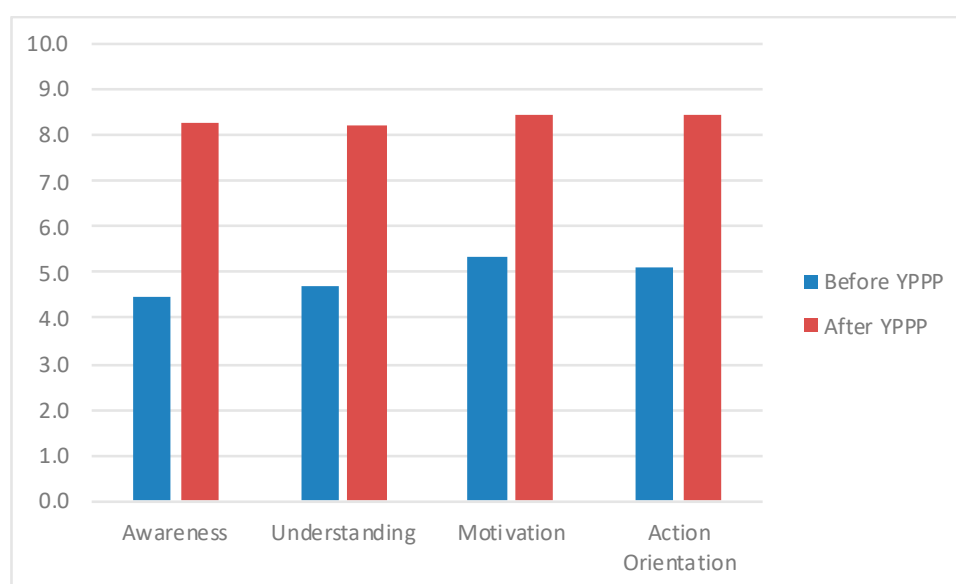


Figure 4. Before and after impact of the Young Persons’ Plan for the Planet (YPPP) Program.

Although the sample size is relatively small, further confirmation of these results was reflected in the respondent statements to the open-ended questions at the end of the survey: ‘*very eye opening ...*

we should never belittle the fact of how (much) we can do or change'; 'if it wasn't for this program (intervention) I would have little knowledge of sustainability and would be afraid to take action'; and, 'This program made me even more inspired and ready to help create a better future for this planet'.

Motivation was identified the highest 'before intervention' factor, which is understandable as this program was an extra curriculum program where we would expect students, who undertook this activity over and above their own studies, to be already motivated. We noted however, that Motivation still increased as a result of the program (48%). We also noted an increase in Understanding (57%); *'The YPPP program (intervention) has really helped me understand the troubles that the world is going through but afterwards I think I have a very good knowledge about it'.*

For the competencies, the most noticeable increase in the mean in the area of Collaboration between schools (Figure 5). We would expect this given the sample was taken from the Australian and Mauritian students who attended the International Conference.

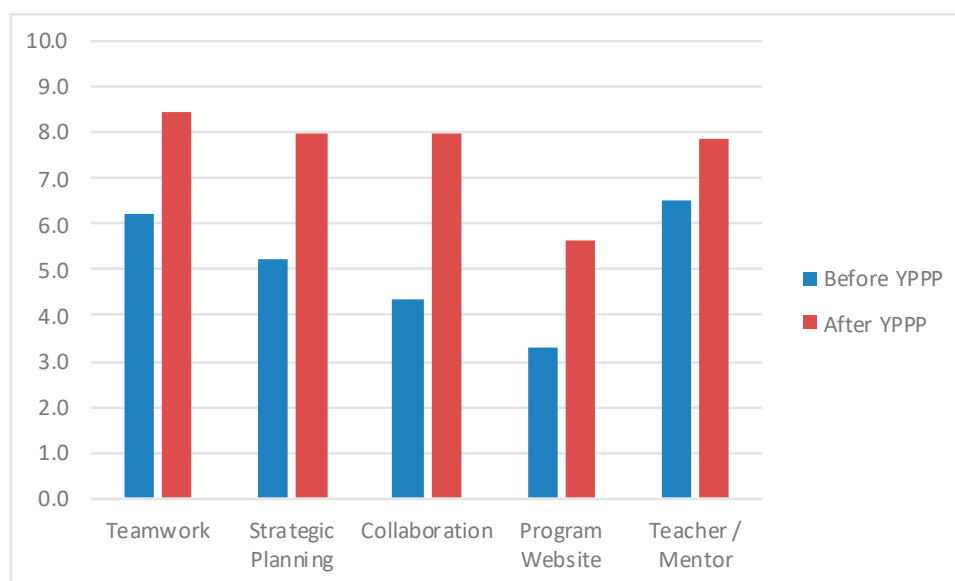


Figure 5. Before and after the program: Impact of program competencies.

Of interest is also the importance rating of these competencies before and after the YPPP Program. The results highlighted the importance of the teacher/mentor role in the YPPP Program. This is of interest as teachers/mentors regularly reported having to do very little once the students had started the intervention as the *'students drove the program'*. The important role of the teacher/mentor in initiating and inspiring the participants at the beginning of the program is, therefore, highlighted (Figure 5).

Furthermore, the importance of teamwork, strategic planning, and collaboration are also highlighted in participant responses to the open ended questions: *'this program ... gave me the ability to connect and collaborate with other global citizens'*; and, *'the world needs us, youth, to come up with new ideas to save the planet. Together with all the countries around the world, we can achieve the 17 SDGs sooner'*.

3.1.2. UN SDGs/Sustainable Future Earth Survey

One of the most noticeable shifts in the UN SDG Survey was the change in participant motivation. On the issue of Climate Action, individual participants, who indicated 'totally motivated to act' in the survey, increased from 29.7% before the intervention, to 47.9% afterwards, an increase of over 60% (Figure 6). Similarly, on issues such as Clean Energy, individuals who indicated 'totally motivated to act' increased from 28.3% before the intervention, to 46.75% after the program (Figure 6), again an increase of over 60%.

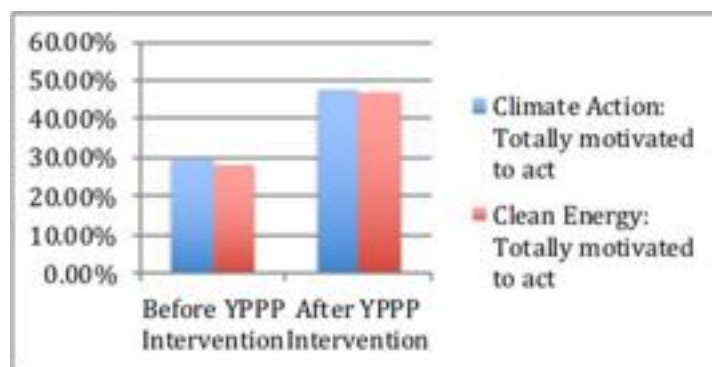


Figure 6. Examples of changes in adolescent motivation to act.

3.1.3. Future Scenarios Survey

We also calibrated participant preferred future scenarios for Australia. This research had also been conducted through a national scale survey in 2016 [36]. The results of both the national survey and the adolescent group are included in Figure 7, calculated using the Borda scoring method. The national majority preference for the Community Well-being scenario is replicated in the results for this adolescent subgroup. It is noted that Coordinated Action and Strong Individualism are higher for this adolescent subgroup and Free Enterprise is lower.

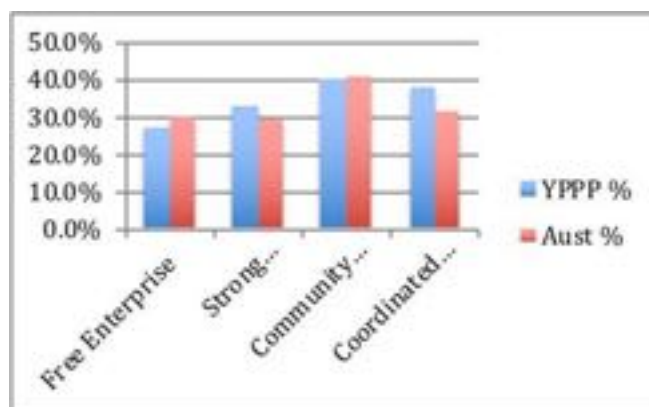


Figure 7. Preferred future scenarios for Our Future, Your Voice Survey: Australian National Survey (Aust) ($n = 2485$) compared to YPPP Program adolescents ($n = 145$).

3.1.4. Climate Change Survey

The comparison of the results of the national and scientist population subset to the adolescent subset of participants in this program confirmed consistency with the overall results of the original national survey (Figure 8).

Use of the Climate Change Survey, in parallel with the UN SDG/Sustainable Future Earth Survey, provided further confirmation of the earlier results, which showed increased participant understanding and empowerment toward sustainable outcomes. This was demonstrated in (i) the question of ‘whether climate change would have an impact on personal economic and social circumstance?’ In this case, individual participant scores moved from 52.6% to 72.9%, representing a statistically significant increase of 38% with $p < 0.05$. When asked (ii) ‘whether scientists are overstating the impact of climate change’ a comparison of individual participant results, before and after the delivery of the program, Strongly Disagree increased from 31.0% to 47.9%, again a statistically significant increase of over 50% with $p < 0.05$ (Figure 8).

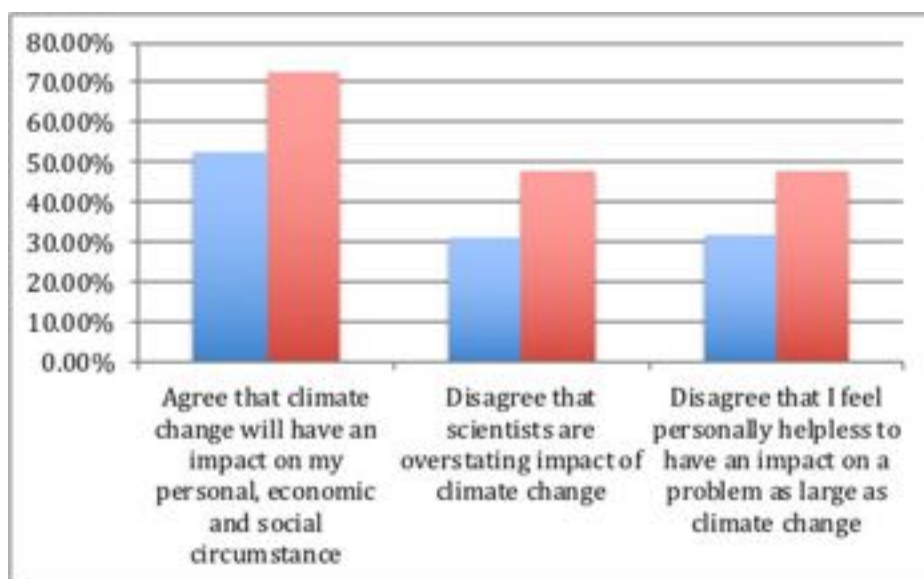


Figure 8. Changes in adolescent understanding and empowerment.

However, perhaps most importantly for our study was the increase in empowerment of participants in the program. When asked whether individual participants ‘felt personally helpless to have much of an impact on a problem as large as climate change?’ a before and after intervention comparison of results for individual participants who ‘totally disagreed with this statement’ highlighted a significant increase from 32.1% to 47.9% (Figure 9).

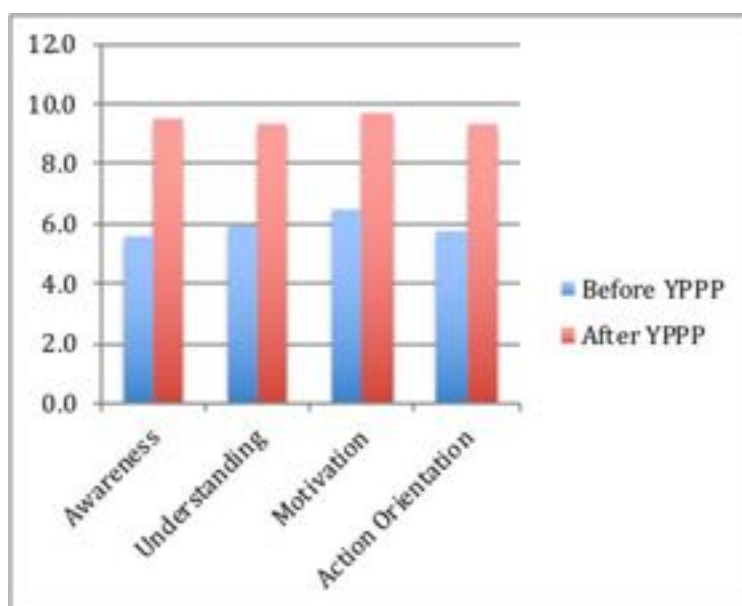


Figure 9. Results of the focus group surveys.

3.1.5. TOBN (Threats, Opportunities, Both, Neither) Survey (Impact of Alternative Motivational Framing of the Global Context on Plans for Achieving Sustainable)

This element of the research was inconclusive; although there was significant variation in the quality of the SDG Plans generated by each group of students in the program, these results could not be allocated back to a series of TOBN (Threats, Opportunities, Both, Neither) Focus Briefs provided at the beginning of the research. Key motivators and competencies were identified, however, in the

open-ended questions, and these were linked to the program team and support competencies including teamwork, strategic planning, collaboration, intervention website, and teacher and mentor support.

3.2. Qualitative Research

3.2.1. Focus Groups

Focus groups were conducted with two groups of 2017 Alumni Students—Kent Street High School (Perth, Western Australia), and Norwood Morialta High School (Adelaide, South Australia), to further explore the impact emerging from the quantitative results of the 2017 Intervention (Figure 9).

However, perhaps the most informative insight was an anecdote by one of the students on the impact of the intervention: “I woke up one morning after we had completed the YPPP Plan for our EcoZone and thought I want to do more than just develop a plan on how to implement the SDGs in our area—I actually want to start doing something! So, I contacted the other students in our groups, and we set up the Rubbish Rangers in our school. We each chose sections of the school covering all the school and made sure all the rubbish was picked up on those areas. We know we weren’t changing the world, but in a small way we were making a difference already’. When asked how the other students and teachers reacted, the student that replied the other students and teachers ‘asked us why we were on detention duty picking up rubbish when we such good students’. The student then proceeded to explain to the other students and teachers about this YPPP. This again reinforces that the program not only increased awareness, understanding of the SDGs—but also motivation and action orientation.

3.2.2. Media Interviews

There was significant media interest in the program, and subsequently a number of media interviews were conducted with students, teachers, and school principals. Students and teacher interviews were also conducted in conjunction with the Young Persons’ Plan for the Planet Conferences in Australia and Mauritius. The feedback from these media interviews confirmed the results identified in the quantitative data (Figures 10–13).



Figure 10. Senior High School students addressing the Parliamentary Breakfast to launch the Young Australians Plan for the Planet.



Figure 11. Senior High School students speaking with SKY News at the Australian Parliament House to launch the Young Australians Plan for the Planet.



Figure 12. Winner of the Prime Ministers National Science Teachers Award (2016), Suzy Urbaniak at the launch of the Young Australians' Plan for the Planet (Parliament House).



Figure 13. Joel Bucholtz, Executive Principal, Pimlico High School Townsville and Board Member, Council of International Schools.

3.2.3. UNIC (Australia) Interviews and Australia Conference (Canberra, 2017) and Mauritius (Port Louis, 2018) International Conference Presentations

In addition to the quantitative data, other qualitative data was gathered through student interviews and presentations on both their findings on the SDGs as well as the impact of the program. These are quite extensive and, again, confirmed the findings of the quantitative research. Due to the extensive size of these interviews and presentations they have also been made available in Supplementary Information.

4. Discussion

4.1. *Impact of the Intervention on Awareness, Understanding, Motivation, and Action Orientation towards Sustainable Outcomes*

(i) Our results demonstrate that there was a significant impact of the program on the first research question on adolescents' awareness, understanding, motivation, and action orientation in relation to the SDGs, climate change and renewable energy. The reported transition of students from seeing the issues of the world from 'overwhelming' to 'understanding' to 'empowerment' is potentially significant due the importance placed on this type of 'paradigm shift' or mindset change' as a key leverage point in systems change (30).

We recognise that this program was an extracurricular program for students, and the voluntary nature of extracurricular activities, therefore, could predispose these students to both, an interest in sustainable outcomes, as well as a motivation to become involved. However, the significant improvements noted in awareness, understanding, motivation, and action orientation, highlight the increased empowerment the students articulated post program, even amongst those presumably positively disposed to the issues. This was also reflected in student desire to become involved in projects to deliver the SDGs, such as the 'Rubbish Rangers' Team. This raises the issue of whether the significance of these attitude changes represent what Meadows describes as paradigm or mindset shift (Meadows, 2019). The range of students who then went on to become actively involved in sustainability issues in their local communities, as well as internationally, indicated that the attitude changes were not only in awareness and understanding of the SDGs and sustainable outcomes, they were also empowering. Clearly, there is the opportunity to do further research in this area to test this apparent mindset shift, both demographically as well as generationally.

If a paradigm shift in an adolescent population is being achieved as a result of the YPPP Program, as this cohort are the drivers of future change, this could provide a significant leverage point for the systemic change required to achieve greater sustainable outcomes. This proposition provides an opportunity for further research.

(ii) The findings for research question two on alternative motivational frameworks were inconclusive. There was no evidence of any specific impact on the adolescent cohorts strategic planning outcomes based on the alternative motivational frameworks presented at the outset of the study. Of importance, however, were the impacts of the strategic planning key competencies of teamwork, collaboration, website support, and mentoring.

(iii) The findings on research question three in the Future Scenario's Survey highlighted a preference, by young Australian adolescents, for a future scenario of Community Well-being, consistent to that of the overall Australian population (36). This highlights the opportunity, identified by Ban Ki-Moon, of engaging youth in the planning and delivery of the UN Sustainable Development Goals and achieving sustainable outcomes (4).

(iv) The results of the Climate Change Survey provided two further insights on research question four; the first was a confirmation of the impact on understanding of the issues of sustainability at both individual and community levels. The link between this increased understanding and increased empowerment to take action, on issues such as climate change, resonates with Meadows identification of a paradigm shift in mindset being a key leverage point for systems change (30) It also highlights the success of one of the key program objectives, i.e., students were encouraged to increase awareness

about the world around them and, thereby, be better positioned to enact positive solutions for both themselves and their communities.

4.2. Methodology

The open-ended questions, included in the surveys post-delivery of the program, provided the opportunity for participants in the research to give feedback on the methodology used in the program. Overall, the participants highlighted how the key competencies (Strategic Planning, STEM, and Global Competencies) made a significant difference in their ability to both understand, and feel empowered to act, to address the SDG's and achieve sustainable outcomes.

In addition, in the quantitative data, as well as the focus groups and open-ended questions, the participants highlighted the importance of the 'soft skill' competencies such as Teamwork and Collaboration. This resulted in the program being modified to incorporate an increased level of team and collaborative approaches to addressing the challenges in the SDGs. For instance, at the outset of the intervention, participants were each allocated an SDG on which to focus. It became very clear, however, that participants much preferred to examine the SDGs as sub-teams or as a whole team rather than individually. This was identified as a key factor in increasing the enjoyment of the program and the program was adjusted accordingly to incorporate this.

This Teamwork and Collaboration approach was also identified as making two further contributions: (i) A sense of collective empowerment amongst the participant; and, (ii) a greater cross-cultural understanding of the impact of the SDGs and issues of sustainability in other cultures. As a result, the program was expanded to include increased interaction across both national and international geographies. This was facilitated through both remote technologies, such as audio and video conferencing, as well as face-to-face conferences, where participants were able to share experiences and learning. Details of the 'It's our future Earth' Conference 1.0 (Canberra, Australia) and Conference 2.0 (Mauritius) interaction programs are included in Supplementary Information.

Open-ended question feedback also highlighted participants' desire to get involved in action, as well as planning. For this reason, the intervention has now been expanded to incorporate an SDG Challenge Project component that participants can take part in once they have completed their SDG strategic planning stage of the program.

5. Conclusions

As highlighted above, the scope and scale in addressing the SDGs has in itself been described as a 'wicked problem' [29], due to both their individual complexity as well as the interconnectivity of the individual Goals. The novelty of the program is the development and application of key competencies such as strategic planning, STEM, challenge-based learning, and global competency skills to achieve sustainable outcomes in an adolescent population. However, the outcomes of this research have highlighted a number of opportunities for intervention programs to achieve sustainable outcomes, as well as for further research in the pursuit of sustainable outcomes. This research brings into relief a number of important issues.

Firstly, the research highlights the importance of education for sustainable development as a key factor in engaging, connecting, and empowering adolescents in achieving the UN SDGs and sustainable outcomes. Our research also highlights that such complexity and interconnectivity can not only be better understood, but also better planned for and managed, through this type of interactive and collaborative approach to education for sustainable development. This also opens the opportunity for the application of this type of educational intervention in additional demographically, culturally, and geographically diverse populations, as well as liaison between them.

Secondly, as highlighted at the outset of this paper, adolescents are often identified as a challenging group with which to engage. This study identified that a significant issue impacting this challenge, specifically within the field of sustainability, can be a lack of a voice for adolescents and sense of empowerment to be heard and make change. It is also encouraging that the findings of this study, i.e.,

engagement and connection of adolescents in the strategic planning process for the delivery of the UN SDGs and sustainable outcomes, contributes to an increase in the sense of empowerment and desire to take action.

Thirdly, our study highlights the importance of engaging and empowering youth in designing a sustainable future Earth. Further, the study demonstrates that the use of an integrated program, based on key competencies (strategic planning, STEM, challenge-based learning, and global competency skills), is not only achievable but that adolescents can both fully understand these principles and develop means to apply them in a real-world context.

Fourthly, as well as this study identifying a number of important integrated components in education for sustainable development it also highlights the opportunity for this type of integrated program to address the 17 SDGs utilising a holistic systems-based approach. Rather than the need to break down the 17 SDGs into individual SDGs, or groups of SDGs on which to focus, the program demonstrated that all 17 SDGs, collectively and as importantly, their interconnectivities, can be successfully addressed using these integrated competencies as a structure.

Finally, and perhaps the most interesting finding of this research, was the opportunity to utilize this type of intervention to achieve a paradigm shift in mindset—a key leverage point for the systems change required to achieve sustainable outcomes [15,30]. The findings in this study, in both the quantitative and qualitative data, that participants reported a significant shift in mindset from being ‘overwhelmed’ to ‘understanding’ to ‘empowerment’, provides the opportunity for further research on the use of this type of integrated intervention to achieve, what can perhaps be more accurately termed, a ‘sustainable future mindset’.

Supplementary Materials: The following are available online at <http://www.mdpi.com/2071-1050/11/20/5817/s1>.

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4.2 EDUCATION FOR SUSTAINABLE DEVELOPMENT: A STUDY IN ADOLESCENT PERCEPTION CHANGES TOWARD SUSTAINABILITY FOLLOWING A STRATEGIC PLANNING-BASED INTERVENTION – THE YOUNG PERSONS’ PLAN FOR THE PLANET PROGRAM (PAPER III)

Research Question III: *What is the impact of a strategic planning-based community intervention on attitudes towards sustainable outcomes in a subset of Australian and Mauritian populations (adolescent students in senior high school)?*

Contribution to the Paper IV: The research, initially conducted in Australia and then extended to Mauritius, demonstrates that a strategic planning-based community intervention could successfully *engage, connect and empower* an adolescent community segment in achieving sustainable outcomes, as well as contributing to the development of a *sustainable future* mindset. Paper III demonstrates the impact of combining two of the key management competencies - strategic planning and community engagement - in this community subgroup, thus positioning the integration of these key competencies in Paper IV.

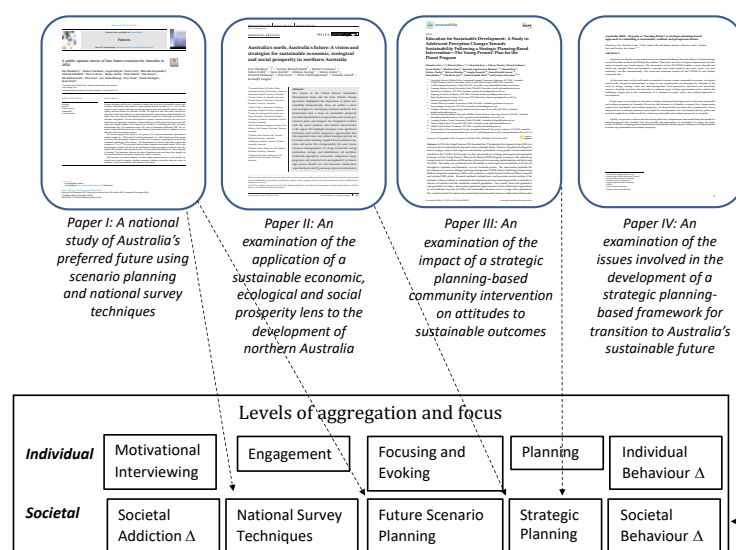


Figure 4. Levels of aggregation and focus for Paper IV in the development of visions and strategies for Australia's sustainable future

5 AUSTRALIA 2030 - DEVELOPING A STRATEGIC PLANNING FRAMEWORK FOR TRANSITION TO A SUSTAINABLE, RESILIENT AND PROSPEROUS FUTURE (PAPER IV)

Research Question IV: *What are the issues involved in the development of a strategic planning-based framework for transition to Australia's sustainable future?*

Contribution to the aim of the thesis: This research paper examines the feasibility of using three management competencies – future scenario planning, strategic planning, community engagement - to develop a potential *framework for transition* to achieve sustainable outcomes in Australia, the issues involved in their implementation, as well as the policy implications of this framework.

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Author Contributions:

Chambers, Ian: Conceptualisation, Formal Analysis, Funding Acquisition, Investigation, Methodology, Writing - original draft, Writing – review and editing;

Roberts, John: Supervision, Writing – review and editing;

Cribb, Julian: Writing – review and editing;

Russell-Smith, Jeremy: Writing – review and editing;

Hewson, John: Writing – review and editing;

Poulter, Jim: Writing – review and editing; and

Gordon, Iain James: Writing – review and editing.

Statement of Contribution

This thesis is submitted as a Thesis by Compilation in accordance with https://policies.anu.edu.au/ppl/document/ANUP_003405

I declare that the research presented in this Thesis represents original work that I carried out during my candidature at the Australian National University, except for contributions to multi-author papers incorporated in the Thesis where my contributions are specified in this Statement of Contribution.

Title: AUSTRALIA 2030 - DEVELOPING A STRATEGIC PLANNING FRAMEWORK FOR TRANSITION TO A SUSTAINABLE, RESILIENT AND PROSPEROUS FUTURE

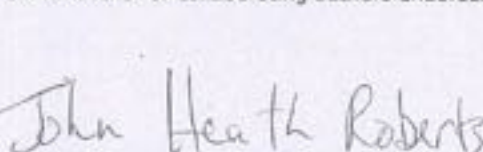
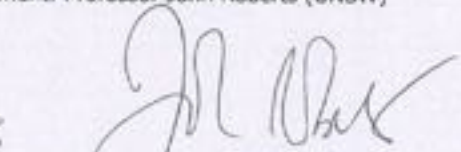
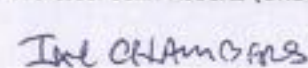
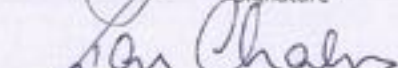
Authors: Chambers, Ian: Conceptualisation, Formal Analysis, Funding Acquisition, Investigation, Methodology, Writing - original draft, Writing - review and editing; Roberts, John: Supervision, Writing - review and editing; Cribb, Julian: Writing - review and editing; Russell-Smith, Jeremy: Writing - review and editing; Hewson, John: Writing - review and editing; Poulter, Jim: Writing - review and editing; and Gordon, Iain James: Writing - review and editing.

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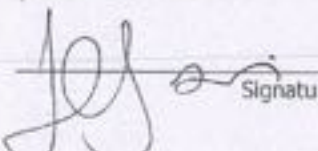
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Delegated Authority - Print Name	Signature	Date

Australia 2030 - Developing a strategic planning framework for transition to a sustainable, resilient and prosperous future

Chambers, Ian¹, Roberts, John², Cribb, Julian³, Russell Smith, Jeremy⁴, Hewson, John¹, Poulter, Jim⁵ and Gordon, Iain James^{1,5,6,7}

ABSTRACT

Australia was already facing significant environmental challenges from the effects of climate change on the Great Barrier Reef and critical agriculture water infrastructure. This past summer has seen the devastation of the 2019/2020 bushfire season, drought and floods bringing the environmental, economic and social impacts of natural hazards into acute focus, not only nationally, but also internationally. With the Covid-19 pandemic gripping the world, Australia now can reimagine, and develop, an alternative to the ‘business as usual’ approach in rebuilding a sustainable, resilient and prosperous future. The range opportunities include alternative energy supply, sustainable mining, water and land management, food production and improved education, health and knowledge services. In the past, Australia has been slow to embrace many of these opportunities, largely due to the continuation of the ‘business as usual’ policy and a political approach to development. In this paper we examine an alternative strategic planning-based approach to developing a framework for transition to sustainable and resilient prosperity in Australia. We review the literature to: (i) identify a range of management competencies useful to building this framework for transition; (ii) demonstrate how these key competencies can be integrated into a strategic planning-based framework; and, (iii) identify the key policy and practical implications of this framework. Finally, we present indicators that establishing this framework for transition and developing these key competencies is both feasible and provides the opportunity for Australia to leverage the events of 2020 as a pivot to demonstrate leadership in addressing the challenges and opportunities in achieving sustainable and resilient prosperity. That is, our objective is to provide a foundation for systematic strategic planning at a national level including illustrations of its application in practice.

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1.0 Introduction

There was a popular meme circulating as the world confronted the initial challenges of the Covid-19 pandemic: ‘Mother Nature has sent us to our rooms ... she gave us fire and floods, she tried to warn us, but in the end, she took back control ... and when she has finished cleaning up our mess, she will let us out again. How will we use this time?’ (Ferguson, 2020).

Prior to Covid-19, Australia was already staring down the barrel of a range of ecological and related economic and social challenges. The emergence of Covid-19 exacerbated these challenges. However, the pandemic has also provided a period in which to reflect on the current ‘business as usual’ approach. This paper examines the feasibility of an alternative strategic and systems theory approach to address complex sustainability challenges and opportunities that Australia is currently facing. To test the application of this alternative systems approach, we examine a ‘*framework for transition*’ that could facilitate moving beyond the current ‘business as usual’ public policy approach to development.

Section 1 provides a brief overview of Australia’s current position and the opportunity Australia presents as a case for examining pathways to sustainable futures. In Section 2 we review the literature to: (i) identify a social change model and a range of management competencies that could be utilized to achieve sustainable outcomes; (ii) identify systems change leverage points that could be utilized to test this model; and (iii) examine how this model and these management competencies and leverage points can be integrated into a strategic planning-based *framework for transition* to achieve these outcomes. In Section 3 we test the application of this framework against the ‘business as usual’ approach with reference to the systems change leverage points and, in Sections 4 and 5, we discuss policy choices, implications and conclusions derived

from this framework.

1.1 Australia as a case study for developing a framework for transition to achieve sustainable outcomes

Prior to Covid-19, Australia was already at a sustainability crossroads. The 2019/2020 bushfire season devastated large regions of south-eastern Australia's unique ecosystems and natural heritage. The associated economic impact, measured in simple terms such as insurance payouts and impact on industries such as tourism, has been estimated by Moody's Analytics to exceed AUD \$4 Billion (Butler, 2020), not including the \$2 Billion Federal Government's commitment for rebuilding after the fires (Heathcote, 2020; Moore, 2020). Likewise, over the last decade more than 90% of the Great Barrier Reef (GBR) has been bleached, and an estimated 50% of corals have died. The 2020 bleaching has been the worst experienced to date, in both coverage and severity, with concerns being raised as to the GBR's ability to recover (James, 2018; Johnstone, 2020; Kilvert, 2019). The nation has witnessed further ecological, economic and societal impacts in the Darling River Basin ecosystem, one of Australia's major river basins extending through the states of Queensland, NSW and South Australia. This region provides the lifeblood for over 39% of Australia's agriculture production, worth over AUD \$15 Billion (ABS, 2019). The combination of fires, drought, heat-waves and unprecedented flooding, much of which has been attributed to the impacts of climate change, have left entire communities economically and socially devastated (Slatery, 2019). However, despite these major threats to the country's ecological well-being, the 2019 IPBES Report identified Australia as being one of the worst performing nations for environmental management (IPBES, 2019).

Australia has not only been identified as a laggard in addressing environmental challenges, but also in policy settings addressing a range of economic issues. The lack

of oil reserves, electric vehicle (EV) development and deployment, and renewable energy production, exemplify this (Derwin, 2019; G. Drew, 2015; OR, 2019). In social policy, although Australia has prided itself on its social cohesion and multiculturalism (CSIRO, 2019) societal challenges remain. For example, over the past decade measures of social cohesion (sense of belonging and worth, social justice, equity, political participation, attitudes to newcomers) have declined by over 10% (CSIRO, 2019). Australia has also slipped from 15th to 32nd in global rankings of gender equality, and in measures of political empowerment, from 35th to 48th (AHRC, 2018). ‘Closing the Gap’ strategies to address inequalities between indigenous Australians and the rest of society have also met with very limited success (AIHW, 2019).

A further measure of the nation’s performance in addressing the sustainability agenda is Australia’s rankings in progress towards achieving the UN Sustainable Development Goals (SDGs). Australia is ranked lower than most other advanced countries (Thwaites & Keston, 2018) on the global SDG index, and between 2016 and 2018 the nation slipped from 20th to 37th position in the world (Thwaites, 2016). The 2019 Senate review of the SDGs in Australia identified limited understanding, endorsement and coordinated action on the SDGs across both geographical and organizational boundaries (FADTRC, 2019).

Australia, therefore provides a useful case in which to examine the development of a *framework for transition* to address the nation’s current ecological, economic and societal challenges in achieving sustainable outcomes for three reasons: (i) Australia’s unique ecological, economic and social landscapes present a broad range of sustainability challenges, as well as opportunities; (ii) Australia’s Indigenous heritage represents the longest continuous history of sustainable prosperity globally (Gittins, 2015; Pascoe, 2014); and, (iii) both theoretical modelling and research on northern

Australia has identified *sustainable prosperity* as a feasible option for Australia, however, an option that is dependent on successful development and implementation of public policy changes (Chambers, Russell - Smith, et al., 2018; Hatfield-Dodds et al., 2015). Further, Australian National University's (ANU) research conducted on northern Australia identified a range of opportunities including alternative energy supply, sustainable mining, water and land management, food production, and improved education, health and knowledge services (Chambers, Russell - Smith, et al., 2018). A more detailed background on both the sustainability challenges and opportunities Australia is facing is included in Supplementary Information.

1.2 The gap and the opportunity that this paper addresses

At a practical level, this paper aims to address the gap between the opportunity for Australia to achieve *sustainable prosperity (SPR)* as identified in the modelling work of Hatfield-Dodds et al. (2015) as well as the ANU's northern Australia study (Chambers, Russell - Smith, et al., 2018), and the direction that current policy choices are taking the nation (Hatfield-Dodds et al., 2015).

At an academic level the paper aims to further develop the work of Costanza et al. (2017) on 'overcoming societal addictions' and the application of an individual focused behavioural change model - Motivational Interviewing (MI) - at a national level (Costanza et al., 2017). Costanza et al. (2017) postulate that one of the reasons that society and nations have struggled to move beyond the 'business as usual' approach to development is 'societal addiction' to an established set of social norms and approaches to development (Costanza et al., 2017). To address this, the authors propose a novel approach to achieve sustainable outcomes based on the adaptation of the MI model at a societal level. Given the political ambivalence and deadlock that Australia has demonstrated over the past quarter of a century, on issues ranging from climate change

to energy policy, adaptation of the MI model at a national level provides an opportunity to overcome this impasse and reset public policy to a direction that can achieve the sustainable prosperity outcomes identified by Hatfield-Dobbs et al. (2015).

This paper is therefore structured around the examination of key elements of the MI model and its application at a national level. The approach utilises systems theory to identify of a range of *management competencies* that can be applied at a national level to adapt the MI model and the integration of these *management competencies* into a *framework for transition to achieve sustainable prosperity*.

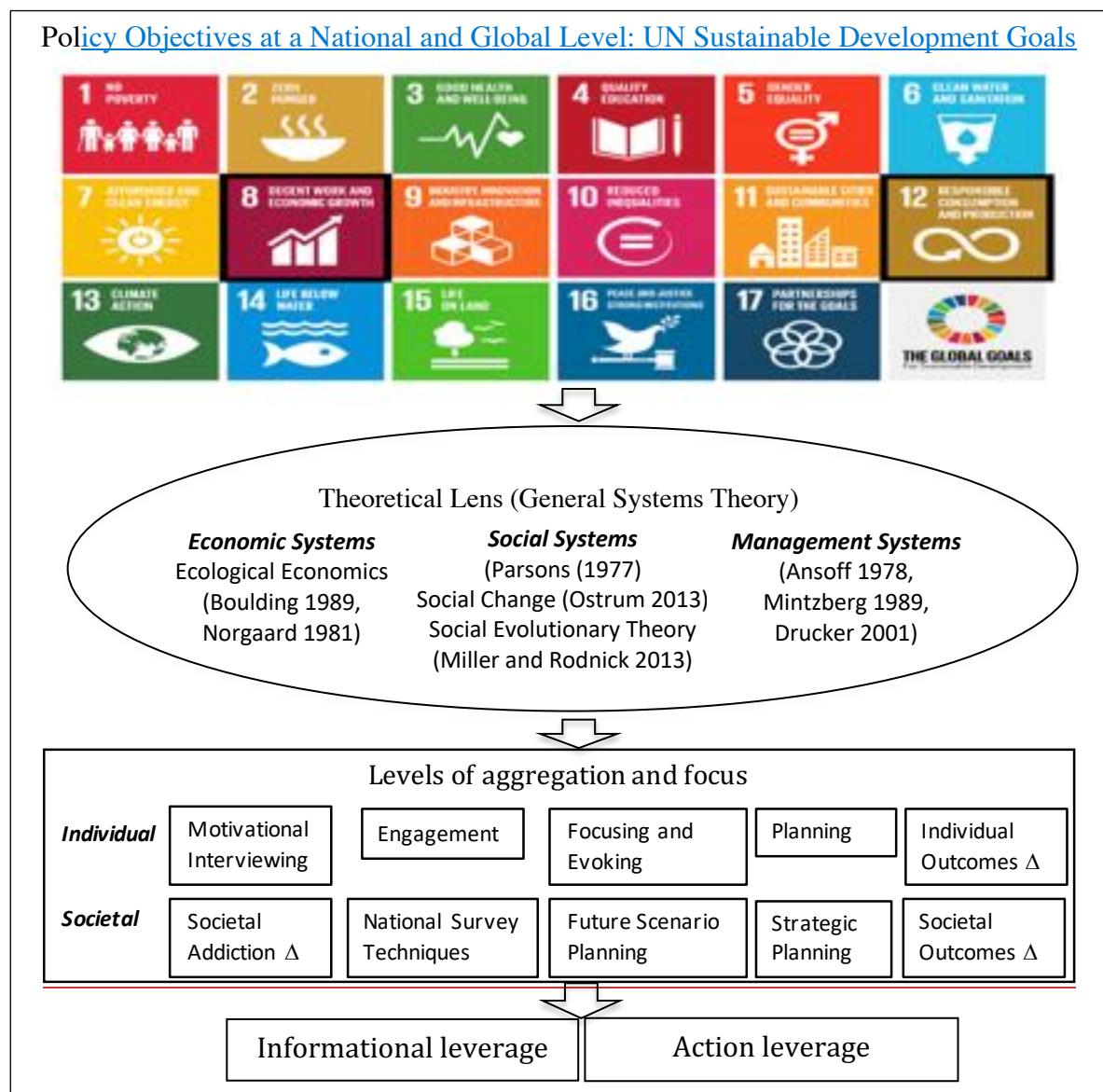


Figure 1. Leveraging the Motivational Interviewing and Strategic Planning models at a national level to develop a potential framework for transition to sustainable prosperity

Figure 1 summarises this approach and includes a summary of: (i) the MI framework for individual behavioural change management; (ii) the potential application of the MI model at a societal level, including societal application ‘gaps’; and (iii) the theoretical frameworks that underpin this application.

Complementing the social change model of Constanza et al. (2015), Meadows (1997) identified twelve leverage points for social change intervention (Table 1) (D. Meadows, 1997). These leverage points provide a useful structure against which to test both the potential impact of the adaptation of the MI model, as well as a comparison of an alternative framework for transition to the current ‘business as usual’ approach.

Order of effectiveness	Leverage points	Description
1	Transcend Paradigms	The power to transcend paradigms.
2	Mindset or Paradigm Shift	The mindset or paradigm out of which the system — its goals, structure, rules, delays, parameters — arises.
3	Goals	The goals of the system
4	Empowerment	The power to add, change, evolve, or self-organize system structure
5	Rules of the System	The rules of the system (such as incentives, punishments, constraints)
6	Access to Information	The structure of information flows (who does and does not have access to information)
7	Positive Feedback Loops	The gain around driving positive feedback loops
8	Negative Feedback Loops	The strength of negative feedback loops, relative to the impacts they are trying to correct against
9	Rate of Systems Change	The lengths of delays, relative to the rate of system change
10	Material Parameters	The structure of material stocks and flows (such as transport networks, population age structures).
11	Stabilising Buffers / Stocks	The sizes of buffers and other stabilizing stocks, relative to their flows
12	Economic Parameters	Constants, parameters, numbers (such as subsidies, taxes, standards).

Table 1. Meadows leverage points for systems change in decreasing order of effectiveness (where 1 = most effective)

2.0 METHODOLOGY: DEVELOPING A *FRAMEWORK FOR TRANSITION TO SUSTAINABLE PROSPERITY*

Although it is of concern that Australia’s success in addressing the challenges and opportunities of the global sustainability agenda has been limited, it should not be a surprise as this has been described as a ‘wicked problem’ (Pryshiakivski & Sercy, 2012). The interdependence of economic, ecological and social sub-systems results in one of the most significant challenges in developing visions and strategies to achieve

sustainable outcomes (Costanza et al., 2015; Tuckson, 2014). Further, the complexity of addressing the interconnectivity of these three sub-systems often results in them being ‘disconnected’ at political, policy and academic levels (Costanza, 2014b; FADTRC, 2019). As a result, Australia’s ‘business as usual’ approach to development has often failed to address both the convergence of these three subsystems and this interconnectivity (Tuckson, 2014).

2.1 Utilising systems thinking to identify potential management competencies to address this ‘wicked problem’

Systems theory, in establishing a common theoretical platform to address the interconnectivity of ecological, economic and social sub-systems (Beralandffy, 1968; Boulding, 1968), provides a framework within which to address the complex societal issues inherent in this ‘wicked problem’. As noted by Gough and Longhurst (2018), this commonality in theoretical foundation provides the scope to integrate these sub-systems, leverage their convergence and facilitate desired sustainable outcomes such as the United Nations Sustainable Development Goals (SDGs) (Gough & Longhurst, 2018).

The emphasis on the interconnectivity of sustainable outcomes, as well as the monitoring, measurement and feedback loops that general systems theory provides, (Costanza et al., 2015; D. H. Meadows, 1999), also underpins the Adaptive Management (AM) framework (see Figure 2) used extensively in ecological systems management (Schreiber, Bearlin, Nicol, & Todd, 2004). This is also consistent with the key components of the MI behavioural change model (Miller & Rollnick, 2012).

Within general systems theory, *social change and social evolutionary theory* emphasises the unique and important role that visioning can play in engaging, motivating and achieving change in both individual and social contexts (Costanza et

al., 2017). As part of the social subsystem underpinning this, *future scenario planning* (SP) provides a management competency that has been used to facilitate visioning at a societal level (Kahane, 2004).



Figure 2. Key components of the Adaptive Management and monitoring cycle (Salafsky, Margoluis, & Redford, 2001; Schreiber et al., 2004)

Critical to the success of visioning in the MI model is individual engagement in the visioning process (Miller & Rollnick, 2012). A further management competency, *Community engagement* (CE), is therefore also required to facilitate the *engaging, focusing and evoking* (visioning) components of the MI model at a societal level. Further, *community engagement* (CE) in the *future scenario planning* (SP) process also addresses a number of Meadows’ higher-priority systems change leverage points – *goal setting* and *empowerment* (D. H. Meadows, 1999). As also observed in Table 1, *economic and social incentives, punishments* and *constraints*, are also included in Meadows’ leverage points. However, traditional *macroeconomic theory* is limited by Adam Smith’s ‘exclusions’ of social issues, such as poverty, and ecological issues as ‘externalities’ (Randall, 1999). Traditional economic theory also lacks the inclusiveness the United Nations seeks achieving sustainable outcomes exemplified in the Sustainable Development Goals (SDGs) (UN, 2016).

Ecological economics uses a general systems theory approach to expand classical economic frameworks to include ecological and social parameters, and the limits imposed by these parameters (Costanza et al., 2015). This expanded parameter set therefore provides a broader scope within which to manage Meadows' lower order leverage points such as incentives, punishments and constraints, within the rules of the system.

Management systems, also build on general systems theory, providing a 'discipline agnostic' approach to integrating economic, ecological and social objectives and outcomes through an additional management competency that is reflected in the *planning* phase of the MI model - *strategic planning* (Balducci, Valeria, & Gabriele, 2011; Herriman, 2010). The application of management systems approaches has also contributed to the development and application of 'Think Global, Act Local' frameworks and structures to achieve change in both local and global social organisations (Nagy & Fawcett, 2009), a core tenant of the UN approach to the SDGs (Patole, 2018). Furthermore, the recent inclusion of ecological parameters, such the 'triple bottom line' and the Global Progress Indicator (GPI) as alternatives to GDP, have facilitated the incorporation of ecological and social sub-systems into these strategic planning and management frameworks. However, as again noted in the MI model, individual engagement in the planning phase is a key component of the models success (Miller & Rollnick, 2012). Therefore, *community engagement (CE)* in the *strategic planning* (STP) process is an important factor in the application of the MI model at a societal level.

Future scenario planning (SP), *strategic planning* (STP) and *community engagement* (CE) provide three management competencies that: (i) can be used to adapt the MI model at a national level; (ii) are consistent with Hatfield-Dodds et al. (2015)

modelling, which identifies the importance of both ‘bottom up’ individual choices and ‘top down’ collective choices in achieving sustainable prosperity outcomes (Hatfield-Dodds et al., 2015); (iii) incorporate the adaptive management cycle; and, (iv) integrate both the higher and lower order leverage points identified by Meadows (D. H. Meadows, 1999). *General Systems Theory* (Boulding, 1968) therefore provides the scope to integrate ecological, economic and social sub-systems, and leverage their convergence in a range of management competencies that can facilitate the achievement of sustainable outcomes.

2.2 Leveraging management competencies to adapt the MI model at a national level

Leveraging *Future Scenario Planning (SP)* and *Community Engagement (CE)*: As noted, critical to the success of the MI model is individual *engagement* in both focusing and evoking (visioning and feasibility), and planning processes (Miller & Rollnick, 2012). *Community engagement (CE)* in the *future scenario planning (SP)* process at a national level also provides the scope for the development of a national vision, consistent with the MI model (Miller & Rollnick, 2012). Management systems also emphasize the importance of visioning, engagement and empowerment of key stakeholders in the strategic-planning process (Balducci et al., 2011; CTB, 2019; Herriman, 2010; Nagy & Fawcett, 2009).

An example of how national *community engagement (CE)* can be combined with *future scenario planning (SP)* is demonstrated in a study conducted by the ANU of preferred future scenarios for Australia (Chambers, Costanza, et al., 2019). This study showed that national survey methodologies can be used, in conjunction with SP, to engage the community in the identification of preferred future scenarios (Chambers, Costanza, et al., 2019). This study is of particular interest when looking at community

engagement as it utilized two online methodologies at the national level: (i) a *demographically* representative sample ($n = 2083$); and (ii), a nationally advertised *self-selected* sample ($n = 485$). The results were consistent across both samples. However the use of the two methodologies enabled both the promotion of community engagement in the choice of preferred national scenarios in the self-selected sample methodology, as well as the validation of these preferences through the parallel use of the demographically representative sample, providing confidence levels of 99% +/- 0.03% (Chambers, Costanza, et al., 2019).

Leveraging Strategic Planning (STP): Long-term strategic planning has been successfully used to address a number of transition challenges. Of note is the use of the Marshall Plan to address the challenges of transition and transformation following the devastation of the Second World War in Japan (J. Sachs, 2008). Strategic planning has also been used successfully in other countries, such as Germany and China to transition to preferred futures at both economic and societal levels. The addition of sustainability goals combined with the *community engagement* process in the three most recent 5-Year Plans in China highlights how this approach can be transformative in achieving sustainable outcomes across the range of economic, ecological and social sub-systems at a national level (CCCCP, 2016; Jinping, 2017).

As noted, *community engagement* (CE) in the *strategic planning* (STP) process is a key component in the adaptation of the MI model at a national level for Australia. Further, national engagement in strategic planning in delivering preferred outcomes is emphasized by a number of authors such as Sachs, et al. (2019), who highlight that governments require both a coordinated strategy, combined with community engagement and co-design, to achieve a sustainable future outcomes (J. D. Sachs et al., 2019).

The feasibility of community engagement in the strategic planning process in Australia is demonstrated in a further ANU study of *Education for Sustainable Development* conducted across a national community subgroup of adolescents (Chambers, Roberts, Durant, & al., 2019). Ki-moon has emphasized the importance of *engaging* and *empowering* young people as key stakeholders to achieve trans-generational sustainability in the successful delivery of key sustainable outcomes - specifically the UN SDGs (Ki-moon, 2016; UN, 2016). Adolescents have also proved one of the more challenging subgroups to engage, and so this ANU study provides a useful example of the application of the SP and CE management competencies.

In the study, senior high school participants were invited to develop a strategic plan using a VMOSA (Vision, Mission, Objectives, Strategies, Actions) model to deliver sustainable outcomes based on the SDGs (Nagy & Fawcett, 2009). The strategic planning-based intervention was conducted across fifteen separate regions in Australia, with the regional plans then integrated by participants into a national plan to deliver the 17 SDGs (Chambers, Roberts, Durant, et al., 2019). Of particular note in this study, was that as well as demonstrating the feasibility of *community engagement (CE)* in the *strategic planning (STP)* process at a national level, the researchers also observed a *paradigm shift* in participant attitudes towards a *sustainable future mindset (SFM)*, reflective of Meadows' second highest ranked leverage point for systems change (D. H. Meadows, 1999). The combination of STP and CE, therefore, can potentially contribute a further leverage point in societal behavioural change – SFM – to the achievement of sustainable outcomes. A further benefit noted by a range of authors such as Coaffee and O'Hare (2008) and Cutter (2013) on the use of *strategic planning (STP)* is its contribution to the development of both regional and national *resilience* in these communities (Coaffee & O'Hare, 2008; Cutter et al., 2013).

Sustainable Development Goals (SDGs): Both the MI model and Meadows' leverage points emphasise *goal setting* in achieving individual and systems change (D. H. Meadows, 1999; Miller & Rollnick, 2012). As Australia is a signatory of the UN SDGs, along with 193 other nations, the SDGs provide an important framework for national goal setting to achieve sustainable outcomes (FADTRC, 2019). The integration of the SDGs with *community engagement (CE)* and *strategic planning (STP)* in a potential *framework for transition* has a number of further benefits for achieving sustainable outcomes in Australia: i.e. (i) the SDGs provides the opportunity to leverage global cooperation in achieving sustainable outcomes (J. D. Sachs et al., 2019); (ii) the SDGs are already being delivered across a range of political, government, business and community settings in Australia (FADTRC, 2019); and, (iii) the SDG 2030 objective provides a nationally and globally agreed timeline for the achievement of sustainable outcomes in Australia (FADTRC, 2019).

Fully utilizing the SDGs as a component of a *framework for transition* however requires two limitations to be addressed in their application to the Australian sustainable prosperity agenda to be addressed. The first of these is the requirement for an overall goal to bring the 17 SDGs together (Costanza, 2014a). As identified in this paper, this limitation can be addressed through the establishment of an overall *goal or vision* as an outcome of combining the *community engagement (CE)*, *future scenario planning (SP)* and *strategic planning (STP)* management competencies (Nagy & Fawcett, 2009).

The second limitation with the SDGs is explicitly addressing the issue of *population* (Allen, 2016). A 'big' Australia, levels of immigration, social cohesion, as well as built infrastructure requirements, have brought Australia's preferred population size increasingly into public debate when considering Australia's sustainable future (Lowe, 2012.). Addressing this issue is also consistent with the work on 'limits to growth'

which emphasises the importance of population impacts on ecosystem capabilities to support objectives such as economic, ecological and social prosperity (Costanza et al., 2015; D. Meadows, Randers, & Meadows, 2004). This issue can be addressed through the explicit rather than implicit inclusion of population (P), together with the SDGs, in a potential *framework for transition*.

2.3 Adaptation of the MI model at a national level

Combining *future scenario planning (SP)*, *strategic planning (STP)* *community engagement (CE)* management competencies with the *Sustainable Development Goals (SDGs)* and *Population (P)*, therefore, provides the opportunity to adapt the MI model of into a strategic planning-based *framework for transition* at a societal level that could be utilized in Australia to achieve sustainable outcomes as summarised in Figure 1.

3.0 APPLICATION OF A STRATEGIC PLANNING-BASED FRAMEWORK FOR TRANSITION IN AUSTRALIA

3.1 Application of *Future Scenario Planning (SP)* and *Community Engagement (CE)* to develop a potential vision for sustainable prosperity in Australia

An example of how these management competencies can be combined to develop a vision for Australia's sustainable future is demonstrated in the ANU study on preferred future scenarios for Australia (Chambers, Costanza, et al., 2019) discussed in Section 2. In this study, 'Community Well-being' was identified as the preferred national scenario. Further, it is noted that this preferred 'Community Well-being' scenario is consistent with: (i) sustainable prosperity outcomes (Hatfield-Dodds et al., 2015); (ii) the SDGs (FADTRC, 2019); and (iii) the Earth Charter (2000) (Chambers & Humble, 2017). The scenario therefore provides a useful commencing point to develop a vision for Australia's sustainable future. An example of this is demonstrated in the *Education for Sustainable Development (2019)* study where *future scenario*

planning (SP), *strategic planning* (STP), and *community engagement* (CE) were applied to the UN SDGs and the Earth Charter to develop a national *vision*.

Australia, a country where there is respect for nature, observance of universal human rights, economic justice and sustainability, and a culture of peace.

(Chambers, Roberts, Urbaniak, et al., 2019).

3.2 Application of *Community Engagement* (CE), *Strategic Planning* (STP) and the SDGs in the planning process

As has already been highlighted in Section 2, the SDGs provide a nationally as well as globally agreed framework and set of goals that Australia can utilize to transition to sustainable prosperity. The challenge with the SDGs is to turn these goals into objectives, strategies and action plans, and these action plans into on-ground action. However, as discussed above, the benefit of *strategic planning* (SP) is that it provides a systems-based approach for integrating key economic, ecological and social components of the *SDGs* under a planning and delivery framework. This effectively replicates the MI approach at a societal level (Costanza et al., 2017).

An example of how *strategic planning* (STP) and *community engagement* (CE) can be applied to the planning and delivery of the *SDGs* in Australia is further demonstrated in the *Education for Sustainable Development* study (Chambers, Roberts, Urbaniak, et al., 2019). Figure 4 provides a specific example of how *strategic planning* (STP) was applied to SDG 7: Affordable and Clean Energy by this adolescent community segment.

SDG Vision: Reliable and efficient energy (solar, wind and biofuels) that improve the quality of life and protect the environment.					
Focus Areas Top 4 from across Australia	Objectives What are we aiming to achieve?	Strategies How are we going to achieve this?	Actions What do we have to do to achieve this?	Outcomes/Measures What are the results we want to achieve and how can we measure these?	SDG Interconnects
I. Renewable and Reliable Energy for Australia - Including small and isolated Communities.	A thriving economy based on a secure, efficient and predominantly renewable energy supply (including solar, wind and biofuels) - providing constant reliable cheap energy, alongside the creation of jobs. Replace fossil fuel generators in small and isolated communities with renewable energy sources (such as solar and wind) to reduce the reliance on and consumption of non-renewable energy and fuels.	State, Territory and Federal government funding for a network of alternative energy sources (solar, wind and biofuels), accompanied by battery storage. In small and isolated communities replace fossil fuel generators and/or unreliable/inefficient power supplies - hence, reducing the consumption of non-renewable energy and fuels. 'Take communities off the grid' to avoid power loss through transmission lines.	Identify suitable locations to build plants for alternative energy sources (solar, wind and biofuels). Federal Government to fund plants via NAB (Northern Australia Infrastructure Facility) and other appropriate funding bodies. Fund through an increase in the fuel action.	Increased use of renewable energy sources with battery storage. Increased business development. Increased employment in renewables to replace jobs lost in non-renewable industries. Use of diesel generators as emergency backup only.	Decent Work and Economic Growth Industry, Innovation and Infrastructure Responsible Consumption and Production Sustainable Cities and Communities Climate Action Partnerships for the Goals
II. Investment and Funding for Energy Research - into new and current renewable energies.	Exploration of new renewable energy sources that are cost-effective and more efficient. Ongoing research to improve current technologies so that they're more efficient and profitable. Suitable locations for implementation and lowering the cost for individuals and businesses. Reduction of high-price energy.	State, Territory and Federal government investment and funding for the exploration of new renewable energy sources, alongside further research to improve current technologies (including new facilities for this sole focus). Encourage participation from universities - receive funding from State, Territory and Federal Governments. Improve research facilities.	Identify suitable locations to build plants for alternative energy sources (solar, wind and biofuels). Promote the use of renewable technologies. Funded through levies on non-renewable energy producers - levies reduced if producers significantly invest into independent renewable research.	Increased use and improvement of current renewable energy sources. Establish how effective and beneficial renewable technologies are (both for individuals and businesses). Establish the cost and environmental impact of new and current renewable energies. Increased business development/research facilities. Increased employment. Reduce carbon emissions. More affordable energy.	Decent Work and Economic Growth Industry, Innovation and Infrastructure Responsible Consumption and Production Climate Action Quality Education Sustainable Cities and Communities

Figure 4: A strategic planning-based model for United Nations Sustainable Development Goal (SDG) 7: Affordable and Clean Energy

From this study, there were a number of additional benefits to the application of strategic planning (STP) and community engagement (CE) to the SDGs to achieve sustainable outcomes:

(i) Figure 3 illustrates how interconnectivities can be identified and linked (Column 5) providing a framework for goal-based design and organization, and key factors for successful transformation to achieve the SDGs (J. D. Sachs et al., 2019);

(ii) In addition to leveraging the interconnectivities of the SDG, this study demonstrated the ability to utilise *strategic planning (STP)* to cascade and integrate regional, state and national plans across the each of the SDGs. The outcomes of this study are presented in Figure 5 for SDG 4: Quality Education (Chambers, Roberts, Urbaniak, et al., 2019). The modular and scalable capability of the intervention used in this study therefore demonstrates an approach that could be utilized to overcome the current challenges of integration and coordination in delivery of sustainable outcomes that

Australia has been experiencing with the SDGs (FADTRC, 2019);

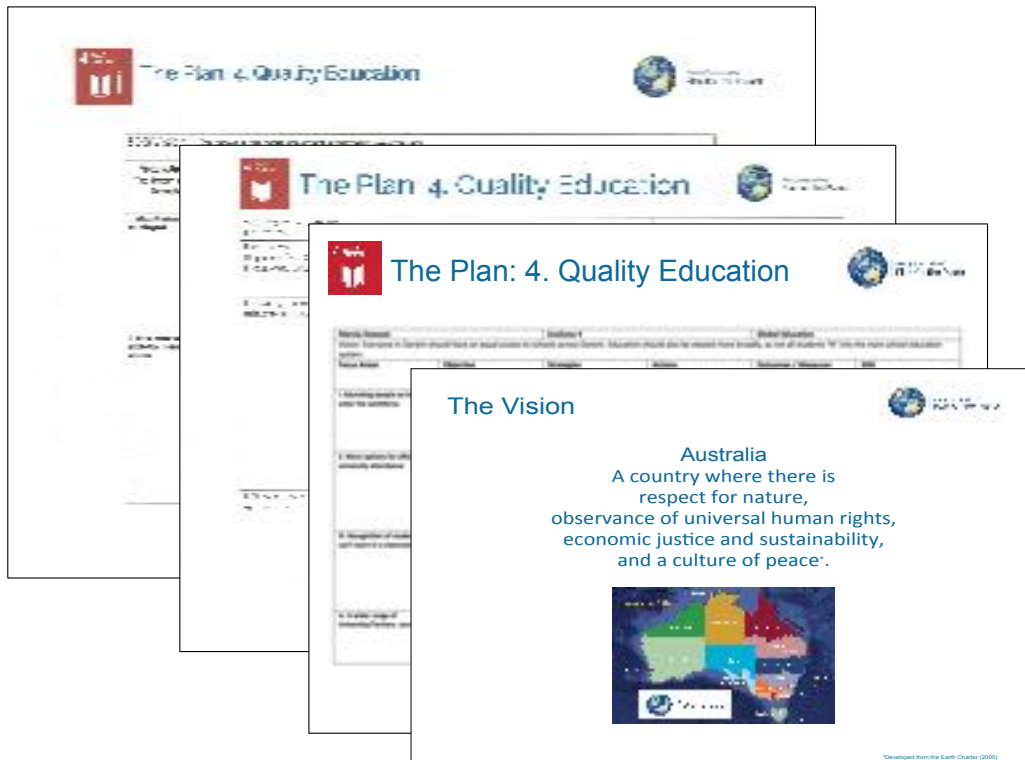


Figure 5. Outcomes of the strategic planning-based model for a national vision and the United Nations Sustainable Development Goal (SDG) 4: Quality Education plans for Australia (national), South Australia (state) and Darwin (regional)

(iii) Integration of these management competencies – future scenario planning, strategic planning and community engagement – provides consistency between Vision and individual SDG Objectives, Strategies, Actions and Measures;

(iv) The inclusion of ‘Interconnectivities’ as part of this VOSAM strategic planning resulted in two of the additional leverage points identified by Meadows - positive and negative feedback loops - to be incorporated into the *strategic planning* (STP) framework (D. Meadows, 1997). This provides consistency with the AM model for ecological management (Schreiber et al., 2004);

(v) The *Education for Sustainable Development* study showed increased *empowerment*, one of Meadows’ higher ranked leverage points (D. H. Meadows, 1999). As well as the sense of empowerment, the study also reported an increase in ‘*action orientation*’,

enabling active participants to achieve sustainable outcomes (Chambers, Roberts, Urbaniak, et al., 2019);

(vi) *Community engagement* (CE) in the *strategic planning* (STP) process provides the opportunity to leverage community skill sets for achieving the *SDGs*. An example particularly relevant to Australia is a study by Russell-Smith et al. (2017) on local *community engagement* in fire management in northern Australia (Russell-Smith & Whitehead, 2015). In this study, Indigenous (Aboriginal) community understanding of, and skills in fire management techniques are leveraged to provide a range of ecological, economic and societal benefits (Russell-Smith et al., 2015). Application of these skills significantly reduced wildfire damage, including carbon and greenhouse gas emissions release, compared to adjacent regions where this skill base was not utilized (Russell-Smith & Whitehead, 2015). In this study, *community engagement* provided economic as well as ecological benefits, through marketable carbon offsets and societal benefits such as the validation of skills and community heritage. Similar results have been obtained with the use of Indigenous feral animal control in Indigenous Ranger programs, Indigenous agricultural and aquaculture approaches to food production, sustainable land management, gender equality in governance (Poulter, 2016b) and mine rehabilitation (Chambers, Russell - Smith, et al., 2018);

(vii) The *strategic planning* competency provides a mechanism for ongoing evaluation, review and update in line with MI (Miller & Rollnick, 2012), AM (Schreiber et al., 2004), and systems models (Barbier & Burgess, 2017).

(viii) As previously noted, *community engagement* (CE) in *strategic planning* (STP) increases community *resilience* (Coaffee & O'Hare, 2008).

(ix) Finally, alignment with the *SDGs* provides a United Nations 2030 *timeline for transition* to sustainable outcomes (FADTRC, 2019).

3.3 A potential *framework for transition to a sustainable, resilient and prosperous future*

As outlined by Meadows (D. H. Meadows, 1999, 2008), Costanza (Costanza, 2014b) and Tuckson (Tuckson, 2014), effective societal change requires an integrated approach to subsystems management. As discussed in the previous section, the application of *community engagement (CE)*, *future scenario planning (SP)*, *strategic planning (STP)* and integration with the *SDGs* provides the opportunity to integrate these management competencies into a strategic planning-based *framework for transition to sustainable prosperity (SPR)*. This approach has the further benefit of also potentially developing a *sustainable future mindset (SFM)*, as observed in the *Education for Sustainable Development* study (Chambers, Roberts, Urbaniak, et al., 2019).

Examples in this paper aim to demonstrate the feasibility of this strategic planning-based *framework for transition* as a model for achieving sustainable and resilient prosperity in Australia. This can be summarised as:

- (i) leveraging *community engagement (CE)* through national survey methodologies combined with *future scenario planning (SP)* to identify a preferred national future and shared *vision for Australia*,
- (ii) leveraging *community engagement (CE)* and *strategic planning (STP)* with the 17 *SDGs* combined with a *Population (P)* goal and a *sustainable future mindset (SFM)*
- (iii) to achieve *sustainable ecological, economic and social prosperity (SPR)*

Although Australia has been used a case study in which to test the feasibility of this framework, the modular and scalable approach provides the opportunity to apply the framework equally to other geographic regions and countries.

3.4 Testing this *framework for transition* against Meadows' key leverage points

It is useful to revisit Meadows' key leverage points and compare Australia's current 'business as usual' approach to the 'strategic planning' framework presented in this paper. To achieve this, the 'business as usual' approach (Table 2) is based on: (i) the Federal Government White Paper on Developing the North (CoA, 2015); and (ii) the introduction of the 'carbon tax' with its focus on economic parameters. The 'strategic planning' framework is based on: (iii) the ANU study on achieving sustainable prosperity in northern Australia (Chambers, Russell - Smith, et al., 2018); and (iv) the principles outlined in the *framework for transition*.

No	Key Leverage Points	'Business as Usual' Approach		'Strategic Planning - Based' Framework		Combined
1	Transcend Paradigms	Not included		Not included		
2	Paradigm Shift	Not included		Engagement Driven	☆	☆
3	Goals	Uncoordinated approach to SDGs		Coordinated approach to SDGs	☆	☆
4	Empowerment	Imposed		Facilitated	☆	☆
5	Rules of System	Imposed	☆	Engagement Driven		☆
6	Information	Not included		Included	☆	☆
7	Positive Feedback	Not included		Measures	☆	☆
8	Negative Feedback	Included in 'tax'	☆	Measures	☆	☆
9	Rate of change	Rapid	☆	Community Driven	☆	☆
10	Material Parameters	Imposed (tax paying segment)	TBD	Covers all age segments	TBD	TBD
11	Stabilising Buffers	Business as Usual	☆	Preferred Future	☆	☆
12	Economic Parameters	Regulated	☆	Community Driven		☆
Total			5		8	10

Table 2. Comparison of the 'business as usual' approach to the 'strategic planning' framework based on Meadows key leverage points

The first observation in this comparison is that the 'strategic planning' framework activates a greater number of Meadows' key leverage points than the 'business as usual' approach. A second observation is the impact of this framework on

Meadows' higher order leverage points (*paradigm shifts, goals and empowerment*) compared with the 'business as usual' approach. It is also useful to note that this 'strategic planning' framework is not without precedent in both Australia and internationally, for example: the bipartisan approach to the development of the Australian Wages Accord in 1983 (Ewer & Higgins, 1986); and the current approach being taken to the transition to renewable energy in Germany (Brown & Hess, 2016).

When combining the 'business as usual' approach (economic parameters) with the 'strategic planning' framework (*paradigm shifts, goals and empowerment*), we observe an even stronger model for systems change based on Meadows' leverage points, highlighting that the opportunity to leverage a *framework for transition* to sustainable prosperity can build on the current 'business as usual' approach rather than replacing it.

3.5 Other key benefits of a Strategic Planning-based *framework for transition*

There are a number of additional benefits of this *framework for transition* to sustainable prosperity for Australia compared to the current 'business as usual' approach: (i) the framework is apolitical and, therefore, can be developed, updated and managed across political divides, having as its key outcome the common goal of sustainable prosperity; (ii) the framework provides a long-term approach to achieving sustainable prosperity as compared to the 'business as usual' model often driven by short-term political agendas; (iii) the framework has as its core the SDGs, the global agenda for sustainable development; (iv) the framework embraces key higher level system change leverage points, such as establishing *common goals, feedback loops, community engagement and community empowerment*; and (v) the framework can be constantly updated thus accommodating the dynamically changing economic, ecological and social environments.

4.0 DISCUSSION

As outlined at the introduction of this paper, Australia is at a sustainability crossroads. Whilst facing challenges to its sustainable economic, ecological and social prosperity, the Covid-19 ‘hibernation’ period provides an ideal opportunity to rethink and re-set the national agenda to align more fully with a publicly preferred future for the nation (Chambers et al., 2010).

4.1 Developing policy choices to achieve sustainable prosperity

Both Hatfield-Dodds et al. (2015) and the northern Australia sustainability study (2019) highlight the importance of policy changes if the nation is to achieve sustainable prosperity (Chambers, Russell Smith, & Costanza, 2018; Hatfield-Dodds et al., 2015). Though clearly beyond the scope of this paper to cover the fully policy implications, it is useful to identify the range of policy, political and practical applications of this *framework* in the outcomes of the Education for Sustainable Development study discussed in Section 2 (Chambers, Roberts, Urbaniak, et al., 2019). These are summarised in Table 3.

UN SDGs	Public Policy (examples utilizing the Education for Sustainable Development study)
1. No Poverty	Prevention: Addresses causes through universal health, education, employment, care and housing Adaptation: Development of community services tailored for individual needs Leverage: Raise community awareness of causes, impacts and solutions
2. Zero Hunger	Prevention: Guaranteed access to clean water and low-cost fresh food for Indigenous communities Adaptation: Increased research and investment in climate change resistance farming practices Leverage: Focus on increased local food production
3. Good Health	Prevention: Improve health in the community through promotion of physical activity & healthy eating Adaptation: Provide healthcare to all communities through clinics and on-line medical care Leverage: Provide funding towards major diseases and illness impacting Australians.
4. Quality Education	Prevention: Compulsory early childhood education for all. Adaptation: All students to learn second language of major trading partners Leverage: Improved education through teacher quality and enrichment programs
5. Gender Equality	Prevention: Fair ratio of men and women in positions of power in politics, business & community Adaptation: Provide women, girls and LGBT victims with ERS (effective response services) Leverage: Equal opportunities across all subjects especially STEM programs
6. Clean Water and Sanitation	Prevention: Building of appropriate infrastructure to prevent water disasters Adaptation: Reduction program for water contaminants due to gas, mining pesticides and fertilisers Leverage: All Australian communities guaranteed access to clean drinking water

7. Clean Energy	Prevention: Explore cost effective private and public transport alternatives Adaptation: Funding for alternative clean energy sources Leverage: Manufacture and use biofuels for vehicles, aircraft and industry
8. Decent Work & Economic Growth	Prevention: Improve inter-regional trade through coast and environmental cost reduction Adaptation: Develop more sustainable methods of agriculture and manufacturing around Australia Leverage: Focus on high return industries such as tourism and high technology
9. Industry, innovation & infrastructure	Prevention: Sustainable global best practices adopted in industry, government and community Adaptation: Upgrade and coordinate infrastructure to address sustainability challenges & opportunities Leverage: Develop and implement new technologies targeted towards renewables and sustainability
10. Reduced inequalities	Prevention: Establish minimum standards for key household resources including water and energy Adaptation: Increased support for Indigenous and non-English speaking background Australians Leverage: Increase support for disadvantaged children to achieve best schooling outcomes
11. Sustainable Cities	Prevention: Establish minimum standards for household water and energy efficiency Adaptation: Pollution and consumption reduction programs Leverage: Focus on affordable and sustainable housing and transport services
12. Responsible Production and Consumption	Prevention: Reduce food transportation and refrigeration products in Australia. Adaptation: Ensure sustainable production and management in the Murray Darling Basin Leverage: Incentives for conversion of inefficient to efficient product ranges
13. Climate Action	Prevention: Research impacts & actions to address climate change (economic, ecological & social) Adaptation: Raise awareness of climate change, its impacts, prevention and adaptation strategies Leverage: Develop and integrate renewable technologies to achieve global competitive advantage
14. Life below Water	Prevention: National program for the eradication of invasive aquatic species Adaptation: Address key impact factors to address degradation of ocean and inland (GBR, MDB) Leverage: Increased research to achieve sustainable life under water (reefs, lakes, dams and habitats)
15. Life on Land	Prevention: Control and eradication of key invasive species such as feral cats Adaptation: Education to achieve greater awareness of biosecurity in the community Leverage: Support sustainable farming projects through education, tax concessions, carbon credits
16. Peace	Prevention: Prevention programs to address issues of alcohol and drug related youth/community crime Adaptation: Increased education re domestic violence: rights, freedoms and laws. Leverage: Government, community and business partnerships focused on youth crime reduction
17. Partnership	Prevention: Increased research and facilities funding to implement improved SDG implementation. Adaptation: Greater collaboration/coordination across government/business/community on the SDGs. Leverage: Greater collaboration and coordination with Indigenous communities on the SDGs.

Table 3: Public policy examples leveraging the strategic planning-based framework of transition

4.2 Structural support for a strategic planning-based *framework for transition*

Management consultants McKinsey highlighted the importance of supporting strategy with structure in their 7S framework (Singh, 2013). The current fragmented approach to SDG deployment in Australia demonstrates, however, that there are no obvious national structural facilities or organizations that can effectively coordinate this *framework for transition* (FADTRC, 2019). There is, however, scope to potentially address this gap through the development of a Centre of Excellence focused on: (i) addressing the challenges and leveraging the opportunities; and, (ii) developing world's best practice in key competencies and methodologies to achieve sustainable prosperity

across each of the key systems.

There are already a number of initiatives taking place in this area, for example, the Australian-based Commission for Human Futures (CHF, 2020) has called for the world's nations to come together to develop a strategy for human survival. The CHF recognises that intersecting catastrophic risks to human civilization pose an increasing danger to our common future and require integrated solutions, shared worldwide. It identifies ten such risks, many of which are raised in this paper. It also foresees great opportunity for growth, renewal, opportunity, wellbeing and sustainability flowing from effectively addressing such risks.

The recent establishment of the U7 group of international universities, of which Australia is a participant through the ANU, also provides an opportunity for the nation to take international leadership in approaches to achieving sustainable prosperity (Frocrain, 2019). A recent study on attitudes to climate change across Australia found that, even in rural regions where there was a lower perception of the threat of climate change, participants still believed Australia should be taking a global leadership role in addressing the issue (Neilson, 2019). Following the 2019/2020 bushfires, environmental issues equaled the economy as the issues of highest concern across the Australian population (Coorey, 2020).

Australia's strategic geographic position, adjacent to historically one of the fastest growing global markets in Asia, combined with its significant opportunities in exportable sustainable resources such as solar and biofuels, highlights the need to not leave success to chance. As emphasized by Porter (2011), a country's competitive advantage is achieved by two key factors: (i) a nation's ability to understand and address global challenges and opportunities; and (ii) the nation's strategic focus (Porter, 2011). The Centre of Excellence approach would utilize an established mechanism in

Australia to facilitate this type of evaluation and focus. Historically, Australia has ‘punched beyond its weight’ in key areas of scientific research and much of this has been attributed to the success of the Centre of Excellence approach (ARC, 2020). Australia has the opportunity to apply this to perhaps its greatest challenge – long-term sustainable and resilient prosperity.

5.0 CONCLUSIONS

Australia has often been described as ‘the lucky country’ (Schultz, 2010) due to the nation's historical ability to leverage what has been perceived as an apparently ‘endless supply’ of natural resources. However, the era of the ‘lucky country’ is coming to an end as the nation's resources start to run out, the population grows, the global economy transitions and the climate changes. As Hatfield-Dodds et al. (2015) (Hatfield-Dodds et al., 2015) outline, the emergence of this new set of challenges means that sustainable prosperity is far from an inevitable outcome. The Covid-19 pandemic has further demonstrated that a more integrated, and long-term, approach is required to both anticipate and address the economic, social and ecological challenges that have emerged.

In this paper we have argued that these changing global economic, ecological and social environments require a strategic and systems-based approach with a clear vision, objectives and strategies to facilitate ongoing transitioning for long-term sustainable and resilient prosperity. Covid-19 has provided an opportunity to move beyond the ‘business as usual’. There is now an opportunity to use this time productively and leverage potential highest order *paradigm shifts* (D. H. Meadows, 1999), to rethink and rebuild a sustainable, resilient and prosperous future for the ‘lucky country’. It is an opportunity that must not be wasted.

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6.0 SUPPLEMENTARY INFORMATION

6.1 AUSTRALIA 2030: ANALYSIS AND APPLICATIONS OF STRATEGIC PLANNING ACROSS A RANGE OF ECONOMIC, ECOLOGICAL AND SOCIETAL SETTINGS IN AUSTRALIA: SUPPLEMENTARY INFORMATION SECTION

Research Question IV: *What are the issues involved in the development of a strategic planning-based framework for transition to Australia's sustainable future?*

Contribution to the Thesis: The research examines the feasibility of using three management competencies – future scenario planning, strategic planning, community engagement - to develop a potential *framework for transition* to achieve sustainable outcomes in Australia, the issues involved in their implementation, as well as the policy implications of this framework.

Original article: Submitted to the *Sustainability* journal on 30 April 2020 as recommended by the Supervisory Panel as Supplementary Information. Recommended changes were submitted on 30 July 2020. Further revisions requested on 17 August 2020. Status at time of thesis submission: Under Revision

Author Contributions:

Chambers, Ian: Conceptualisation, Formal Analysis, Funding Acquisition, Investigation, Methodology, Writing - original draft, Writing – review and editing;

Roberts, John: Supervision, Writing – review and editing;

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Statement of Contribution

This thesis is submitted as a Thesis by Compilation in accordance with https://policies.anu.edu.au/ppl/document/ANUP_003405

I declare that the research presented in this Thesis represents original work that I carried out during my candidature at the Australian National University, except for contributions to multi-author papers incorporated in the Thesis where my contributions are specified in this Statement of Contribution.

Title: AUSTRALIA 2030 - DEVELOPING A STRATEGIC PLANNING FRAMEWORK FOR TRANSITION TO A SUSTAINABLE, RESILIENT AND PROSPEROUS FUTURE

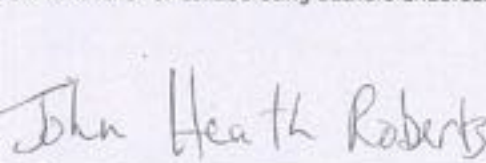
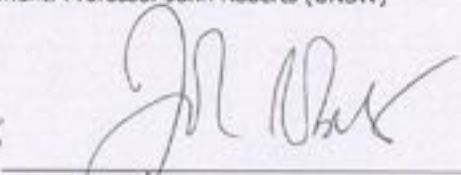
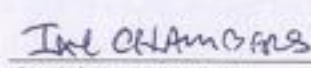
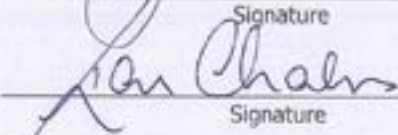
Authors: Chambers, Ian: Conceptualisation, Formal Analysis, Funding Acquisition, Investigation, Methodology, Writing - original draft, Writing - review and editing; Roberts, John: Supervision, Writing - review and editing; Cribb, Julian: Writing - review and editing; Russell-Smith, Jeremy: Writing - review and editing; Hewson, John: Writing - review and editing; Poulter, Jim: Writing - review and editing; and Gordon, Iain James: Writing - review and editing.

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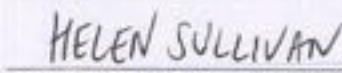
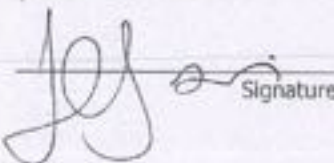
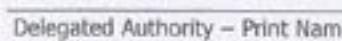
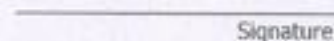
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Senior author or collaborating authors endorsement: Professor John Roberts (UNSW)

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Endorsed

		1 OCTOBER 2020
Primary Supervisor - Print Name	Signature	Date
		
Delegated Authority - Print Name	Signature	Date

Supplementary Information

A SWOT analysis provides a useful framework to capture the nation's overall positioning (Table 1). Based on the Australian National Outlook Report 2019, this analysis provides a succinct summary of key examples of Australia's strengths and opportunities in: (i) international markets (major exports including energy fuels, minerals, agriculture and education); (ii) ecological heritage (unique ecosystems, Great Barrier Reef and Murray Darling Basin); and, (iii) social heritage (multiculturalism and indigenous heritage).

STRENGTHS	WEAKNESSES
• Unique ecosystems (CSIRO, 2019) • Energy Fuels (Jotzo, 2019) • Mining (CSIRO, 2019) • Agriculture (CSIRO, 2019) • Education and Knowledge Services (CSIRO, 2019) • Social Cohesion & Multiculturalism (CSIRO, 2019) • Indigenous heritage and knowledge as a sustainable agricultural society (Pascoe, 2014)	• High dependence on fossil fuel energy exports (AFR, 2019 (21/02/19); Evens, 2019) • Lack of EV infrastructure and deployment (G. Drew, 2015; OR, 2019) • Transport: Complete dependence on imported vehicles (CSIRO, 2019) • Fuels: Complete dependence on imported transport fuels (CSIRO, 2019)
OPPORTUNITIES	THREATS
• Move to renewable energy (CSIRO, 2019) • Demand for minerals to support developing renewable energy and non-fossil fuel transport and EVs (CSIRO, 2019) • Move to sustainable agricultural practices (CSIRO, 2019; SDF, 2019) • Leveraging Australia's strengths in Education and Knowledge Services (CSIRO, 2019) • Leveraging Australia's indigenous sustainable land, water and agricultural management knowledge and practices (Pascoe, 2014)	• Covid-19 • Climate change (CSIRO, 2019) • Urban expansion (CSIRO, 2019) • Natural resource management and loss of biodiversity (CSIRO, 2019) • Management (CSIRO, 2019) • STEM Skills (CSIRO, 2019) • 'Business as usual' model of development (Constable, 2019)

Table 1. SWOT analysis of Australia's current position based on the Australia National Outlook 2019 Report

1.1.1 Energy production, export and transport

With Australia's coal exports comprising a quarter of the country's export economy under threat due to the global shift to clean energy sources (Evens, 2019), the nation's future sustainable prosperity will depend on finding alternatives to this

revenue stream. Gas exports have grown significantly, however, they are vulnerable to the same worldwide concerns about fossil fuels that are impacting both export and domestic markets (Jotzo, 2019).

Australia however is ideally positioned to develop substitute industries such as solar, wind, hot rock, tide, wave, hydrogen and biofuels, exporting energy as hydrogen gas or via HDMI cable transmission (Chambers, Russell - Smith, et al., 2018). With its strategic geographical location adjacent to the ASEAN energy hub and high solar intensity, and the costs of HDMI decreasing and efficiencies offsetting transmission losses, capturing a significant component of the rapidly developing ASEAN market for renewable energy market presents a real opportunity for Australia. 20% of the ASEAN energy market which has been targeted for renewables would substitute almost half of the current Australian export earnings being realized by coal (Chambers, Russell - Smith, et al., 2018). However, in the development of renewable energy resources and leveraging these into the highly lucrative ASEAN energy markets, Australia has been described as a laggard (Gerard Drew, 2015).

Similarly, with less than fifty (50) days of oil reserves available in the country, Australia's economy (both domestic and export industries such as agriculture, tourism and manufacturing) and security are both highly dependent and exposed to the availability of imported oil and its commodity price (Chambers, Russell - Smith, et al., 2018; Derwin, 2019). The impact of the coronavirus pandemic has highlighted further the vulnerability this imposes on Australian business and society. Alternative energy can, therefore, also overcome Australia's crippling reliance on imported oil, by shifting the transport and off-road sectors to renewables via electric vehicles (EV's), hydrogen and biofuels.

The decline of Australia's car manufacturing industry over the last decade has resulted in the country being completely dependent on imported vehicles. International trends to ban internal combustion engine vehicles (OR, 2019) and adopt EV transport technologies and alternative fuels results in Australia being vulnerable to these trends. This is exacerbated by the country being one of the worst performing developed nations globally in terms of electric transport infrastructure and deployed EV fleet (OR, 2019). This however provides a further opportunity for the country. The move from internal combustion vehicles to EV's simplifies the process of production allowing the production of 'flat pack vehicles. EV's designed in Germany, manufactured in Australia and China and assembled in Australia are already entering the Australian market (Evins, Slessor, & Boisvert, 2019). This potential 'disruptive technology' alone provides an opportunity for Australia to rebuild its vehicle manufacturing industry.

1.1.2 Mineral resources and mining technologies

Riding on the emerging boom in new energy systems, advanced electronics and the move to alternative forms of transport such as EVs is the demand for mineral resources to supply the production of these vehicles such as lithium, nickel, copper, cobalt, zinc and rare earth elements (CSIRO, 2019; Fullerton, 2019). Australia is well positioned to expand the minerals export markets, however, this is a highly competitive international industry and the Australian Minerals Council has already highlighting the need for policy reform to support these opportunities (Constable, 2019). Mining technologies and knowledge services have been estimated to be a major export representing one of the largest potential contributors to Australia's economy. Further, there are over 50,000 un-rehabilitated mine sites across Australia, with no clear plan to restore these by either the mining industry or the State/Federal Governments (Chambers, Russell - Smith, et al., 2018), despite this being a significant industry

opportunity estimated to be worth over \$18 Billion in Australia alone (Chambers, Russell - Smith, et al., 2018). As well as the ecological benefits of the development of this industry, there are further social benefits as well as knowledge services export opportunities (Chambers, Russell - Smith, et al., 2018).

1.1.3 Agriculture and Food Production

Agriculture and food production are one of Australia's key industries, remaining one of the country's major export industries (Thirwell, 2016; Workman, 2019). However, the same drivers that are contributing to the changes in the global economy such as climate change and renewable energy pose both significant threats to these industries, as well as opportunities. Climate change is the most critical of these factors. As global climate changes impact global food production, Australia has the opportunity to develop climate change resilient agriculture and food production, thus potentially expanding its global position as an agriculture and food exporter. Examples already exist of this transition such as desert farming tomato producer Sundrop (SDF, 2019). This solar powered greenhouse facility leverages both solar power and desalination technologies to develop produce with less reliance on natural resources than traditional greenhouse production and currently supplies over 40% of the truss tomato market in Australia. Other technologies and opportunities are rapidly entering the market such as genomic technologies which can be used to adapt plants to changing climatic and subsoil conditions, as well as precision farming to relieve drought impacts and increase yields, again leveraging Australia's existing strengths in these areas (CSIRO, 2019). Emerging water and land management technologies provide the opportunities to both rationalise and develop large areas for agricultural production as well as export of these 'knowledge services' (Chambers, Russell - Smith, et al., 2018). Native plant species, carbon farming through tree planting, agriculture and wildfire

management practices, ecosystem services, aquaculture and biofuels provide further opportunities (Chambers, Russell - Smith, et al., 2018).

1.1.4 Education and Knowledge Services

Education services currently rank third in Australia's export earners, with emerging technologies and markets providing new opportunities to expand the development of these services (CSIRO, 2019). However, this continues to remain a highly competitive market, with political, technological and capability factors all playing an important role in the continuing development of these services internationally. Further Australia also has strengths in knowledge services, the 'business of ideas', in areas such as health care, mining technologies and IT services.

1.1.5 Social Cohesion

Australia's success as a multicultural society has been fostered nationally and recognized internationally (CSIRO, 2019). It has also been noted as a pillar of Australia's overall success in the second half of the 20th Century. Australia has a further competitive advantage in its long indigenous history as a sustainable agricultural society and the consistency of these values and attributes with global trends in sustainability. Australia's Indigenous society established sustainable prosperity as a culture stretching back over at least 65,000 years (Pascoe, 2014; Poulter, 2016a), in essence, captured in the indigenous concept of Care for Country (Altman & Kerins, 2012). The Care for Country mindset is all-pervasive covering agriculture, governance and social norms. A mapping of the Care for Country approach against the UN SDGs provides a useful insight into how the global sustainability culture, and Australia's Indigenous heritage have converged (Pascoe, 2014; Poulter, 2016a) as seen in Table 2.

UN SDGs	SDGs / Australia's Indigenous Heritage
1. No Poverty	There was no poverty as there were no disparities in wealth and no personal accumulation of material possessions. A universal ethos of caring and sharing applied.
2. Zero Hunger	There was zero hunger because Aboriginal population was universally matched to the developed and managed carrying capacity of the land, even in the worst of seasons.
3. Good Health	There was unrivalled good health and well-being due to plentiful food and exercise within a caring social culture and a disease-free environment. Not even the common cold was present and marsupial animals did not have any diseases transmissible to human beings.
4. Quality Education	All people had quality education matched to their personal abilities and aptitude. Children were given both individual and group tuition, with the groups being on ability level rather than age cohorts. Tertiary level education and Eldership training was a continuous process that allowed all people to achieve their maximum potential. The universal twin qualifications for Eldership were knowledge and character.
5. Gender Equality	Gender equality was achieved by having twin male and female Boards of Elders each with their own inviolate authority. (Male domination and domestic violence issues only came into being after colonisation and the decimation of the 1789 smallpox plague).
6. Clean Water and Sanitation	Clean water and sanitation were universally available. Aquaculture areas for instance included freshwater mussel farms that acted to continually purify the water. Universal taboos ensured pristine sanitation.
7. Clean Energy	Affordable and clean energy is difficult to apply, as there was no reticulated energy system.
8. Decent Work & Economic Growth	Decent work and economic growth need to be judged in terms of economic sustainability rather than growth.
9. Industry, innovation & infrastructure	Clearly met if thinking in terms of artefact manufacture etc. and the maintenance of significant sites and communication routes (Songlines).
10. Reduced inequalities	This SDG Goal is predicated on the assumption that there were in fact social and material inequalities, which there were not.
11. Sustainable Cities	All villages were geographically and spatially organised according to kinship and totemic relationship, thus ensuring community cohesion and sustainability.
12. Responsible Production and Consumption	A schedule of seasonal produce was available, with excess agriculture, aquaculture and game produce being stored or smoked to ensure yearlong availability for the whole community.
13. Climate Action	Needs to be redefined as 'Environmental and Ecological Sustainability' or 'Sustainable Adaptation to Environmental Change'.
14. Life below Water	Sustainable Aquaculture was evident in both ocean and inland water management systems.
15. Life on Land	Sustainable agriculture was evident in crop, animal and land management practices.
16. Peace	Clearly met but could be better phrased as Social Cohesion
17. Partnership	Pluralist Social Inclusion.

Table2: Australia's Indigenous Heritage measured against the UN SDGs

Multiculturalism and Australia's indigenous heritage therefore provide two further opportunities for the country in (i) leveraging our Indigenous people's deep understanding of the land, resource and ecosystems management; and, (ii) leveraging multicultural key skill bases to further sustainable economic, ecological and social prosperity.

6.2 EMPOWERING AUSTRALIA'S NORTH

SUSTAINABLE LAND DEVELOPMENT IN NORTHERN AUSTRALIA

(Jeremy Russell-Smith, James, Pedersen, & Sangha, 2018)

Research Question II: *What insights does a sustainable economic, ecological and social prosperity lens provide in an examination of development options for northern Australia?*

Contribution to the Thesis: This book insert examines: (i) the application of the *sustainable prosperity* model for Australia's North in the energy subset; and, (ii) the potential economic benefits to the region in both market share of the energy and associated industries and markets, as well as ecological and social benefits.

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Statement of Contribution

This thesis is submitted as a Thesis by Compilation in accordance with https://policies.anu.edu.au/ppi/document/ANUP_003405

I declare that the research presented in this Thesis represents original work that I carried out during my candidature at the Australian National University, except for contributions to multi-author papers incorporated in the Thesis where my contributions are specified in this Statement of Contribution.

Title: EMPOWERING AUSTRALIA'S NORTH

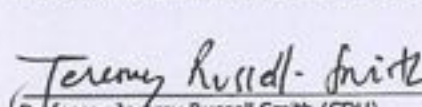
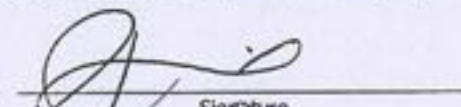
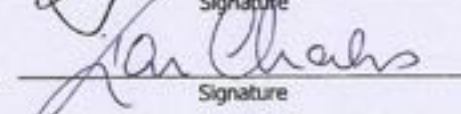
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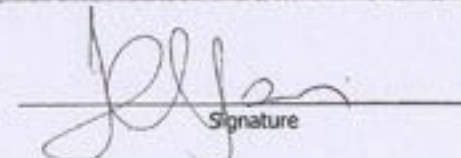
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_____ Delegated Authority - Print Name	_____ Signature	_____ Date



Sustainable Land Sector Development in Northern Australia

Indigenous rights, aspirations, and
cultural responsibilities

edited by Jeremy Russell-Smith, Glenn James,
Howard Pedersen and Kamaljit K. Sangha

BOX 4.2 emPOWERING AUSTRALIA'S NORTH

Low Cost, Geographically Available Energy: The Key Factor for Sustainable Economic, Ecological, and Social Prosperity

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Current situation: A review of the literature and proposals for the development of Australia's North, including the federal government's 2015 'White Paper', demonstrates a surprising lack of focus on available and future energy requirements of the region. This is surprising for a number of reasons.

Firstly, North Australia's abundant mineral resources (e.g. bauxite) often have to be transported vast distances southwards and internationally to where there are sufficient supplies of fossil fuels to transform those resources into 'value-added' products. This not only deprives North Australia of significant opportunities for industry and 'value-added' product and service development, it adds significant costs to Australian goods and services when competing in international markets.

Secondly, dependence on such fossil fuel resources exposes regional enterprises to significant energy market volatility.

Thirdly, while energy distribution networks are currently very underdeveloped across the North, the region possesses some of the richest reserves of clean and renewable energy in the world. With rapidly expanding global requirements for clean and renewable energy, and North Australia's geographical proximity to some of the world's fastest growing markets in South East Asia, development of renewable energy resources offers a significant opportunity for the region's long-term economic development and social sustainability. It is notable that there is no mention of the renewable energy option in the Northern Development White Paper. It is important therefore to further explore this significant opportunity.

The opportunity: The renewable energy opportunity is perhaps most graphically captured in [Figure B4.2.1](#), developed by researchers at the Australian National University. This graphic demonstrates how solar energy capture from just a fraction of the North could potentially supply enough solar energy to meet not only Australia's needs but most of the world's energy requirements also.

Professor Blakers and colleagues describe how a solar energy generation facility could be developed to raise water (e.g. at Lake Argyle in the Kimberley) into elevated storage tanks, to then drive hydro-energy generation. Such hydro-energy could then be distributed through high voltage direct current (HDVC) long-distance energy transmission cable technology as part of a national energy 'superhighway'. An alternative approach to the high cost of construction of hydro storage is to connect the solar and wind energy rich regions in the north with an energy hub in the South East via the high geothermal regions of central Australia

(Continued)

BOX 4.2 (Continued) emPOWERING AUSTRALIA'S NORTH

Figure B4.2.1 The vast renewable energy resources of Australia's north and national and international connectivity opportunities. (From Blakers, A.W. et al., *GREEN – The International Journal of Sustainable Energy Conversion and Storage* 2, 189–202, 2012.)

(Figure B4.2.1). Such transmission and connectivity capability are already a feasible option and well established in other regions such as Europe.²

Development of a national energy superhighway would allow, firstly, for diversifying Australia's energy security options by interconnectivity of current conventional fossil fuel energy sources generated in the South, with the vast renewable energy resources of the North. Secondly, further connection of the national superhighway with the Association of Southeast Asian Nations (ASEAN) super-grid network (Figure B4.2.2) would allow Australia to become a major regional energy supplier based on abundant renewable energy generated on a tectonically and politically stable platform.

There are a number of benefits from this approach:

- It would allow Australia to become a major player in the clean energy market for the region with the associated economic opportunities this would bring.
- It would provide a strategy for transitioning from Australia's high dependency and current exposure on fossil fuels (especially coal) to alternative and abundant revenue sources from renewable and clean energy.
- It would contribute significantly to Australia's international climate change commitments as well as assisting other countries in the region meet theirs. The immediately accessible Indonesian energy market, forecast to grow by more than 500% by 2050,³ has committed to a 23% renewable energy target over the same period.⁴

Other regional renewable energy options also exist. For example, the vast areas of salt pans in North Australia could be used to produce alternative algal transport fuel products.^{5,6} Key limitations for extensive production of these types of fuels include space requirements and low-cost, readily accessible energy sources. The development of a national energy superhighway

(Continued)

BOX 4.2 (Continued) emPOWERING AUSTRALIA'S NORTH

Figure B4.2.2 Connecting Australia to the existing and planned ASEAN super-grid network. (From Blakers, AW. et al., *GREEN – The International Journal of Sustainable Energy Conversion and Storage* 2, 189–202, 2012.)

overcomes these energy limitations, allowing Australia to potentially meet its own requirements for transport fuels as an alternative to oil. This is a market currently worth AUD 44 billion in Australia⁷ and also provides opportunities for significant export earnings.⁸

The rapid development and associated declining costs of renewable energy and transmission technologies, coupled with the international growth of clean energy markets, means that investment costs associated with development of a national energy superhighway and connection to the ASEAN super-grid are now eminently feasible. Estimates are AUD 7.2 billion for connectivity to the ASEAN super-grid⁹ and AUD 6 billion for the national energy superhighway based on recent Australian feasibility studies and European contracts.² In total, this is approximately a quarter of the cost of the National Broadband Network (AUD 45 billion) or Australia's new submarine fleet (AUD 50 billion), and less than three years of current Australian Government annual subsidy of AUD 5.6 billion to the fossil fuel industry.¹⁰

emPowering remote communities: Harnessing the vast and well-distributed clean and renewable energy resources of North Australia has significant implications to empower remote communities. Decreasing dependence on expensive and transported fossil fuels for remote community energy needs can allow not only economic but also social and ecological sustainability.¹¹ The rapid growth of solar combined with battery storage and electric vehicles, can enable not only self-sufficiency of remote communities but also economic and community development. Costs of installation are immediately offset by significant reductions in costs of imported fuels such as diesel, and decreased costs for other infrastructure and community support resources such as water transport and storage.¹² Energy production can also be easily scaled up to support developing economic and community developments – and reduce exposure to external prices of fossil fuel products.

(Continued)

BOX 4.2 (Continued) emPOWERING AUSTRALIA'S NORTH

Conclusions: emPowering the North has historically been seen as a challenge for both regional and remote communities. The rapid growth of renewable and clean energy technologies and rapidly declining price points reversing this equation, providing significant economic and sustainable development opportunities for North Australian communities – opportunities that can be harnessed now.

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In such convoluted biophysical, social, and policy terrain, mapping a development path that is accessible to the region's Aboriginal people requires a leap of faith: that there will at some point be a real interest in development that respects northern landscapes and their local peoples. But to ground such an attempt it is necessary to acknowledge that, in the short to medium term, infrastructure and public subsidy 'push' will override other considerations. We assume, optimistically, that ideological influences will weaken as evidence of economic, social, and environmental failures mount and alternatives are tested.

4.5.1 Orthodox Development Trajectories

To form a view of environmental services needed and deliverable in northern landscapes, it is useful to make some projections of at least plausible orthodox development directions. A starting point is to consider commitments already made that appear unlikely to be reversed, irrespective of economic, social, or environmental credentials. We do not review here in detail other technically and economically plausible options (e.g. Box 4.2) that were not considered for the white paper or in any other government program of which we are aware.

7.0 SUMMARY AND DISCUSSION

7.1 Contribution to academic knowledge

The focus of this thesis has been the leveraging of academic rigor with best practice to identify and develop practical solutions to the complex societal challenge of achieving sustainable outcomes in Australia. Although the thesis comprises four discrete papers, as outlined in the introduction, the following models provided a useful structure for the four papers both academically and practically: (i) the modeling work of Hatfield-Dodds et al. (2015) on achieving *sustainable prosperity* in Australia (Hatfield-Dodds et al., 2015); (ii) the application of the individual focused Motivational Interviewing (MI) model at a national level to achieve sustainable outcomes (Costanza et al., 2017) (Miller & Rollnick, 2012); and (iii) the VOSAM strategic planning framework (Nagy & Fawcett, 2009).

Paper I addresses the question of *what are the preferred future scenarios for Australians in 2050?* The research methodology utilised extended the use of scenario planning through the integration of national survey methodologies to identify a nationally preferred future – paralleling the first and second phases of the MI model. The benefit this provides in the academic environment is the opportunity to advance a novel methodology to assess community attitudes and develop national engagement in a range of plausible future scenarios that are key to social policy setting. These findings also demonstrate that the *scenario planning* phase of the MI model (Miller & Rollnick, 2012) could be applied at a societal and national level. The further finding that the *self-selected* and *representative* sample populations had noticeable differences in results is also an important observation, as the two survey methodologies have been used interchangeably in social policy setting in Australia. Examples include the *self-selected* survey methodology used in the Australian *same sex marriage postal plebiscite*

(Medhora, 2017) and the *representative* survey methodology used in the Australian *republic referendum* (Uhr, 2000). However, the findings of differences between the *self-selected* and *representative* sample survey outcomes identified in Paper I, particularly surrounding participants' perceptions of the attitudes of others to future outcomes, could be significant in the choice of survey approaches in determination of public preferences and policy making.

Paper II reviews the *insights that a sustainable economic, ecological and social prosperity lens provide in an examination of development options for northern Australia*. The research methodology used compares the *business as usual* approach outlined in the Federal Government White Paper (CoA, 2015) for developing northern Australia to the Hatfield-Dodds et al. (2015) *sustainable prosperity* model (Hatfield-Dodds et al., 2015). This approach provides an opportunity to test the practical application of the modeling research on sustainable outcomes within a regional subset of the nation. The findings of this paper confirm both the validity of the *sustainable prosperity* modeling approach in this Australian test region, as well as the feasibility of the preferred scenario identified in Paper I. The research also confirms the modeling findings that key social policy, decision-making, and community engagement changes are required for Australia to achieve sustainable prosperity. These findings also demonstrate that the strategic planning phase of the MI model could be applied at a societal and national level (Miller & Rollnick, 2012).

Paper III examined the *impact of a strategic planning-based community intervention on attitudes towards sustainable outcomes in a subset of Australian and Mauritian populations (adolescent students in senior high school)*. The research methodology provides a novel application of a strategic planning-based intervention to community engagement to facilitate the achievement of sustainable outcomes – the

United Nations Sustainable Development Goals (SDGs). The research focuses on four sub-questions that allow the core investigation to be complimented by examination of the potential impact of global framing on outcomes, as well as testing the consistency of the findings of this subgroup with those of two other national surveys on *future scenario planning* as examined in Paper I (Chambers et al., 2010), and a further national survey on *climate change* (Neilson, 2019). The key research outcomes from this study demonstrate that the application of community engagement in strategic planning can facilitate ‘connection, engagement and empowerment’ at a societal level, in understanding and delivering sustainable outcomes. The further finding in this study that immersion of this community subset in this intervention resulted in a participant mindset shift from ‘overwhelmed’ to ‘understanding’ to ‘empowerment’ that is highly significant. This is due to: (i) the importance of this type of paradigm mindset shift as a higher leverage point in systems change as identified by Meadows (Meadows, 2019a); and (ii) the importance of this community subset (adolescents) as key drivers of future sustainable outcomes (Ki-moon, 2016). These findings also demonstrate that the *engagement* and the *planning* phases of the MI model (Miller & Rollnick, 2012) can be applied at a societal and national level. Finally, the modular and scalable design of the intervention provides the opportunity to apply this approach to other community segments, as well as other countries, as demonstrated by both its application and outcomes with this community subgroup in Mauritius.

Paper IV examined the *issues involved in the development of a strategic planning-based framework for transition to Australia’s sustainable future*. The research methodology used integrates the academic literature with the findings of Papers I – III to develop a systems-change perspective on achieving sustainable futures in Australia. Academically, the *framework for transition* developed in this paper provides an

opportunity to: (i) leverage a range of systems change subsystems – social, ecological economics and management subsystems; and (ii) integrate the application of a range of often disparate management competencies - *scenario planning*, *strategic planning*, *community engagement* – to form the framework for a national change management model. Further, the provision of examples of how this range of management competencies could be combined, demonstrate the application of the MI model (Costanza et al., 2017; Miller & Rollnick, 2012) at a national level. Again, due to the modular and scalable nature of these management competencies and their integration into a *framework for transition*, this approach has potential application to specific regions within Australia, as well as other countries.

7.2 Recommendations

There are a number of recommendations that emerge from the four papers and the thesis as a whole.

Firstly, from Paper I, there are a number of further opportunities for researchers. There is the scope to more fully explore the differences in results between the *self-selected* and *representative* samples. From both a practical as well as academic perspective, the differences identified between *self-selected* and *representative* sampling pose the question as to whether the different approaches to determining public preferences and subsequent public policy decisions should be used interchangeably or tailored to specific public policy outcomes. Other options for testing include involvement in scenario development as part of the scenario planning competency, as well as consideration of non-preferred plausible to facilitate the examination of potential development of new strategies. Further, there is the opportunity to apply the methodological process of scenarios and public surveys utilized in Paper 1 to sub-regions of Australia as well other countries. It is therefore recommended that these

opportunities be more fully examined.

Secondly, Paper II identifies the significant opportunities and benefits available to one region of Australia by pursuing a broader ecological, social as well as economic approach to achieving sustainable prosperity. It is therefore recommended that further regional and national opportunities for developing Australia's future sustainable prosperity be explored and developed both academically and practically.

Thirdly, this thesis demonstrates that leveraging a range of management competencies - *scenario planning, strategic planning and community engagement* - provide an important opportunity in the development and deployment of a successful sustainable prosperity agenda in Australia. It is therefore recommended that these management competencies be included in both practical and academic approaches to achieving sustainable outcomes. Further, the importance of engagement in the strategic planning process is often acknowledged at corporate, government and community levels. The findings of Paper III, that community engagement can potentially increase both 'empowerment' and a 'mindset shift', two of Meadows' highly ranked level leverage points in systems change (Meadows, 2019a), provides further insight into the role of engagement in the strategic planning process and also offers the opportunity for further research in this area.

Finally, although Paper IV identified a range of management competencies that can be combined to establish a *framework for transition* to achieve sustainable outcomes, it is recognized that these management competencies are not exhaustive. This therefore presents the opportunity for further academic research to: (i) more fully examine the academic and practical application of these management competencies; (ii) examine other management competencies that could further facilitate this *framework for transition*; (iii) examine their interaction and the interdependence of

these management competencies; as well as (iv) examine the opportunities for research on the potential impact of these management competencies on other global sustainability frameworks such as the UNESCO focus on Futures Literacies.

7.3 Limitations

There are a range of limitations in this research in both scope and application. Firstly, it is recognized that this research has not fully explored a core tenet of the current global economic model – the ‘continuous growth’ assumption. The reasons for this are twofold. First, this issue has been addressed in other research on Australia by authors such as Hatfield-Dodds et al. (2015) and Ward et al. (2016) with differing conclusions (Hatfield-Dodds et al., 2015; Ward et al., 2016). The research reported in this thesis therefore sought to explore both the academic and practical applications of the findings of these authors to Australia’s sustainable future, rather than revisiting these alternative models. Second, any *framework for transition* will require phased implementation, particularly when examining an issue as fundamental as the current *business as usual* approach compared to a *sustainable prosperity* approach. As discussed in Paper IV, Meadows highlights that the initial phase requires a focus on higher end leverage points - *goals* and a *paradigm mindset* change (Meadows, 2019b). This research has therefore focused on approaches to achieve these higher level *systems change* leverage points due to the gap in this knowledge, rather than lower order systems change leverage points such as economic factors that have been explored more fully in other academic literature (Costanza, 2014b; Robert Costanza et al., 2015). It is also noted that the limitations of this research have resulted in there not being the scope to examine the notion of criticality in systems theory, the conditions of this criticality, and the potential impact on acceleration of phase shifts. However, as identified in Paper IV, achieving a sustainable future in Australia can be best facilitated through the

application of the full range of Meadows' leverage points (Meadows, 2019b). There is, therefore, significant scope to further explore this application and the interaction of these leverage points and criticality in academic, management, and public policy disciplines.

Secondly, the examination of a *sustainable future mindset* in Australian Indigenous society was limited in Paper II due to the scope of the research being derived from the Federal Government White Paper (CoA, 2015). This area however was able to be more explored to a limited extent in Paper IV, where the SDGs were tested against core elements of Indigenous society, with favorable results. This area of Australia's cultural heritage in sustainability therefore presents an important opportunity for further research due to: (i) the importance of preserving this national cultural heritage, as well as; (ii) the opportunity to practically learn and benefit from accessing this knowledge of Australia's ecological, environment, and sustainability practices.

Thirdly, it is recognized that there is a required transition from the United Nations concept of *sustainable development* (UN, 2016) to the concept of *sustainable prosperity* (Hatfield-Dodds et al., 2015). The UN SDGs provide the first key phase of this transition, and this research explores a number of management competencies and a potential framework for this transition. However, it is clear that this transition from *sustainable development* to *sustainable prosperity* can be more fully explored, particularly with reference to the UNESCO focus on Futures Literacies at both an academic as well as a practical level.

Fourthly, it is recognized that this thesis does not examine the influence of vested interests in decision-making and the impact on sustainable outcomes. The decision to not include this issue in the research was based on: (i) the focus of this research on public policy changes, not vested interest impact on public policy (ii); the

extensive work that has already been undertaken in this area, and, (iii) the opportunity that a *strategic planning-based framework for transition* presents in dissipating the impact of vested interests through the establishment of a common vision and community engagement in strategies and actions to achieve these outcomes. However, the outcomes of this thesis identify in this an important opportunity for further research.

Finally, it is recognized that this research has focused on a specific strategic planning model, VMOSA (Vision, Mission, Objectives, Strategies, Actions) (Nagy & Fawcett, 2009), and its application to achieving sustainable outcomes in Australia. It is recognized, however, that other planning models such as those applied in the 5 Year Planning Program in China (Jinping, 2017) and the Marshall Plan (Sachs, 2008) are available. The use of the VMOSA strategic planning model was deliberate in this research, as it focuses on visioning and strategies for the smooth transition from current to alternative futures, primarily in democratic societies, as well as paralleling the key phases of the MI individual change model (Miller & Rollnick, 2012). The Chinese approach applies a similar smooth transition model, however, in a more controlled economic and societal environment (Jinping, 2017). The Marshall Plan was focused on a post WWII development plan, which was discontinued when ‘sufficient development’ was deemed to have been achieved (Sachs, 2008), thus lacking a framework for continuity. The VMOSA strategic planning methodology was therefore selected as the most appropriate methodology for application to the Australian democratic environment, as well as providing a framework for *continuous improvement*. There is therefore an opportunity for further research on the potential application of alternative models of planning to the achievement of sustainable outcomes in Australia.

7.4 Further Research

There are a number of opportunities for further research that have been identified within the four research papers and their associated discussion in this thesis: (i) examination of differences in application and outcomes for *self-selected* versus *representative* sample surveys methodologies; (ii) application of the sustainable economic, ecological and social prosperity model across other regions of Australia and to Australia as a whole; (iii) application of the strategic planning-based community engagement approach to other demographic and geographic segments; (iv) further research on the *management competencies* and their interconnectivity in *frameworks for transition* to sustainable prosperity in Australia; (v) further research on Australia's Indigenous sustainable heritage and the practical and academic application of this heritage to Australia's present and future sustainable prosperity; (vi) further research into the potential links between a *sustainable prosperity mindset* as identified in Paper III and systems theory notions of paradigm shift and criticality within a phased implementation approach; (vii) further research on the potential application of alternative strategic planning models to the achievement of sustainable futures; (viii) the opportunity to further research on the impact of vested interests on decision making impacting sustainable outcomes across two areas: (a) analysis of the impact of vested interests on decision making at political, economic, and societal levels on sustainable outcomes; and (b) the impact of a strategic planning-based model of social change on dissipating vested interest influence on sustainable outcomes; and (xi) further research on measuring sustainable ecological, economic and social prosperity outcomes in Australia. Although this has not been covered in the previous discussion, any pursuit of *sustainable prosperity* outcomes in Australia requires the establishment of clear and concise measures of *sustainable prosperity* across the three key parameters examined

in this research – ecological, economic and societal - thus providing an important opportunity for further research at both academic and social policy levels.

8 CONCLUSIONS

This research set out to examine visions and strategies for Australia's sustainable future. The overall conclusions of this thesis are that sustainable prosperity is the publicly preferred option for the majority of Australians and is a viable option. However, as identified in other literature and throughout this thesis, achieving this outcome is not predestined. In this thesis it has also been argued that the changing global economic, ecological, and social environments require a strategic and systems - based approach with a clear vision, defined objectives, and detailed strategies to facilitate ongoing transitioning for long-term sustainable and resilient prosperity. Covid-19 has provided a timely opportunity to move beyond the *business as usual*. There is now a unique opportunity to use this time productively and leverage Meadows highest order intervention point – a *paradigm shift* in mindset (Meadows, 2019b); to rethink and rebuild a sustainable, resilient, and prosperous future for the 'lucky country'.

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