Chapter 6
Uncertainty and Future Planning: The Use of Scenario Planning for Climate Change Adaptation Planning and Decision

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Abstract This chapter reports on lessons on the use of scenario planning for informing long-term climate change adaptation planning and decision. Lessons are extracted based on the development and application of exploratory scenarios (multiple plausible futures) involving two different levels of stakeholder engagement in Australia: (i) a regional/institutional and (ii) a community level. Lessons from the regional/institutional level focus on the South East Queensland Climate Adaptation Research Initiative (SEQCARI) involving a multi-sectoral investigation of climate change adaptation in the South East Queensland (SEQ) region, comprising the sectors of urban and regional planning, coastal management, physical infrastructure, emergency management, and human health. Lessons from the community level are drawn from the recovery phase of the Cardwell town in far north Queensland in the aftermath of category five Tropical Cyclone Yasi. Findings indicate that at the regional/institutional level exploratory scenarios are useful to support the integration of different stakeholders' and sectors' perspectives concerning climate change adaptation. In particular, they provide opportunities for improved understanding of sector-specific as well as cross-sectoral issues to be addressed. At the community level, exploratory scenarios assist in the scoping of specific and tailored adaptation options. However, a limited number of options accounts for multi-dimensional challenges and longer-term future planning related to climate change impacts.

Keywords Community · Foresight · Australia · Natural hazards Adaptation · Collaborative planning

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6.1 Introduction

Scientific uncertainty related to climate change comprises one of the most widely recognized barriers to effective climate adaptation (Milly et al. 2008; Quay 2010). Additionally, recent modeling indicates that climate change is likely to increase the intensity and frequency of extreme weather events but there are substantial limitations in terms of foreseeing when and where those events are likely to occur (CSIRO 2007; Tompkins et al. 2010). Climate change projections are often too broad and subject to errors when applied to finer resolution to provide certainty to policy development at the local and regional scales (Tang et al. 2010), especially to inform land use policies. Furthermore, decision-makers also have to deal with uncertain social and economic futures (Tompkins and Neil Adger 2005; Rydin 2013), and diverse political interests regardless of available scientific knowledge concerning climate change impacts (McFadden 2007; Measham et al. 2011).

Foresight and future studies are often suggested as suitable approaches to deal with both complexity and uncertainty, including those related to environmental and social change (Quay 2010; Floyd 2012). In particular, foresight methodologies such as scenario planning can assist in the identification of new challenges as they emerge and foster anticipatory rather than reactive strategies (Fuerth 2009; Bengston et al. 2012). Foresight can be understood as "the capacity to anticipate alternative futures, based on sensitivity to weak signals, and an ability to visualize their consequences, in the form of multiple possible outcomes" (Fuerth 2009: 17). This chapter aims to contribute to advancing foresight and future studies methodologies by distilling lessons on the use of scenario planning (Vervoort et al. 2014) involving multi-stakeholders[1] for climate change adaptation planning and decision. Lessons are drawn from two action research projects (Floyd 2012; Flood 1998; Reason and Bradbury 2006) carried out in the state of Queensland, Australia, namely the South East Queensland Climate Adaptation Research Initiative (SEQCARI), a multi-sectoral and regional scale project; and a disaster recovery study on the town of Cardwell following the category five Tropical Cyclone Yasi, a community-based project. By focusing on different projects, the study offers comparative evidence to investigate the effectiveness of scenario planning processes for different contexts (Bowman et al. 2013). Comparisons of this type are also important because stakeholders' interests vary across scales (Rounsevell and Metzger 2010).

To this end, the chapter is structured in three parts. The first part provides a summary on scenario planning as a type of foresight and future studies methodology (Sect. 6.2). The second part describes the use of scenario planning in the two abovementioned projects (Sect. 6.3). The third part reports on the lessons learnt from the two projects to guide future application of scenario planning for climate change adaptation planning and decision (Sect. 6.4).

[1]Stakeholders refer to all participants to the process, including practitioners, researchers, representatives from public and private sectors.

6.2 Background to Scenario Planning

There has been an increased use of scenario planning over the last 60 years in academic research, policy and decision-making processes, and corporate and community planning (Ramirez and Wilkinson 2014; Gidley 2013). Perhaps the uptake of scenario planning across so many sectors is related to its enlightenment to strategic planning for dealing with uncertainty and complexity (Bowman et al. 2013). In particular, through scenario planning, it is possible to carry out systematic exploration and description of a range of ways in which uncertainties may play out. These include their impacts on the sector or problem sought to be addressed, and how critical uncertainties may interact leading to surprising outcomes (Bowman et al. 2013; Schoemaker 1993).

Scenario planning can facilitate individual and group decision-making in light of uncertainty, especially from a long-term perspective (Raford 2015; Bai et al. 2016). Other benefits associated with the use of scenario planning include its ability to enable learning and awareness building (Raford 2015), being conducive to improving learning processes, identification of issues and decision-making (Evans 2011), encourage stakeholders to work cooperatively and creatively to overcome barriers and achieve change (Kahane 2012), and promote stakeholder engagement (Chirozva et al. 2013) to ensure more robust decisions are made (Ernst and van Riemsdijk 2013).

Scenario planning can be understood as "a process that brings stakeholders together to construct possible narratives about the future of their environment" with the purpose to create possible futures that can be used for the assessment of strategic options and capabilities (Evans 2011: 461). Hence, it is essentially a participatory engagement method that contributes to knowledge co-production and learning, ownership of problem and solutions, and dealing with power imbalances (Butler et al. 2014). It helps participants to challenge theirs and others' values and assumptions, enables better understanding of issues by lay participants, and provides a platform for integrating scientific information and local knowledge (Butler et al. 2014). It also facilitates mutual learning as a key outcome of transdisciplinary projects which equally accept the value of knowledge produced through science and practice (Scholz 2000). The effectiveness of scenario planning processes is underpinned by its connection to realities and complexities of the issue it refers to (Chirozva et al. 2013). Additionally, scenarios are instructive for a decision context that involves a particular question or problem demanding decisions now but will involve actions only to be realized in an uncertain future (Vervoort et al. 2014; Fuller and Loogma 2009).

While the majority of works reporting on scenario planning tend to focus on their successes, there are problems and limitations associated with scenario planning that should also be considered. For example, Raford (2015) discusses three methodological limitations associated with qualitative scenario planning: it is labor and time-consuming demanding substantial commitment from participants, it focuses on recruiting participants from senior professional levels that can bias the

content of the scenarios, and it is dependent on the skills and experience of workshop facilitators and scenario writers. Limitations are compounded by the lack of formal evaluation methods that are suitable to assess scenario planning exercises (Raford 2015). Additionally, one of the key difficulties in undertaking scenario planning concerns the ability participants have to understand the scenarios and/or the systems they attempt to unfold (Wollenberg et al. 2000) or limited understanding and acceptance of long-term benefits of future strategies based on current actions (Floyd 2012). Hence, scenarios need to be truly understood by involved participants to enable learning to occur.

6.3 Research Approach

There is widespread variation on the understanding and types of scenario planning concerning quantitative and/ or qualitative approaches (Börjeson et al. 2006). A simpler systematization offers three categories and six types under which scenarios may be classified: predictive (forecast and what-if types), exploratory (external and strategic types), and normative (preserving and transforming types) (Börjeson et al. 2006). Predictive scenarios seek to predict what is likely to happen in the future to enable prior planning and adaptation to future expected conditions. Exploratory scenarios seek to explore situations or developments that may occur by generating multiple possible futures to capture a long-term perspective that enables structural or profound changes. Normative scenarios assist in the identification of targets and inherent pathways to meet those targets.

Additionally, there are conflicting definitions of scenario types in the literature (i.e., qualitative, quantitative, inductive, deductive) (Rounsevell and Metzger 2010). Findings reported in this chapter refer to a qualitative and inductive approach to scenario planning involving the development and application of exploratory scenarios (multiple plausible futures) (Vervoort et al. 2014). In particular, scenario narratives or storylines covering simultaneous possible futures were developed and used to test a range of options/ strategies, including the identification of potential outcomes brought by these options/ strategies over a long-term time horizon. The chapter reports on two action research projects (Floyd 2012; Flood 1998) involving stakeholder engagement in Australia at a regional/institutional and a community level. The regional/institutional project refers to the South East Queensland Climate Adaptation Research Initiative (SEQCARI project) which comprised of a multi-sectoral investigation of climate change adaptation in the South East Queensland (SEQ) region, including the sectors of urban and regional planning, coastal management, physical infrastructure, emergency management, and human health. The community-based project refers to the recovery phase of the Cardwell town in far north Queensland in the aftermath of category 4/5 Tropical Cyclone Yasi (Cardwell project).

Both projects adopted the 2×2 matrix method whereby the top two highly uncertain and highly important independent drivers were used to construct possible

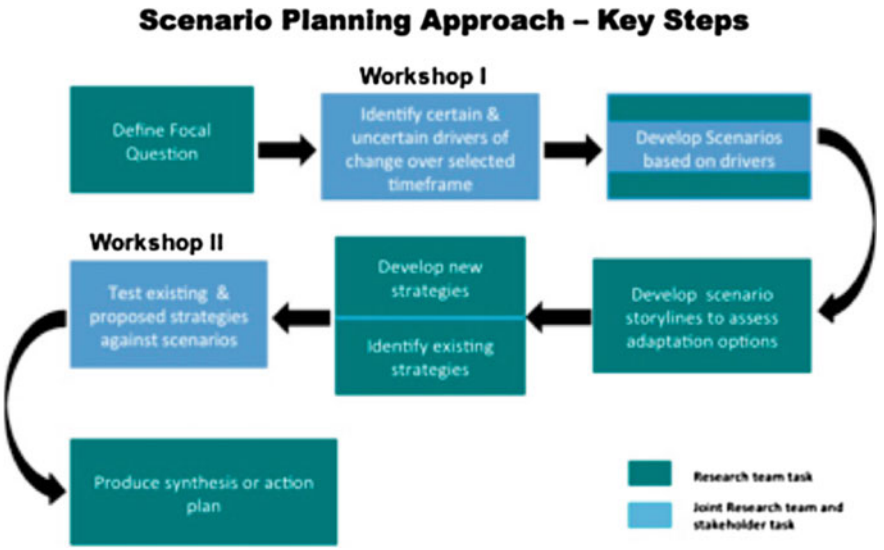

Fig. 6.1 Scenario planning process followed by the two research projects

futures (Ramirez and Wilkinson 2014). While four scenarios were identified as a result of the 2 × 2 matrix method, due to participants' time constraints to attend full-day workshops, only two scenario narratives were fully developed and used to test a selected set of strategies relevant to each project (e.g., adaptation options for the SEQCARI project; and future options for the Cardwell project). Following the inductive process, in the first series of workshops a focal question (long-term perspective of 20–25 years into the future) was placed to participants to guide: (i) the identification and ranking of drivers of change; (ii) the selection of the 2 × 2 matrix; and (iii) the outlining of key aspects of the scenario narratives. Scenario narratives were then fully developed by the research team and used in the second series of workshops to test new and proposed strategies (see Fig. 6.1). A description of the two scenario planning processes is presented in Table 6.1.

6.4 Using Scenario Planning to Inform Decision-Making for Climate Change Adaptation

As outlined by Butler et al. (2014), scenario planning is a participatory engagement method that contributes to knowledge co-production and learning, ownership of problems and solutions, and dealing with power imbalances. In particular, scenario planning can help participants to challenge values and assumptions they might have, improve understanding of complex issues by lay participants, and provide a platform for integrating scientific information and local knowledge (Butler et al.

Table 6.1 Overview of scenario planning processes of the two projects

Project title	South East Queensland Climate Adaptation Research Initiative (SEQCARI) (2009–2012)
Project description	A multi-sectoral investigation of climate change adaptation in the South East Queensland (SEQ) region, comprising the sectors of urban and regional planning, coastal management, physical infrastructure, emergency management, and human health. Focus on regional/institutional dimension
Stakeholders	Local and state governments, non-government and community-based organizations, peak industry bodies
Scenario development process	Two series of two workshops focused on coastal and inland human settlements (average of 20 persons per workshop). 2 × 2 matrix: form of governance (inclusive to exclusive) and community responsibility and involvement (low to high)
Selected scenario narratives	*Shared Path*—a scenario characterized by extremely high level of community acceptance and involvement in governance and in the management of community affairs operating in a political system offering high degree of inclusive governance for its citizens *Free Ride*—a scenario characterized by extremely low levels of community responsibility and involvement in governance and in the management of community affairs that operate in a political system offering high degree of inclusive governance for its citizens
Assessed strategies	Sectoral and cross-sectoral climate adaptation options
Project title	Improving adaptation of coastal communities through bottom-up approaches—a case study of the Cardwell community in North Queensland (2011–2013)
Project description	A partnership between the Cardwell community and researchers established to conceptualize and develop a long-term strategic action plan for the community's future. Focus on community dimension
Stakeholders	Community members
Scenario Development process	Two series of two workshops focused on the community recovery phase following Tropical Cyclone Yasi (average of 17 persons per workshop). 2 × 2 matrix: governance (inclusive to exclusive) and socio-environmental assets (high to low quality)
Selected scenario narratives	*By the People for the People*—a scenario where decisions regarding the management of the district's high-quality socio-environmental assets are driven from the bottom-up by communities in collaboration with local government and regional non-government organizations *Controlled Democracy*—a scenario where decisions regarding the management of the district's high-quality socio-environmental assets are driven from the top down by the local, state and federal governments with little opportunity, if any, for community involvement
Assessed strategies	Future options developed based on participants' aspirations for a future Cardwell

2014). Additionally, Bowman et al. (2013) also claim that the inductive approach to scenario planning enables trust building as participants incrementally introduce their different aspirations and debate them throughout the process. Based on this

literature, there are four key lessons that can be gleaned from the use of scenario planning for climate change adaptation planning and decision in the two above-mentioned projects. Lessons included, but are not limited to: (i) co-production of knowledge and learning, including the understanding of cross-sectoral issues; (ii) integration of scientific information and knowledge; (iii) understanding of people's interests and values, and trust building and leadership issues; and (iv) ability to think strategically.

Similar to findings from other studies (e.g., Scott et al. 2012), stakeholder engagement leading to co-production of knowledge and learning through scenario planning was observed at the SEQCARI project. Perhaps due to its focus on the regional/ institutional dimension, scenario planning workshops provided opportunities for multi-sectoral stakeholders to interact and improve their understanding of the challenges confronting climate change adaptation for human settlements from a multi-sectoral perspective (Serrao-Neumann et al. 2014). In particular, for some participants the workshops comprised of the first opportunity they had to understand how specific sectors operate. For example, participants from the planning sector were able to gain a better understanding that land use and development control decisions that are taken under their portfolio often have significant impact on emergency management personnel for both disaster prevention and disaster response (Low Choy et al. 2012a). Comparatively, co-production of knowledge and learning was less evident at the Cardwell project. In particular, perhaps due to the fact that most participants in the project practiced some degree of volunteering activities within their community, most people indicated their awareness of issues affecting their community which in turn motivated their involvement in community matters in the first place.

Scenario planning is essentially a participatory process whereby symbolic texts are socially constructed (Fuller and Loogma 2009). It is therefore expected that scenario planning can provide a platform for integration of scientific information and local knowledge. In both projects, such integration is best demonstrated by the breadth and level of complexity that characterized the outputs of the "wind tunnel" testing exercise embedded in scenario planning, that is the suite of climate adaptation options in the SEQCARI project (Low Choy et al. 2012b) and future options in the Cardwell project (Serrao-Neumann et al. 2012). Nonetheless, separating knowledge co-production and learning and integration of scientific information and knowledge as different outcomes from scenario planning are not as straightforward because these are interlinked processes. However, considering the issues regarding climate science and inherent uncertainty, it is important to highlight the role that best available scientific information plays in informing strategic actions focused on minimizing future vulnerability of places and communities in light of climate change—as it was the case in the two projects. Additionally, it is important to acknowledge how the scale at which scenario planning focuses on may influence the learning process. For example, while the multi-sectoral/multi-stakeholder perspective adopted in the SEQCARI project enabled the interaction of stakeholders from across a range of sectors, it lacked a stronger community perspective. Conversely, the Cardwell project lacked the institutional perspective although the

strategies the community was seeking to implement could be facilitated or hampered by the actual institutional capacity of their local and state governments.

Multi-stakeholder scenario planning processes are known to be time-consuming given participant's unfamiliarity with the method. However, it appears that it is this time-consuming characteristic of scenario planning that enables trust to be built as participants incrementally introduce their different aspirations and open up for debate. The extended number of workshops held at the Cardwell project confirmed this assumption as participants needed this time to understand how theirs and others' aspirations were aligned with, or contradictory to, achieving their set vision for the community. In this project, the ongoing interaction between community members facilitated the debate about, and understanding of, different individual's aspirations which had the same ultimate goal of improving the community's quality of life. Additionally, as indicated by Bowman et al. (2013), a strong, committed leadership in the Cardwell project was fundamental to ensure the scenario planning process did not fracture and enabled trust to be built to overcome participants' resistance in accepting other's viewpoints (at least at that point in time).

The issue associated with biased and narrow perspective in scenario planning based on the breadth of participants outlined by Butler et al. (2014) was evident at the Cardwell project. While many scholars (Scott et al. 2012; Schoemaker 1991; Quay 2010) highlight the benefit of using scenario planning to derive long-term strategic solutions for climate change adaptation, some workshop participants struggled to think of and accept the inclusion of strategies that could not be immediately implemented by their community. This situation may be related to the issue raised by Rounsevell and Metzger (2010) who emphasized that when participants involved in scenario planning do not have a defined conceptual model of the system that is being described in the scenario narratives there is a risk for the system interrelationships and feedbacks to be misunderstood. Rickards et al. (2014) also noted this difficulty which they attributed to the cognitive challenge for participants of scenario planning workshops to understand other's meanings and difficulty to grasp long-term thinking. In the Cardwell project, participants tended to focus on pursuing strategies needed to solve existing/immediate problems in their community. On the other hand, this "narrower" perspective enabled them to scope more specific and tailored strategies that were relevant for the community's reality and context. Comparatively, participants in the SEQCARI project were able to deal with the long-term perspective more easily probably based on their experience with dealing with strategic issues in their professional roles on a regular basis. Nonetheless, more locally based dimensions ended up being oversighted by the strategic, long-term focus. These issues related to bias and limited strategic focus in scenario planning can be traced back to the time constraint factor that permeates an essentially participatory process. Nonetheless, it is important to acknowledge that there are limitations as to what can be achieved through scenario planning, indicating that complementary foresight methodologies may need to be employed to obtain more holistic outcomes.

6.5 Conclusion

This chapter set to distill lessons from the use of inductive exploratory scenario planning processes involving two projects in Australia: a regional/institutional and a community-based project. Investigated projects included (i) the SEQCARI project —a multi-sectoral investigation of climate change adaptation in the SEQ region, comprising the sectors of urban and regional planning, coastal management, physical infrastructure, emergency management and human health; and (ii) the Cardwell project—a community-based project involving a partnership between researchers and members of the Cardwell community in North Queensland to develop a strategic action plan for the Cardwell community in the aftermath of tropical cyclone Yasi.

Findings from the SEQCARI project indicated that inductive exploratory scenarios enabled the integration of multi-stakeholder and sector perspectives related to complex challenges such as climate change adaptation for human settlements. In particular, in this project, the scenario planning process provided opportunities for improved interaction between practitioners and understanding of sector-specific issues. In parallel, community-based projects appeared to be better positioned for scoping more specific and tailored adaptation options that are specially focused on solving existing and future challenges relevant to local contexts. However, they may lack broader interaction between different layers of actors involved in decision-making, therefore hampering participant's ability to ascertain feasibility and envision the implementation of adaptation pathways. Multi-stakeholder scenarios processes are known to be time-consuming given participant's unfamiliarity with the method; however, longer interaction among participants is needed to enable trust building. In the community-based project, it was also noted participant's difficulty in grasping with both multi-dimensional challenges related to, and longer-term strategic thinking demanded for, climate change adaptation. Additionally, both projects needed to deal with the time lag between scenario generation and application demanding the allocation of sufficient time for participants to familiarize with scenarios.

The chapter concluded by signaling the suitability and limitations of scenario planning for climate change adaptation planning and decision. Given the limitations of scenario planning, it is pertinent to propose that complementary foresight methodologies are also employed and, more importantly, the efficacy of these methodologies be tested by more research projects to improve the overall applicability of foresight methodologies for climate change adaptation planning and decision.

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