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SCIENTIFIC DIVERSITY, SCIENTIFIC UNCERTAINTY AND RISK MITIGATION POLICY AND PLANNING

Scenario Exercise Literature Review

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Publisher: Bushfire and Natural Hazards Cooperative Research Centre, East Melbourne, Victoria

Recommended citation: Wodak, J. (2014). Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy And Planning: Scenario Exercise Lite
Review, Bushfire and Natural Hazards Cooperative Research Centre, Australia.

Cover photo: Ian Horvath.

Executive Summary

The Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy and Planning (RMPP) project aims to investigate the diversity and uncertainty of bushfire and flood science, and its contribution to risk mitigation policy and planning.

The RMPP project draws on human geography, political science, legal studies and science, technology and society studies, to investigate how policy makers, practitioners, courts, inquiries and the community differentiate, understand and use scientific knowledge in relation to bushfire and flood risk. It will use qualitative social science methods including scenario exercises, theoretical tools and case studies, to analyse how diverse knowledges are ordered and judged as salient, credible and authoritative, and the pragmatic meaning this holds for emergency management across the PPRR spectrum.

This research report outlines how scenario exercises may be used for understanding risk mitigation decision-making, as scenario exercises will inform a core component of the RMPP project. The report outlines what scenario exercise are, why they are used, and how they can be used to achieve the aims of the RMPP project. The focus is on environmental scenarios: that is, scenarios about environmental challenges. Literature about scenarios for other purposes, such as business and strategy, are included where appropriate.

Key findings of this report include:

- Broadly, two dominant approaches to scenario exercises exist. According to the first, scenario exercises involve the generation of predictive models of possible future events through combined quantitative analyses. In the second, scenario exercises involve participants of various kinds responding to possible future events in order to pay attention to how knowledge of such futures is produced.
- These two approaches align with five more specific categories of scenario exercise design:
  a) The first type are categorised here as Normative/Anticipatory ("what are the conditions required to get us to given end?"), Exploratory/Descriptive ("what will happen in the future if a given condition changes?") and Predictive ("what are the consequences of some specified event?").
  b) The second type are categorised as Actor-focused and Reflexive Interventionist/Multi-Agent-Based (RIMA). These designs produce predictions, though their predictive quality is secondary to the matter of who is involved and the knowledges they employ in the scenario exercise (see Section 1.3).
- There are many methodological lessons to be drawn from the existing use of scenario exercises. This review identified Chatham House's 2008 *Future of Food Supply* as an excellent exemplar of successful scenario exercise. In this case participants were asked to identify the driving forces behind political, economic and social developments, identify key uncertainties and identify key interdependencies.
- Scenario exercises have benefits and limitations. For instance, while they can bring together diverse expert knowledges to better understand complex systems, the focus is often on the product and not the process. While they can allow participants to test decision options, evaluate implications and analyse pathways, they are also vulnerable to being influenced by the interests of dominant participants. These considerations need to be at the forefront of scenario exercise design.

- Scenario exercise development can follow a deductive, inductive, or incremental structure. Deductive development works from identification to analysis, inductive development begins with individual events or elements and moves to consequences, and incremental development starts with a reference scenario before incrementally changing key drivers and threats.
- Regarding scenario staging, there are many lessons to learn from the existing literature about the composition and convening of scenario exercises (see Section 4.4). Success in scenario exercises, several authors argue, is achieved when they are credible, salient, and legitimate in the eyes of participants.

This report presents the first stage of the RMPP project. It was written before any of the scenarios have been designed or staged, and before the Principal Investigator has commenced work on the project. Therefore, the report aims to synthesize a broad array of literature, including a broad array of scenario types and methods, as the most suitable types and methods will only become known when the actual scenarios are designed and staged.

Approximately 250 sources on scenario exercises, methodology, analysis, and design were reviewed, including from academic journals, white papers, grey literature, industry guidelines, governmental and NGO reports, training manuals and coursebooks. A mixture of highly practical and applied guidelines were researched, in conjunction with more theoretical academic articles.

The instructional and practical sections of this report quote from these sources at length, to incorporate the breadth and depth of their findings into the report.

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Acknowledgement

This report was funded by the Bushfire & Natural Hazards Cooperative Research Centre (BNHCRC) as part of the 'Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy and Planning' project. This project is a collaboration between the Institute for Culture and Society at the University of Western Sydney, and the Fenner School of Environment and Society at the Australian National University.

Special thanks go to Professor Peter Fairbrother, Professor George Cairns, Dr Matthew Walker and Dr Glenn Elliott (RMIT University), Professor Andrew Campbell and Dr Jeremy Russell-Smith (Charles Darwin University), Dr Chris Bearman and Jared Grunwald (Central Queensland University), Professor Barbara Norman (University of Canberra), Professor Stephen R. Dovers and Associate Professor Geoff Cary (Australian National University), Professor John McAneney (Macquarie University) and Dr Matthew Mason, (Queensland University of Technology) for their advice in providing background information for the writing of this report. Thanks also go to end users John Schauble (Fire Services Commission, VIC), Clare Speechly (Department of the Premier and Cabinet, SA) and Mick Ayre (Country Fire Service, SA) for their comments on a draft of this report. All errors, of course, remain the author's own.

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About the Report

> Wicked problems do not lend themselves to well-bounded, linear problem-solving approaches, nor to the design of interventions based on historical and empirical evidence alone. Attempts to 'tame' wicked problems and identify simple solutions fail. These problems require approaches that enable collaboration across multiple geographical scales, using multiple types of knowledge. They are likely to require people to change both mindsets and behaviors. Uncertainty needs to be considered as more than a lack of knowledge, scientific or any other type. If we are to tackle wicked problems effectively, we need to pay attention to the co-evolution of different types of knowledge and ignorance. This is as important as questions of the scale (both temporal and geographical) of the problem, and the identification of its relevant stakeholders. Global environmental changes are potentially too urgent and too 'wicked' to be resolved by conventional methods of scientific inquiry. Instead, we suggest, they demand the extended processes of a post-normal science methodology that reaches beyond the traditional scientific facts and experts into the wider communities affected by an issue…[where] high decision stakes and high levels of uncertainty create the need for a new scenarios approach (Wilkinson and Eidinow 2008: 1-2).

In this statement, Wilkinson and Eidinow encapsulate the core concerns of the RMPP project: to mitigate risk through policy and planning within the scientific diversity and scientific uncertainty around natural hazards. Natural hazards now constitute a wicked problem, due to their intrinsic complexity and unpredictability, and due to the dissolution of difference between 'natural' and human-caused hazards, exemplified by the way anthropogenic climate change is influencing the frequency, severity and nature of 'natural' hazards. In this context, "a new scenarios approach" of scenario exercises for wicked problems offers the potential to examine different knowledges that go "beyond the traditional scientific facts and experts into the wider communities affected by an issue" and in so doing contribute to formulating policy and planning around risk mitigation.

To explore these issues, the RMPP project will convene scenario exercises to determine how diverse individuals use and understand scientific evidence and other knowledges in their bushfire and flood risk mitigation roles. This report outlines central aspects of the use of scenario exercises in response to Project Lead Researcher Dr Jessica Weir's intended usage of scenario exercises, current as of July 2014:

> Scenario exercises will pose actual or hypothetical situations to a group of participants, so as to explore the different reactions to the same sets of information. The scenario exercise enables the opportunity to analyse differences in prospect, rather than retrospect – as has been the inquiry process. The focus will be on how the participants interpret the knowledge, and use it in their decision making in relation to other knowledge practices. The scenario exercises will be issues based and held over a day, with participants from both state and national organisations, and community, practitioner, and researcher knowledge domains. The location will depend on the issue being addressed, and the targeted participants. The scenario exercise will be transcribed for analysis. Semi-structured interviews of participants will follow the scenario exercises, with questions designed to interrogate the scenario exercise experience, further eliciting the ways in which people make decisions and assign meaning or value to scientific evidence.

This report provides the context of what scenario exercise are, why they are used, and how they can be used to achieve the aims in the above statement.

1 Situating the RMPP Project in the Field of Scenario Exercises

> A scenario is a description of how the future may unfold based on 'if-then' propositions and typically consists of a representation of an initial situation and a description of the key driving forces and changes that lead to a particular future state. Scenario exercises, i.e. the development and analysis of scenarios, provide an approach to thinking through plausible future developments and related uncertainties in a structured, yet creative manner. Scenarios can take many forms including an image, a graphic, a table, or text. In particular, scenarios have been seen as useful when trying to understand and reflect upon the considerable uncertainties about future developments in complex systems. Such uncertainty may arise from a system's dynamics, or may be related to assumptions on the future development of driving forces (Alcamo 2008: 15).

While much has been written about scenarios and climate change (Turnpenny et al. 2005, Henrichs et al. 2007, Alcamo 2008), the RMPP project aims to use scenario exercises to understand decision-making with the "considerable uncertainties about future developments in complex systems" of mitigating risks from natural hazards. Literature concerning the relationship between natural hazards and risk (Whatmore 2011, Lane 2011a and 2011b), policy (Van Kerkhoff 2006, McLennan and Handmer 2011), planning (Carlsen 2013) or decision-making (Liua et al. 2008, Mahmoud et al. 2009) do not concern or comment on scenario exercises, while literature about scenario exercises do not concern risk, policy, or planning in relation to natural hazards. Many writers argue for greater connections between scenario exercises and natural hazards, such as Alexander who argues that since "scenarios are often constructed to study past events, and are an essential basis of planning to tackle future ones" he finds it inexplicable that "remarkably little has been written about their use in counter-disaster training" due to the fact that "scenario methodology is a versatile means of training emergency personnel, as it bridges the gap between classroom instruction in the abstract and practical training during real disasters" (2000:89).

However, as this report will detail, the 'versatility' of "scenario methodology" that Alexander refers to is widely seen to stem from non-consistent definitions and usages of scenarios. One of the main reasons for this is that references to 'scenario' in the literature overwhelmingly refer to quantitative scientific models, such as a climate change "emission scenario" (Whatmore 2011) where "the term 'scenario' is also often used to describe the future course of events regarding a single variable, e.g. 'in the scenario of a global warming of 3°C'" (Kosow and Gafner 2008:10) rather than the usage the RMPP project is concerned with: qualitative or narrative based 'scenarios'. The guide that is the most recommended reading for a brief overview of Scenario Exercises (SEs), 'Scenario Building Exercise' from Participatory Methods Toolkit: A practitioner's manual outlines a working definition of the term 'Scenario Exercise' within the constraint that there is no coherent body of literature that reviews, critiques and critically analyses scenarios. It also reaffirms that the literature is overwhelmingly about 'scenario' as quantitative scientific/mathematical/numerical model, such as a climate change 'emission scenario' rather than qualitative or narrative based 'scenarios'. Alcamo argues that the reason literature concerning "environmental scenarios" overwhelmingly denote scenarios such as resource depletion, climate change or ecosystem services in quantitative rather than qualitative analysis because "the field of environmental science and policy" stems from "the demand for numerical estimates of the future state of the environment" wherein "quantitative scenarios are used as a research tool to investigate changes in the environment due to changing driving forces, e.g., to estimate the future ability of forests to take up CO2 from the atmosphere under different intensities of future land use and forest management" (Alcamo 2008:125).

Furthermore, this literature on “environmental scenarios” does not address risk or natural hazards in relation to SEs. To illustrate, the CSIRO report Climate change scenarios for initial assessment of risk in accordance with risk management guidance contains the words “scenario” and “risk” in its title. However, it never defines what it means by “scenario” or “risk”, does not use “scenario exercises” and uses “scenario” only in reference to quantitative scientific models (Hennessy 2006).

In addition, the literature on scenario exercises, either qualitative or quantitative, does not concern practical advice on how to design and conduct scenarios that relate to the aims and criteria of the RMPP project. The singular exception is “the first book-length description of the methodology of environmental scenario analysis”: *Environmental Futures: The Practice of Environmental Scenario Analysis* edited by Joseph Alcamo (2008) former Director of the Center for Environmental Systems Research, University of Kassel, Germany, and current Chief Scientist of the United Nations Environment Programme. This publication has been used extensively in this Report. As there are highly relevant and useful guides for how to conduct focus groups (Morgan 1997, Liamputtong 2011, Kitzinger 2005) this Report also incorporates recommendations and critical analysis from focus groups, where it applies to the aims and criteria of the RMPP project. This is also the case for SE literature about business approaches and future studies where there are “plentiful resources available about scenario development in business and information sciences.” This stems from the fact that the origins and early development of scenario exercises are from military and business strategy, with two of the founding figures, Kahn and Wiener defining scenarios as ‘‘hypothetical sequences of events constructed with the purpose of focusing attention on causal processes and decision points’’ (1967) in their work on possible consequences of nuclear proliferation (quoted in Swart 2004:140). One consequence of this is that “fewer resources are specific to the unique problems of developing scenarios for natural sciences and environmental assessment” such that “stakeholders and scientists have been discouraged from using scenarios for collaborative decision-making due to a lack of guidance on how to formally plan scenarios” which has created “a genuine need for improved guidance for constructing scenarios” (2009:802). To remedy this, this Report makes use of many studies on SEs about the environment which have themselves determined how to apply business approaches and future studies approaches to SEs about the environment (Bradfield 2005 and Ramirez 2008).

1.1 Defining Scenarios

> Rather than any consensus as to what framework scenarios belong to, there appears to be several overlapping camps of opinion, testimony to which is the fact that the terms planning, thinking, forecasting, analysis and learning are commonly attached to the word scenario in the literature. The second is that there appears to be virtually no area in scenarios on which there is wide-spread consensus; the literature reveals a large number of different and at times conflicting definitions, characteristics, principles and methodological ideas about scenarios (Bradfield 2005:797).

This quote, from Bradfield's 2005 article 'The origins and evolution of scenario techniques in long range business planning', summarises the state of the field of scenarios. The article made a major contribution to classifying different scenario methodologies and outlining their respective advantages and disadvantages. It is widely used to establish working definitions of the core concepts using in scenarios about the environment, such as Wilkinson and Eidinow 's landmark 2008 article on 'Evolving practices in environmental scenarios: a new scenario typology' and RMIT's Bushfire Communication Pathway project. This article and project respectively represent two exemplary modes of working within the limitations of the inconsistent definitions of scenarios, when applying them to the real-world situation of environmental challenges.

Before exploring how such writers and practitioners established a methodological framework for SEs, it is necessary to consider the strict definitions of the terms from major multi-year, multi-governmental international projects about environmental challenges, as these projects also had to establish working definitions at a much larger and more complex scale. The United Nations Environment Programme's 3rd Global Environmental Outlook (GEO-3) defined scenarios as "descriptions of journeys to possible futures" which "reflect different assumptions about how current trends will unfold, how critical uncertainties will play out and what new factors will come into play." Furthermore, GEO-3 argued that "it is now generally accepted that scenarios do not predict. Rather, they paint pictures of possible futures, and explore the differing outcomes that might result if basic assumptions are changed." (2002:320). The Millennium Ecosystem Assessment added the additional criteria that scenarios should be "plausible and often simplified descriptions of how the future may develop based on a coherent and internally consistent set of assumptions about key driving forces and relationships" (Carpenter et al. 2005). The Intergovernmental Panel on Climate Change aligns with the importance of coherency and plausible, as it defines a scenario as "a coherent, internally consistent and plausible description of a possible future state of the world." The IPCC also aligns with UNEP's argument that "scenarios do not predict" as the IPCC further defines a scenario as "not a forecast; rather, each scenario is one alternative image of how the future can unfold'' (IPCC 2008).

While these definitions offer clarity about some central tenets of scenarios, they deliberately eschew the terrain of defining the term 'scenario' once it is joined with its associated terms, such as 'exercise', 'development' and 'analysis'. When 'scenario' is used with its associated terms, the definition becomes much less clear. Alcamo argues that this arises since "scenario development is the discursive procedure by which a scenario or a set of scenarios is conceived, formulated, and elaborated" such that 'scenario development' becomes synonymous with "'scenario building.'" In relation to this distinction, Alcamo defines "scenario analysis" as "a broader concept encompassing both scenario development and the analysis of scenarios" whereby "scenario analysis is a procedure covering the development of scenarios, comparison of scenario results, and evaluation of their consequences" (2008:16). Although Alcamo has contributed more to disambiguating these

terms than any other writer in the field of environmental scenarios, he perpetuates the inconsistent terminology. Finding that "the terms 'scenario exercise' and 'scenario-based assessment' are often used synonymously with 'scenario analysis'" the writers in his edited collection on Environmental Futures: The Practice of Environmental Scenario Analysis "therefore use the three terms interchangeably" (2008:16). Consequently, the following two sections outline attempts to define scenario methodology and scenario types, as a workaround for difficulties in defining scenario methodology.

1.2 Defining Scenario Methodology

> Scenario Planning has been around for more than 30 years and during this period a multitude of techniques and methodologies have developed, resulting in what has been described as a 'methodological chaos' which is unlikely to disappear in the near future. This is reflected in the fact that literature reveals an abundance of different and at times contradictory definitions, characteristics, principles and methodological ideas about scenarios. It has been suggested that a pressing need for the future of scenarios is amongst other things, to resolve the confusion over 'the definitions and methods of scenarios (Bradfield 2005:795).

While Bradfield is speaking about the "'methodological chaos'" for scenarios in a business strategy context, the same 'chaos' applies in an environment context. The literature reveals that a principal explanation for this is that environmental scenarios are too often used without rigorously establishing a methodology and/or without recourse to the relatively scarce literature that attempts to create discourse around environmental scenario methodology. These problems are not easily remedied as scenarios are increasingly being used as they are "widely considered a key instrument for addressing the long-term social-ecological challenges society faces" since they "provide a rigorous framework for explicitly dealing with complexity and uncertainty and can help integrating the broad spectrum of perspectives in the assessment and decision making processes." Albert positions this increase in "the scenario method" usage "in a large variety of sustainability issues and on varying spatial scales" in the inverse proportion of how "little research has addressed the question of how scenario processes can be designed and conducted to most effectively influence the relevant decision processes" (2008:2). Henrichs concurs with Albert, as he also argues for the now "wide-spread use of scenario-based approaches" being applied when "the underlying principles, the theory and practice of environmental scenario analysis are often not well understood." One consequence of this is scenario exercises being "carried out in a somewhat 'ad hoc' manner" to the detriment of "the method's full potential and usefulness" (2009:4).

Although not a solution, the German Development Institute's large scale research project on Development Policy: Questions for the Future, included a recommendation for acknowledging the plurality of methods and their contradictory approaches in their comprehensive report on 'Methods of future and scenario analysis: overview, assessment, and selection criteria' (Kosow and Gafner 2008). Their report argued against Albert's above terminology of "the scenario method" since "the scenario method does not exist as such; rather, 'scenario methodology' is rather a comprehensive term which in actual practice covers the most varied possible assortment of approaches, techniques, and research and workshop designs. The term 'scenario methods' represents a methodological concept encompassing a canon of approaches with different degrees of complexity" (Kosow and Gafner 2008:22 emphasis in original). The basis of this argument was from the scoping study that formed part of this report, which included evaluating global, national

and regional governmental, not-for-profit and commercial approaches to SEs. This report concluded that there is not

> a comprehensive or even consistent, theoretical and methodical substantiation for scenario methods. By themselves, the methodological procedures of many studies are thought through only partially or not at all; moreover, the methodological procedures of existing studies are not always transparent. In addition, comprehensive, detailed 'toolkits' for the practical implementation of scenario methods are almost universally absent. Fundamental sets of instructions for the selection of appropriate scenario techniques are nowhere to be found; the same is true of generalized evaluation criteria in the sense of 'best practices'. It is on the whole conspicuous that when scenario methods are discussed they are more a matter of internal experience and knowledge of the ins and outs of advisory services than of detailed and published methods which are available to all (2008:9).

This conclusion aligns with Alcamo's explanation of the problem being exacerbated by a lack of discourse around scenario methods, while the usage of environmental scenarios has significantly increased in number and diversity, in response to rapidly growing environmental challenges and rapidly growing global, national and regional governmental, not-for-profit and commercial interest in these challenges:

> although a plethora of environmental scenarios have been developed and analysed over the past three decades, there is much less information available about the methodologies used to produce these scenarios, and even less critical examination of these methodologies (2008:13-14).

In response, the following section defines the range of scenario types, as a methodology should be determined in part by the types(s) of scenarios used, as well as the context and aim of the scenario.

1.3 Defining Scenario Types

The diverse and at overlapping definitions of environmental scenario types all "fall into two basic approaches" according to Wilkinson and Eidinow. The first approach is predicated on:

> an assumption that accuracy guides decision making and emphasizes the possibility of enhancing knowledge *about* the future. There is a bias towards empirical evidence: accuracy is largely determined in terms of fit within the range described by historical trends. Gaps in knowledge are resolved by building consensus around what is certain and uncertain. This approach assumes the role of the scenario builders as objective experts. The process of scenario building tends to put more stress on research and less on direct engagement with intended users. Decisions and decision makers tend to be excluded from the building process, although they may be consulted once the scenarios are built. The scenarios are the product of new learning (2008:4).

The principal example of this approach they suggest are Intergovernmental Panel on Climate Change. The second approach:

> a range of stakeholders [are] involved in building scenarios that are specific to the context of a specific organization(s). It is designed to gather and utilize many different views on past and current trends in order to see the present situation more clearly. This approach emphasizes the role of plausibility of the scenarios in influencing decision making. The focus is the co-production of practical, rather than accurate, knowledge: creating scenarios as a basis for learning through strategic conversation (2008:4).

The principal example of this approach they suggest are the WBCSD Water scenarios (WBCSD 2006). The RMPP project falls within the second approach, as it is driven by “a process of co-production as a basis for further learning” rather than “an emphasis on identifying technical knowledge” which is the dominant aim of the first approach (Wilkinson and Eidinow 2008:4 emphasis in original).

The range of types and techniques within these “two approaches” are laid out in a useful table by Borjeson in his article ‘Scenario types and techniques: Towards a user’s guide’. Writing from the Division of Environmental Strategies Research at the Royal Institute of Technology (KTH), Sweden, Borjeson’s article applies the more general field of scenarios to his focus on ‘environmental scenarios’:

Table 1
Contribution of techniques in the phases of scenario development

Scenario types	Techniques		
	Generating	Integrating	Consistency
Predictive			
Forecasts	• Surveys • Workshops • Original Delphi method	• Time series analysis • Explanatory modelling • Optimising modeling	
What-if	• Surveys • Workshops • Delphi methods	• Explanatory modelling • Optimising modeling	
Explorative			
External	• Surveys • Workshops • Delphi modified	• Explanatory modelling • Optimising modeling	• Morphological field analysis • Cross impact
Strategic	• Surveys • Workshops • Delphi methods	• Explanatory modelling • Optimising modeling	• Morphological field analysis
Normative			
Preserving	• Surveys • Workshops	• Optimising modeling	• Morphological field analysis
Transforming	• Surveys • Workshops • Backcasting Delphi		• Morphological field analysis

All techniques can be used in several phases but only their main contribution is mentioned in this table.

Contribution of techniques in the phases of scenario development, from Borjenson (2006:731)

Table 2
Summary of key aspects of scenario types

Scenario category/type	Quantitative/qualitative	Time-frame	System structure	Focus on internal or external factors
PREDICTIVE—what will happen?				
Forecasts	Typically quantitative, sometimes qualitative	Often short	Typically one	Typically external
What-if	Typically quantitative, sometimes qualitative	Often short	One to several	External and, possibly, internal
EXPLORATIVE—what can happen?				
External	Typically qualitative, quantitatively possible	Often long	Often several	External
Strategic	Qualitative and quantitative	Often long	Often several	Internal under influence of the external
NORMATIVE—how can a certain target be reached?				
Preserving	Typically quantitative	Often long	One	Both external and internal
Transforming	Typically qualitative with quantitative elements	Often very long	Changing, can be several	Not applicable

Summary of key aspects of scenario types, from Borjenson (2006:737)

The following sub-sections define the principal scenario types laid out in the above table.

1.3.1 Category 1: Normative / Anticipatory / Backcasting

Normative scenarios explore 'What can happen?' and are "concerned with achieving particular future objectives" (Wilkinson and Eidinow 2008:5). In normative scenarios such "objectives", Van Notten argues, "describe probable or preferable futures" (2001:429). In contrast, Alcamo maintains that this type of scenario, which he categorises as "prescriptive" or "anticipatory scenarios", begins "with a prescribed vision of the future" that is not necessarily preferable, as he argues it can also be "pessimistic, or neutral." The scenario "then work(s) backwards in time to visualise how this future could emerge." Two such examples of this are "to estimate the emission reduction steps needed to stabilise CO2 in the atmosphere", which Alcamo classes as having the goal of "to investigate the steps leading to a specified end state" (2008:20). Wilkinson and Eidinow term this sub-category of anticipatory scenarios as 'Preserving scenarios', which are what is "used when the target can be met within an existing structure" (2008:5). Alcamo's second example is "to explain how the 'sustainable development' of a community might be achieved" which he classes as having the goal of "to inform policymakers and the public about how to achieve a 'desirable' end state of the natural environment" (2008:20). Wilkinson and Eidinow term this sub-category of anticipatory scenarios as 'Transforming scenarios' as they involve back-casting by "asking what would need to be changed for the target futures to be achieved" (2008:5). Adding to the proliferation of terms that cloud such clarification, van Notten also offers the synonyms of "prospective, strategy, policy or intervention scenarios" for normative or anticipatory scenarios (2001:429).

While Alcamo and Wilkinson and Eidinow do not stipulate what kind of scenario backcasting is used for, in terms of pessimistic, optimistic or neutral, Van Notten again disagrees as he argues backcasting scenarios concern "the paths that need to be taken to arrive at desirable future situations" (2001:429). In their book Scenario Thinking: Practical Approaches to the Future, Wright and Cairns advocate 'The Backwards Logic Method of Constructing Extreme Scenarios', where 'extreme' is used in the context of 'pessimistic'. They argue that the actual construction of a "backwards logic approach to scenario development" establishes a chain of causality that goes

from “an extreme, but still plausible, outcome to its precursor causation in the present day” (Wright and Cairns 2011:139-140). These qualities are laid out, “in contrast to the standard intuitive logics method of scenario development” in the following table:

Table 8.1 Comparison of standard and backwards logic scenario methods

	Conventional intuitive logics method	*Backwards logic intuitive logics method*
Underpinning basis for scenario development	Causality	Causality
Starting point for scenario development	Components of the chosen two high-impact, high-uncertainty clusters	The (non-)achievement of an extreme in an organization's key objective
Number of scenarios that are developed in detail	Four	One or more
Focus on stakeholder behavior/reactions in relation to unfolding scenario events	High	High

Comparison of standard and backwards logic scenario methods, from Wright and Cairns (2011:140)

1.3.2 Category 2: Exploratory / Descriptive / Forecasting

In his classification scheme, Borjeson uses the question ‘What can happen?’ to denote a different type of scenario: explorative. He then divides explorative into two sub-categories: external and strategic scenarios. External scenarios are defined by the question “What can happen to the development of external factors?” while strategic scenarios are defined by the question “What can happen if we act in a certain way?” (2006:727). Borjeson claims that “through the use of scenario planning” external scenarios facilitate “the possibility to find flexible and adaptive solutions for an actor whose influence on external factors is small” and that they “may also make the organisation more receptive to weak signals of radical changes in the actor’s environment” (2006:728). In line with the literature on scenarios, these claims are not substantiated by case studies, and are generally backed up by short recourse to a list of projects which the author argues support their classification scheme, such as IPCC is Scenario type A, MEA is Scenario type B.

Alcamo and Van Notten offer more grounded definitions of exploratory scenarios. Van Notten notes that they “take the present as their starting point” with an aim to be “often exploratory rather than decision-support exercises” (2001:429). Alcamo adds the criteria that in addition to start in the present, that exploratory scenarios stipulate “an initial situation” with “a set of assumptions on policies, measures and key driving to explore plausible future developments” over the course of “a sequence of emerging events.” He advocates the use of exploratory scenarios when the aim “is to explore the consequences of a specified future trend in driving forces (e.g. to estimate future emissions under demographic change)” or when the aim “is to investigate the consequences of implementing a policy (e.g. to estimate the implications of implementing the EU Water Framework Directive on water quality of Europe’s rivers)” (2008:20).

However this “dichotomous characterization” between Category 1 and Category 2 scenario types is a misnomer according to Kosow and Gafner’s GDI report. They argue that since “selective decisions must be made at many points of the scenario process when a scenario is being constructed (i.e. decisions regarding not only the definition of the scenario field, but also the relevance of key factors, the determination of key factor characteristics to be studied, and the condensation of factors into individual scenarios)… scenarios are always – at least implicitly – normative” (2008:32 emphasis in original). Van Notten concurs, as he argues that “most current scenario studies have a descriptive [i.e. Category 2] character or are at most implicitly normative [i.e. Category 1]” (2001:429). In addition, Kosow and Gafner argue that “it has become common in actual contemporary practice to use both explorative and normative scenarios in combination, especially when the aim is to develop strategies” (2008:32). Nevertheless, they layout the central differences between Category 1 and Category 2 in the following table:

Table 1: Schematic comparison of explorative and normative scenarios

	Explorative	Normative
Procedure	Explores possible future developments with the present as point of departure	Identifies desirable futures or investigates how to arrive at future conditions
Function	Explorative and/or knowledge function	Target-building function and/or strategy development function
Implementation	Study of factors and unpredictabilities, test of possible actions to be taken and/or decision-making processes	Definition and concretization of goals and/or, if appropriate, identification of possible ways to reach a goal
Central question	What? – What if?	How? – How is it to come about? – How do we get there?
Inclusion of probabilities	Possible	Indirect, part of plausible shaping and planning

Source: The IZT with elements borrowed from Henrichs (2003); Greeuw et al. (2000); Steinmüller (1997)

The central differences between Category 1 and Category 2 scenarios, from Kosow and Gafner (2008:31)

1.3.3 Category 3: Predictive

The third main category, predictive scenarios concern ‘What will happen?’ in “an attempt to predict what is going to happen in the future” (Borjeson 2006:726). Borjeson divides these into two sub-categories: “Forecasts” of “What will happen, on the condition that the likely development unfolds?” and “What-if” or “What will happen, on the condition of some specified events?” (2006:726). Wilkinson and Eidinow argues that both sub-categories are effectively “forecasts, which look at what will happen as the likely development occurs” (2008:5). According to Borjeson the “probability and likelihood” of the scenarios becomes a central importance, since the aim of predictive scenarios is to “make it possible to plan and adapt to situations that are expected to occur” so that they can be used “to make decision-makers aware of problems that are likely to arise if some condition on the development is fulfilled” (2006:726).

1.3.4 Category 4: Actor-Focused and Category 5: RIMA

> The problem-focused approach with its implicit emphasis on rigorous analysis and knowable futures tends to focus the scenarios to 'known-knowns' and 'known-unknowns'. This approach struggles to incorporate and untangle the many context-based, qualitative and evolving, dimensions of a wicked problem. Furthermore, there is an implicit assumption of linear learning and decision making. Meanwhile, the actor-focused approach, although it encourages engagement with worldviews of scenario users in order to deliver usable knowledge, may under-attend to the diversity of worldviews that characterize environmental concerns (Wilkinson and Eidinow, 2008:8).

Although Alcamo, Borjeson, Bradfield, Wright, van Notten, Kosow and Gafner argue that the above three categories constitute the principal scenario types, Wilkinson and Eidinow posit two further categories: Actor-focused and RIMA. It remains to be seen whether these are in fact distinct types of scenarios, or whether they are combinations of qualities of the above three categories, such as van Notten, Kosow and Gaffner's above argument that "dichotomous characterization" is a misnomer (2008:32).

According to Wilkinson and Eidinow actor-focused scenarios are distinguished from the above three categories, because they are "produced with a focus on the actors involved, and their relationship to the environment, drawing attention to their interpretation of events." Of benefit to the RMPP project, they argue that this results in "bias" towards "qualitative, rather than quantifiable evidence, turning on the interpretation of any particular input." They caution that this should not "result in the idea that debate is the most effective method for acquiring wisdom" given that knowledge in actor-focused scenarios "is deemed to emerge primarily from the consensus of the group." This approach is suited for scenario practitioners who seek to enable "collaboration and action through a process of shared learning and the forging of a shared vocabulary for strategic conversation" between the participants in "heterarchical and cross-disciplinary groups, who are responding together to a perceived and transitory need" (2008:8).

Wilkinson and Eidinow caution scenario practitioners need to be attentive to how actor-focused scenarios "may under-attend to the diversity of worldviews that characterize environmental concerns" (2008:8). While they do not articulate what this 'under-attending' may entail, or how to counter it in actor-focused scenarios, they posit a fifth category, Reflexive Interventionist/Multi-Agent-Based (RIMA), which they argue can "bridge and enrich the first two approaches" of Category 1 and Category 2 above while being "substantially more than just a sum of these components." RIMA scenarios seek to do this by "recognizing uncertainty and variety in the processes and products of scenario building" by using diverse knowledges, ranging "from explicit knowledge generated through formal modelling, to tacit local know-how, from quantitative data to qualitative input." Having embraced such diversity, RIMA scenarios favour the multiplicity, contingency and temporal nature of 'knowledge' "with different points of view providing a constant challenge to any existing viewpoint or system" rather than attempting to "construct consensus around a single understanding of current reality." In so doing, they claim that the RIMA approach does not seek "simply more participation, but to ensure that participation is more effective" by embracing an actor-focused approach within the structure provided by RIMA (2008:8-10). As with much of the literature, the scope of this article did not extend to detailed reflective case studies that demonstrated the efficacy of each of these approaches. To clarify their schema amidst the ever-increasing number and range of categories Wilkinson and Eidinow explain these principal types through a highly effective metaphor of maps. They explain how different scenarios are like different

ways of navigating through space. Category 1 and 2 are analogous to “creating reliable maps that help us get to a destination as efficiently as possible” whereas Category 4 is analogous to “the participation of a group is essential in drawing maps.” On the other hand, RIMA scenarios:

> is not a question of more maps, or more accurate mapping, but of the requisite variety in the set of maps and their plausibility to a range of worldviews that matters most. …Now the very act of map making itself is recognized as shaping the environment. Moreover, the scenario users are reflexive in their activities: prepared not only to change their route and destination, but also to remodel their ship and its crew. As this suggests, the methodology is iterative and may occur in parallel streams. The aim is not to produce definitive input that charts the continuity of past trends, nor to embark on a process of co-production in shaping what might happen. Instead, it seeks to change the participants’ approach to future thinking, encouraging attendance to both what will catch up with us from the past (continuity) and what is coming at us from the future (possibility), and continually mobilizing and sustaining collaborative thinking and action (2008:10).

The authors then lay these differences out in the following table, showing Category 1, 2, 4 and 5 properties:

Table 1. Summary and comparison of problem-focused, actor-centric scenario and reflexive interventionist, multi-agent-based types.

	Problem-focused	Actor-centric	RIMA
Focus	Objective	Specific to organization	Specific to 'wicked problems' that involve sustaining collaborative action in the public interest/common good
Foreground	Factors, and their continuity	Relationship of a system of actors to their strategic environment; discontinuity and predetermined elements	Interactions between agents and between agents and their common environment
View of environment	Objective and continuous	Causal and discontinuous	Causal and turbulent[a] environments
Research approach	Often mode 1	Often mode 2	Relevance and rigor
Approach to uncertainty	Mapping and reducing uncertainty. Emphasis on knowledge and ignorance as lack of knowledge	Mapping and embracing uncertainty. Also attending to social construction of ignorance (unknown–knowns)	Continuously navigating knowledge, uncertainty and ignorance as they co-evolve across society
Decision culture/context	Credibility of experts building scenarios Rigor	Representative of system of actors Relevance to mental models of intended users of scenarios	More effective rather than just more participation
	Accuracy of scenarios	Plausibility of scenarios	Plausibility across a requisite variety of worldviews
	Influence of evaluation on choice	Influence of interpretation on choice[b]	Procedural fairness
	Assumes problem framing and solving separable and separated Insights derived before use of scenarios	Assumes problem resolving rests on reframing current reality Insights enabled in use of scenarios	Usability of knowledge
Information context	Often biased towards quantitative analysis ad 'fit' with historical and empirical evidence	Emphasis on predetermined elements. Balance future possibilities with past (historical rooting) Often led by qualitative inquiry	Abundance of information, void or crisis of leadership and institutional capacity
Purpose	Contingency planning/risk management/'future-proofing'	Shaping the future	Mobilizing and sustaining collaboration in the public interest to enable institutional innovation and/or renewal
Strategy and innovation[c]	Strategy as 'agility'; innovation as 'exploitation'	Strategy as 'adaptability'; innovation as 'exploration'	Balancing/right timing for social innovation/change in terms of adapt and/versus agile, exploit and/versus explore
Scenario building method(s)	Usually deductive (see van der Heijden 1996)	Varies but usually a single method: inductive, deductive, or normative	Multiple: inductive and deductive and normative. Rapid prototyping via iteration
Storytelling	Stories of the future Often used to simplify/translate complex ideas into simpler concepts	Stories of the context of the scenario 'client(s)' i.e. intended users An effective mode of systems thinking and engagement	Not designed to be told but experimented with
Process	Usually one-off linear learning	Often sustained iterative—double loop learning	Sustained and iterative assumes need to attempt to change a system in order to understand it
Time matters	Single time horizon Emphasis on continuity of past and present	Single time horizon Anticipation of predetermined elements and discontinuities	Multiple time horizons Anticipation of predetermined and discontinuities
Emphasis of scenarios	Scenarios as a product, an output of new learning	Scenarios as a basis for strategic conversation learning process	Scenarios as a basis for unlearning as well as learning; scenarios need combining with other tools, e.g., weak signals/horizon scanning and early warning signs
Example scenario projects	MEA/IPCC	Shell/WBCSD	

Summary of the different properties of scenarios, from Wilkinson and Eidinow (2008:11)

1.3.5 Other Categories

The remaining 'types' of scenarios are described by their respective authors as being categories of scenarios. However, it is argued that they constitute qualities of scenarios that may be incorporated into any of the above five scenario categories. Van Notten argues that the subject of the scenario itself creates three additional scenario types: issue-based, area-based, and institution-based. He defines issue-based scenarios as those which have "societal issues as the subject of study," area-based scenarios as those which "explore a particular geographical area such as a country, region or a city" and "institution-based scenarios" as those which "address the spheres of interest of an organisation, group of organisations, or sector" (van Notten 2001:429-30). He argues further that the temporal quality of a scenario makes it necessary to distinguish between

"developmental or chain" and "end-state or snapshot" scenarios. Van Notten uses the analogue of films for chain scenarios since "they describe the path of development to a particular end-state" in contrast to photographs, which are analogous to snapshot scenarios since "they describe the end-state of a particular path of development but only implicitly address the processes that result in that end-state" (van Notten 2001:433). In contrast, Rothman argues that scenarios should contain both such 'photographs' and 'filmic' qualities, because in his approach "a scenario consists of not only the end-state (a future image or vision), but also the path by which this is achieved. Thus, it should be seen as a dynamic story and not simply a static snapshot of some future point in time" (Rothman 2008:39).

Like van Notten, Alcamo also argues for an issue-based scenario type, although he only identifies one type of issue as constituting a scenario type: policy scenarios. In these, which he also terms "'pollution control,' 'mitigation' or 'intervention'" scenarios, "new policies or measures additional to those already adopted or agreed upon" are the focus of the scenario. For Alcamo, this type of scenario most suits a goal of being to "evaluate policies for achieving particular environmental targets" or "to evaluate the environmental and economic impacts of particular policies" or "to take into account the uncertainty of future environmental conditions" (2008:21).

The opposite of policy scenarios are termed "baseline, reference, or non-intervention scenarios" by van Notten (2001:429). Alcamo uses these same three terms, although he also refers to them as 'benchmark' scenarios as they "portray a 'default' view of the future". Each is concerned with "the future state of society and the environment in the absence of additional, new, and focused environmental policies" with the reference scenario being used "for estimating the benefits of policies, or conversely, the costs of not adopting policies." Alcamo advocates their usage for scenarios that aim "to evaluate the consequences of current policies or 'no new policy intervention,' or similarly, to provide a baseline for new policy interventions" (2008:21).

The last scenario type is one that is most likely to be used for the RMPP project: qualitative scenarios. In these, non-numerical data, such as "outlines, phrases or complete text, or visually as diagrams or pictures" are used to portray potential futures. Alcamo argues that the "most common form is the narrative text, or 'storyline'" which is the same format that was found in the qualitative case studies reviewed for this report. They are most suited for scenarios that aim to "stimulate policy ideas/brainstorming" or for "when communication and education is an important objective" or for "when many views about the future have to be included" (2008:22).

In contrast to the diversity of scenario types and their at-times inconsistent definitions and conflicting usage, the literature on focus groups offer far more coherent, candid and succinct descriptions of the what, how and why of convening groups of people to workshop scenarios. There is some productive cross-over between SEs and focus groups since, whether they are "used alone or in combination with other methods, the conventional aim of focus groups is to capture content in the form of understandings, perspectives, stories, discourses and experiences" (Millward 2012:416). The follow section outlines this cross-over, and the important differences between SEs and focus groups as they relate to the RMPP project.

1.4 Difference between Focus Groups and SEs

> The focus group is a discussion-based interview that produces verbal data generated via group interaction. Focus groups aim to build conversation among participants rather than conversation between the interviewer (or focus group facilitator) and individual participants (Millward 2012:412).

In this article, from the journal *Research Methods in Psychology*, Millward outlines the core concerns and qualities of focus groups. Although the article does not concern SEs per se, Millward discusses types of scenarios that are used in focus groups, such as "decision-making scenario" (2012:416), "content-oriented scenario" (2012:426), and "role-play scenarios" (2012:421), and much of her analysis of focus groups is directly applicable to SEs. In the above quote she discuses the "verbal data" that focus groups aim to generate, much like qualitative tabletop SEs. Of this "verbal data" she distinguishes between two distinct, but related, forms. The first being the actual "group process" of how participants and the facilitator "interact and communicate with each other" and the second being the actual "content around which the group process is organised" in terms of "the focal stimulus and the meanings arising from it." The analysis of these two forms of data is then approached from either the "intra-personal" by which she means "the thoughts, feelings, attitudes and values of the individual" versus the "intra-group" by which she means "how people communicate and interact with each other within the group" (2012:419).

Unlike the literature on SEs, the literature on focus groups includes analysis of the effect of the approach used be the facilitator(s) on the form of data produced. This information is highly relevant, as the roles of facilitator(s) of SEs are integral to what data they may potentially produce, and the absence of this reflection is seldom acknowledged in the literature on SEs. Millward classes facilitator approaches into two principal methods: essentialist versus social constructionist. She defines essentialist as being when the facilitator takes "control over what is discussed as well as how it is discussed" in contrast to social constructionist, which priorities "skilful facilitation of the group dynamic" over "the topic of discussion" (2012:428 emphasis in original). Furthermore, these two approaches differ in their aims, with social constructionist seeking to "maximise involvement and interaction…by ensuring that the discussion is productive" the criteria for which is that "all the relevant issues are covered and in sufficient depth." While this appears to have the qualities of an essentialist approach, due to the facilitator aiming to ensure the 'what' of the "relevant issues" and indeed their relevance, Millward is adamant that it differs from the essential approach as in this social constructionist approach the only thing pre-determined are the "issues to be focused on." Consequently, the 'how' of these issues is arguably more flexible than the 'how' of issues in an essential approach, because a social constructivist approach "should mainly allow the participants to determine the agenda" in an iterative process that actively incorporates the real-time dynamic of the focus group into shaping what the emerging agenda becomes. This creates a very different power relationship between facilitator(s) and participants, because it "require[s] that the facilitator empowers the participants to take progressively more responsibility for the group dynamics as well as the topic of the discussion." While Millward does not provide case studies to evidence this, she maintains that this approach "will provide the opportunity to see how participants naturally organise their discussions of certain issues" including the critically important ability to facilitate "discussion of controversial or sensitive topics that would otherwise threaten rapport if the researcher introduced them" (2012:428). Importantly, this social constructivist approach also creates additional responsibilities and skillset for the facilitator(s), as the increased responsibility it accords participants can result in focus groups becoming dominated by particular individuals. However, as the focus is on the 'how' over the 'what' in this approach, Millward found that

> this picture of domination may tell us something important. For example, it might tell us about information status differentials or it may reveal some power dynamics…The first

> person to speak at length in a discussion can set the tone and direction of the conversation, legitimising some topics as the focus of conversation over others. This is 'difficult' for a discussion in which the intention is to increase the breadth and depth of discussion about a range of preplanned topics, but a rich source of data for those interested in looking at group dynamics. On the other hand, the facilitator will need to be mindful of the ethics of allowing someone not only to inhibit the contributions of others but also potentially to upset them. The group facilitator may need to intervene if other group members are becoming visibly disengaged or distressed by the 'dominating' participant (2012:430).

In his article 'Focus Groups as Qualitative Research: Planning and Research Design for Focus Groups', Morgan acknowledges these qualities, and risks, of a social constructivist approach, although he argues that the "more structured" essentialist approach has the distinct benefit wherein the "higher level of moderator involvement" is more likely to "keep the discussion concentrated on the topics that interest the researchers rather than extraneous issues," such as issues generated when participants become responsible for generating an agenda in a social constructivist approach. Morgan positions the relationship between essentialist and social constructivist approaches as being "a trade-off between more ability to hear about what interests the researchers" in an essentialist approach and "less ability to be sure that this is what actually matters to the participants themselves" in a social constructivist approach (1997:39-40). While he is on the whole more favourable about essentialist rather than social constructivist approaches, Morgan does acknowledge that the relatively fixed format of an essentialist approach generally means that it uses a "narrow set of questions" resulting in "equivalently limited data" where "it may be difficult to know that this is the case" (1997:40) because the focus group is not orientated toward the 'how' or 'why' of participants' interactions with one another and the facilitator(s). In his experience he has found that "once participants sense that there is a distinct agenda for the discussion and that the moderator is there to enforce that agenda" of the essentialist approach "then they are likely to acquiesce in all but the most extreme circumstances" (1997:40). Acknowledging this quality, Morgan recommends the use of an essentialist approach when there is a "strong sense of what the research questions" such that "a standardized interview will make sure that all the groups discuss these issues in a relatively comparable fashion" (1997:39). In contrast, Millward has found the "complete absence of standardisation" as being "the main disadvantage for the essentialist stance" such that this approach makes it "difficult to compare findings across different focus groups within the same research project." To remedy this problem, of when "the focus is on what is discussed rather than how, without prompting, some topics may never come up," Millward recommends that "the facilitator will need to stick more to a script of topic areas and questions to ensure that everything is covered" (2012:428). In addition, she uses three criteria to maximise the ability of the 'what' of the focus group to produce meaningful data: specificity, range and depth, which she defines as:

- Specificity: this is about the extent to which minute detail is sought in people's responses and reactions to the stimulus object or event. It is the moderator's task to elicit meanings and differential responses.
- Range of coverage: this is about the skill of the moderator in actively facilitating transition from one area of a discussion to another.
- Depth: this is about the personal context of the response or reaction elicited by the stimulus. Eliciting in-depth responses involves expanding on responses beyond limited reports of 'positive' or 'negative', 'pleasant' or 'unpleasant' reactions. The moderator's task is to diagnose the level at which participants are talking to each other (i.e. ranging from superficial description to detailed elaboration) and where necessary to deepen it (2012:427).

The following case study provides an example of this essentialist approach in action, on a topic relevant to the RMPP project. South East Coastal Adaptation: Coastal urban climate futures in SE Australia from Wollongong to Lakes Entrance was a National Climate Change Adaptation Research Facility project that investigated coastal urban futures for the year 2030 and afterwards (Norman et al 2013). It constructed and ran two socio-ecological scenarios that were explored in targeted focus groups with "key regional and local decision-makers in the public sector" (Norman et al 2013:15).

The difference between focus groups and SEs can be seen in how this project described its approach to designing and running focus groups in order to explore different stakeholders' response to the two scenarios:

> Key elements include having structured conversations (key questions) with targeted small groups. The selection process involved inviting senior decision-makers of the seven local councils and relevant significant regional organisations, particularly catchment and coastal advisory bodies, to the workshop. The method of the focus group involved recorded discussion led by the Chief Investigator. The nature of the questions provided significant opportunity for decision-makers to contribute their ideas at an early stage of the process (April 2012), to respond to initial findings at a later stage (October 2012) and to be involved in the final report presentation (March 2013). This ensured that key end-users were both formally and informally involved for the duration of the research project (Norman et al 2013:15).

That is, the project used an essentialist approach, with a fixed script of questions and topics, so that the responses could be standardised, and thus compared within and between all focus groups. The following are the questions and the order in which they were asked in the two focus groups:

Focus Group 1: Batemans Bay NSW, April 2012

1. What types of climate information would be most useful to you in supporting your strategies and approaches to adapting to a warming climate?
2. What are the emerging issues in relation to coastal urban futures in your region?
3. In selecting our case studies, which townships do you think we should be focusing on to gain a better understanding of coastal urban futures?
4. What do you understand by the term 'coastal adaptation'? What are your current and future priorities? Why?
5. What do you see are the key impediments to implementing your coastal urban strategies?
6. What would you like to see coming out of this research that could assist you in implementing change?

Focus Group 2: Mallacoota Victoria, April 2012

1. What types of climate information would be most useful to you in supporting your strategies and approaches to adapting to a warming climate?
2. What are the current and emerging issues for your community in the context of climate change?
3. (What are the) particular locations in case study area that are of concern to you?
4. What do you understand by the term 'coastal adaptation'? What are your current and future priorities? Why?
5. What do you see are the key impediments to implementing your coastal urban strategies?
6. What would you like to see coming out of this research that could assist you in implementing change? (Norman et al. 2013:121).

Table 4. Features of Scenario 1 and 2

Issue	Scenario 1: Well adapted settlement	Scenario 2: Poorly adapted settlement
GOVERNANCE		
Government coordination	Federal, state and local government policies aligned and mutually supportive	Policies fragmented and unaligned between levels of government
Regional governance	Strong coordination across agencies at regional level	Little or no regional coordination or governance
Adaptation mainstreaming	Adaptation mainstreamed in ongoing planning and decision-making	Ignored or treated in isolation
Adaptive risk management	Climate drivers included in formal risk management, regularly revisited	Climate not included in risk management or treated as one off exercise
Stakeholder engagement and participation	Highly participative between government, community and business, with progressive social learning	Low participation and buy-in
Adaptive capacity and resilience	Components of adaptive capacity and drivers of resilience explicitly addressed	Vulnerabilities aggravated by poor capacity and resilience not being addressed
Synergies and trade-offs	Synergies gained and trade-off conflicts actively addressed and balanced	Synergies lost and difficult choices avoided or unbalanced
Incrementalism and transformation	Need or opportunity for transformation recognised and addressed, when incremental changes not enough	Never moves beyond incrementalism, opportunities lost
Public vs private rights (e.g. housing in inundation or bushfire prone locations; perpetual property titles; 'selfish' mitigation action)	Public rights given proper weight	Private rights dominate
INTEGRATION		
Across drivers, impacts, sectors and responses	Managed as an integrated system	Silo management of issues
Across relevant spatial extents	Regional and local perspectives inform decisions	Little or no regional view
Across time horizons	Decisions aligned across short, medium and long term	Unaligned and mostly short term
Across objectives and outcomes	Quadruple bottom line in balance and actively managed	Ineffective QBL balance

Some of the related cross-sectoral and sectoral strategies that would be consistent with the above 'well adapted settlement' are referred to in Chapter 7.

This Chapter has provided a summary of the issues likely to be faced and what these might mean for an adapted small town coastal community by 2030 and beyond. Alternative scenarios have been provided to illustrate the range of possible outcomes when planning for climate change. Effective governance and integration have emerged as key determinants of a well-adapted coastal community in 2030. Local differences and circumstances will then shape the physical responses. Intergovernmental cooperation and agreement and an integrated approach to policy will be fundamental to providing a more resilient future for coastal communities.

Features of Scenario 1 and 2 of the South East Coastal Adaptation project, from Norman et al (2013:55)

2 Prior Usage of Environmental Scenarios

Risks are future oriented and become real when they manifest. In other words, risks are what might happen, rather than what is happening. Thus, it is not surprising that within the risk management field the use of scenarios (as a tool) and scenario planning (as a methodological approach) has become a common way to assess and deal with risk in all of its myriad forms. Most basically, scenarios are used to talk about possible future events (risks) in the present and to help prepare for them (Cavelty et al. 2011:6).

The above study is an example of how focus groups that include scenarios have been used in a prior Australian research project on environmental challenges (in this instance climate change), planning, policy and risk mitigation. It is unfortunately not-representative of the use of scenarios or focus groups in projects on environmental challenges, which on the main accord with the CSIRO project discussed at the beginning of this project: Climate change scenarios for initial assessment of risk in accordance with risk management guidance, which either do not use scenarios, or use quantitative scientific/mathematical/numerical scenarios and in either eventuality do not critically reflect on the what, why and how of the use (or decisions not to use) scenarios.

2.1 Usage in Australia

The following section provides an overview of how environmental scenarios have been used in recent and relevant Australian projects concerning environmental challenges, planning, policy and/or risk mitigation:

Report into Bushfire Risk Management - a Natural Disaster Mitigation Project for Logan City Council (2012)

- Outlines an extensive response of a City Council to natural hazards, risk, mitigation, planning and policy
- However, does not mention using scenario exercises, and only mentions the word 'scenario' twice, in relation to "scenario modelling" of climate scenarios (2012:9).

Regional Natural Disaster Planning & Risk Mitigation Strategy (2008)

- Details the activities undertaken and outcomes achieved in conducting a natural disaster planning and risk mitigation project for the Central Local Government Region of South Australia.
- It is formally endorsed by the Natural Disaster Planning & Risk Mitigation Steering Committee,
- Includes Six Governance Recommendations, the fifth of which is: "ongoing regional collaboration through annual scenario exercises" under the "rationale" that "scenario exercises allow a practical opportunity for networking and regional collaboration" (2008:11).
- In the section titled "Assessment" the report advocates the use of "developing scenario analyses of the effects of hazards on exposed elements, such as people, buildings, infrastructure, the economy and the environment" because it found "an understanding of hazard, exposure and vulnerability is fundamental to the assessment process" (2008:32).
- However, the report never defines "scenario analysis" or "scenario" itself, or its methodology for such scenarios or their analysis.

Scenario Planning for Climate Change Adaptation (2012)

- Part of the South East Queensland Climate Adaptation Research Initiative and a partnership between the Queensland and Australian Governments, the CSIRO Climate Adaptation National Research Flagship, Griffith University, University of the Sunshine Coast and The University of Queensland.
- The 140 page report uses "Scenario Planning" in the title, yet the sections on 'The Scenario Planning Process' and 'Methodology' are 1.5 pages combined, with no literature review of

scenarios, no definition of scenario or acknowledgement of the contested definitions and methodologies around scenarios.

- The lack of depth and rigour in the approach to scenarios is represented by the following paragraph from the report, which attempts to cover major debates about scenario methodology with next to no engagement with the debates:

> There is no one way to do scenario planning with most variations being in their qualitative verses quantitative approaches. However, it is important to distinguish that scenario planning is based on the generation of descriptions of possible futures involving a high degree of uncertainty and are not predictions of a particular future. In this sense scenario planning does not involve forecasting or modelling which normally deal with the short term and are based on predetermined elements particularly from the past and the present. Current evidence suggests that two or four scenarios work well with any greater number leading to levels of complexity that potentially dampens engagement. Three scenarios it is suggested, inadvertently promotes the idea that the 'middle' scenario is the most likely most probable future (2012:3).

- The source sited for this approach is an undated report by P O'Brien titled *Scenario Planning – A Strategic Tool* published by the Bureau of Rural Science, Department of Agriculture, Fisheries & Forestry Australia, Commonwealth of Australia. This single source is used for the vast majority of the reports citations regarding scenario development, staging, analysis and methodology.
- Despite this, this report is recommended reading for a cursory overview of how a major Australian collaboration between industry, government and university used scenarios.
- For instance, the following outline of the workshop process is an example of how this report serves as a useful guide or template for running the SEs for the RMPP project:

APPENDIX H – OVERALL WORKSHOP PROCESSES AND TASKS

Second Series Scenario Planning Workshop
Overall Workshop Process & Sequence of Tasks

Task	Scenario Planning Workshop Tasks	Input
1	Reconfirm Focal Question, time frame and purpose of workshop Introduce the "input" material	• Sectoral Fact Sheets • Climate storylines • Adaptation Options • *Lilliput* model (incl. relevant HS types)
2	Introduce the scenarios (2)	• Scenario descriptions
3	Collective Brainstorming session - "Shared Path" ("Warm up" exercise) • develop a dot point narrative describing how we may move from the PRESENT to the possible FUTURE - descriptive "Roadmap" with key "sign posts" identified (i.e. indicators of possible futures being realised such as events, occurrences or observations that can be scanned from the real world) • Identify possible shocks & surprises that might be encountered along the way (compare with sets identified in previous Workshops) (log deliberations and discussions)	• Scenario descriptions • Sectoral Fact Sheets • Climate storylines • Adaptation Options • *Lilliput* model (incl relevant HS types) • Participants' imagination, experience and judgement • Narrative & Roadmap Outline sheet for scenario
4	**'Wind tunnel' or 'test bed' task** – First scenario Use the "Shared Path" scenario to test selected (existing & proposed) Climate Change Adaptation Options (Policies; Plans (design), Processes; Programs; Procedures; Products; People (behaviour)?) Step 1: Overall Assessment - ask the "what if?" question Step 2: Consider how the Adaption Option will address expected climate change in *Lilliput* in terms of the "Climate change adaptation options appraisal criteria" Step 3: Describe proposed modification/s to existing & proposed Climate Change Adaptation Options	• Scenario descriptions • Sectoral Fact Sheets • Climate storylines • Adaptation Options • *Lilliput* model (incl relevant HS types) • Participants' imagination, experience and judgement
5	Identify what needs to be done now to prepare for the future, to take account of signposts, and avoid or minimise unwelcome surprises and shocks later (consider in terms of revisions to adaptation options and key messages to engage stakeholders and to initiate dialogue on climate change adaptation requirements for *Lilliput*)	• Participants' experience and judgement
6	Collective Brainstorming session - "Free Ride" ("Warm up" exercise) • Brainstorm a dot point narrative describing how we may move from the PRESENT to the possible FUTURE - descriptive "Roadmap" with key "sign posts" identified (i.e. indicators of possible futures being realised such as events, occurrences or observations that can be scanned from the real world) • Identify possible shocks & surprises that might be encountered along the way (compare with sets identified in previous Workshops) (log deliberations and discussions)	• Scenario descriptions • Sectoral Fact Sheets • Climate storylines • Adaptation Options • *Lilliput* model (incl relevant HS types) • Participants' imagination, experience and judgement Narrative & Roadmap Outline sheet for scenario
7	**'Wind tunnel' or 'test bed' task** – Second scenario Use the "Free Ride" scenario to test selected (existing & proposed) Climate Change Adaptation options (Policies; Plans (design), Processes; Programs; Procedures; Products; People	• Scenario descriptions • Sectoral Fact Sheets • Climate storylines • Adaptation Options

Task	Scenario Planning Workshop Tasks	Input
	(behaviour)?) Step 1: Overall Assessment - ask the "what if?" question Step 2: Consider how the Adaption Option will address expected climate change in *Lilliput* in terms of the "Climate change adaptation options appraisal criteria" Step 3: Describe proposed modification/s to existing & proposed Climate Change Adaptation Options	• *Lilliput* model (incl relevant HS types) • Participants' imagination, experience and judgement
8	Identify what needs to be done now to prepare for the future, to take account of signposts, and avoid or minimise unwelcome surprises and shocks later (consider in terms of revisions to adaptation options and key messages to engage stakeholders and to initiate dialogue on climate change adaptation requirements for *Lilliput*)	• Participants' experience and judgement

Outline of the Scenario Planning for Climate Change Adaptation workshop (2012:110-111)

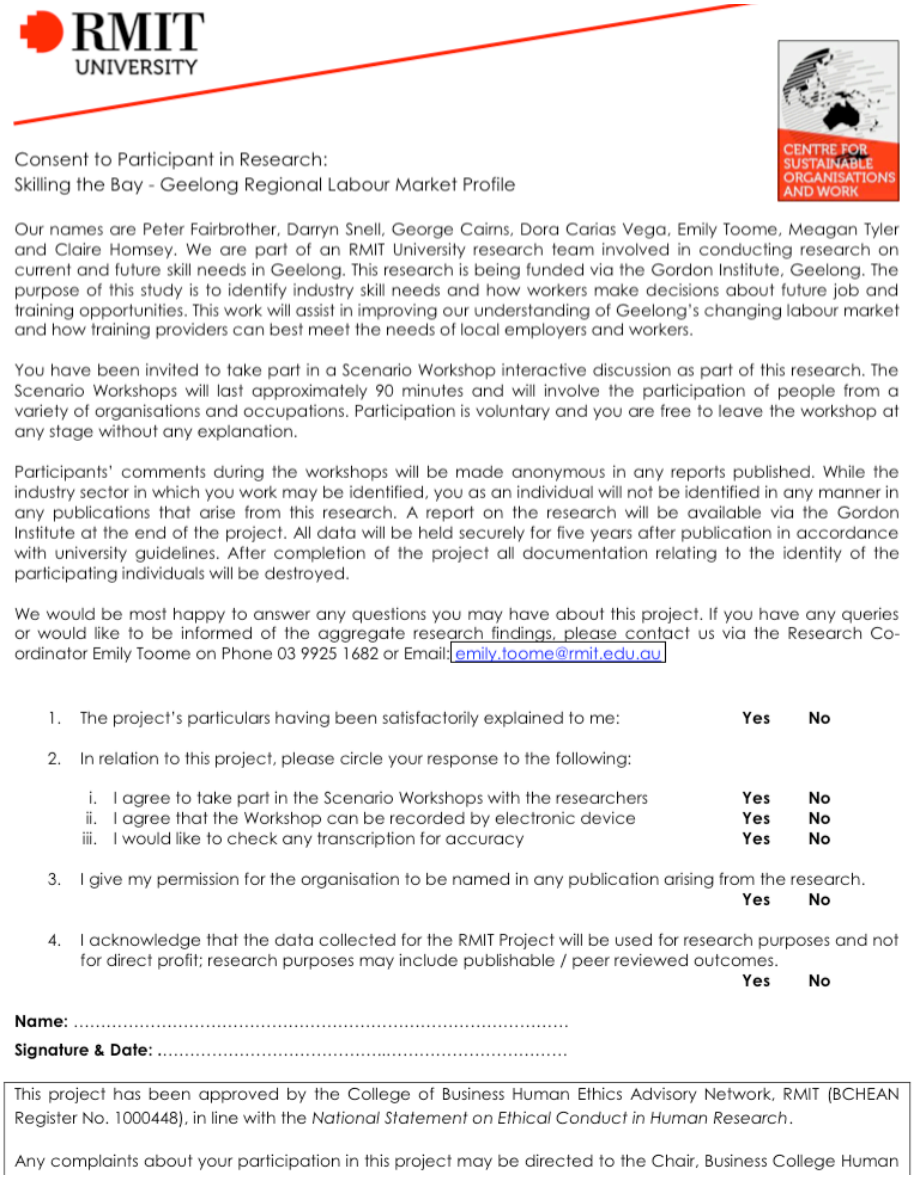
Skilling the Bay: Geelong Regional Labour Market Profile (2013)

- Lead Researchers: Professor Peter Fairbrother and Professor George Cairns,Emergency and Disasters Research Cluster, RMIT University.
- Authors are from the School of Management, and the Centre for Sustainable Organisations and Work, both at RMIT University.
- Lead Researchers and authors also completed a Bushfire CRC funded three year project: *Effective Communication: Communities and Bushfire* which "investigates the complex process of how information on how to prepare for bushfires is being communicated by the relevant agencies to the public" (2013a:1).t This is discussed in their published reports *Briefing Report Seven – Scenario Method*s; *Briefing Note: Identifying Effective Risk Communication Procedures and Products*; and *Report Six – Multiple Hazards Emergency Information: End-User Focus Groups products.*
- Their 'Briefing Report 3 Scenario Workshops' outlines their scenario methodology, although, like their *Effective Communication: Communities and Bushfire* project, it does not comprehensively define what this methodology entails. The define their "use of the scenario method" (2013a:2) as being the "'backward logic' (from Wright and Cairns, 2011) method of constructing extreme scenarios" which "invites the involved and affected stakeholders to respond to one or two, 'extreme scenarios' – outlined by the external facilitator – in terms of a critical analysis of their degrees of possibility and plausibility" (2013a:3).
- The series of scenario workshops, held in Geelong in February 2013 envisioned "futures for the region in ten years' time" and used "a range of stakeholders from key sectors: health care and social assistance, manufacturing, education, and local government."
- The aim of the workshops was for the "stakeholders in the Regional Geelong Area to consider 'extreme futures' and to identify and discuss key issues that are seen as central to future planning and policy making" (2013a:2) in order to "open up discussion about industry futures and the identification of investment and job opportunities, as well as enable an understanding of skills profiles and strategies to deal with skills surfeits, deficits and up-skilling. Such an analysis intends to provide a focused understanding of skills issues, as they emerge and from different actors' perspectives, allowing stakeholders to identify potential ways forward for the region" (2013a:2).
- The Appendix 1: Scenarios 1 to 3 (2013a:13-17) are recommended reading to see exactly what scenarios were devised and read to the participants. The Informed Consent Form given to scenario exercise participants is at the end of this section.

Identification of opportunities to support Structural Adjustment in the Latrobe Valley (2013)

- Lead Researchers: Professor George Cairns, Dr Meagan Tyler, Professor Peter Fairbrother, Emergency and Disasters Research Cluster, RMIT University.
- Authors are from the School of Management, and Centre for Sustainable Organisations and Work, both located at RMIT University. Lead Researchers and authors were also part of a BCRC-funded three year project: *Effective Communication: Communities and Bushfire* "which investigates the complex process of how information on how to prepare for bushfires is being communicated by the relevant agencies to the public" (2013b:1), discussed in their published reports *Briefing Report Seven – Scenario Method*s; *Briefing Note: Identifying Effective Risk Communication Procedures and Products* and *Report Six – Multiple Hazards Emergency Information: End-User Focus Groups products.*

- This report is very similar to the *Skilling the Bay - Briefing Report 3: Scenario Workshops Report* and so the same comments apply to Structural Adjustment in the Latrobe Valley - *Briefing Report Four: Scenario Methods.*
- This report "explains and outlines the rationale behind scenario methodology, its aims and outcomes, how the workshops will run for this project, and how these scenario workshops differ from other kinds of scenario analysis used previously in regard to studies of the Latrobe Valley."
- Like *Skilling the Bay*, this project used "an 'extreme scenario' approach, which is best suited given the time and participation constraints, and previously conducted research" (2013b:1).
- The series of scenario workshops involved "a range of stakeholders from relevant industries, organisations and the public sector" and aimed to "provide a more detailed understanding of how stakeholders in the Latrobe Valley region view their own futures and key issues with regard to the transition to a low carbon economy, as well as providing information for future planning and policy making" (2013b:1).



RMIT UNIVERSITY

CENTRE FOR SUSTAINABLE ORGANISATIONS AND WORK

Consent to Participant in Research:
Skilling the Bay - Geelong Regional Labour Market Profile

Our names are Peter Fairbrother, Darryn Snell, George Cairns, Dora Carias Vega, Emily Toome, Meagan Tyler and Claire Homsey. We are part of an RMIT University research team involved in conducting research on current and future skill needs in Geelong. This research is being funded via the Gordon Institute, Geelong. The purpose of this study is to identify industry skill needs and how workers make decisions about future job and training opportunities. This work will assist in improving our understanding of Geelong's changing labour market and how training providers can best meet the needs of local employers and workers.

You have been invited to take part in a Scenario Workshop interactive discussion as part of this research. The Scenario Workshops will last approximately 90 minutes and will involve the participation of people from a variety of organisations and occupations. Participation is voluntary and you are free to leave the workshop at any stage without any explanation.

Participants' comments during the workshops will be made anonymous in any reports published. While the industry sector in which you work may be identified, you as an individual will not be identified in any manner in any publications that arise from this research. A report on the research will be available via the Gordon Institute at the end of the project. All data will be held securely for five years after publication in accordance with university guidelines. After completion of the project all documentation relating to the identity of the participating individuals will be destroyed.

We would be most happy to answer any questions you may have about this project. If you have any queries or would like to be informed of the aggregate research findings, please contact us via the Research Co-ordinator Emily Toome on Phone 03 9925 1682 or Email: emily.toome@rmit.edu.au

1. The project's particulars having been satisfactorily explained to me: **Yes** **No**
2. In relation to this project, please circle your response to the following:
   i. I agree to take part in the Scenario Workshops with the researchers **Yes** **No**
   ii. I agree that the Workshop can be recorded by electronic device **Yes** **No**
   iii. I would like to check any transcription for accuracy **Yes** **No**
3. I give my permission for the organisation to be named in any publication arising from the research. **Yes** **No**
4. I acknowledge that the data collected for the RMIT Project will be used for research purposes and not for direct profit; research purposes may include publishable / peer reviewed outcomes. **Yes** **No**

Name: .....

Signature & Date: .....

This project has been approved by the College of Business Human Ethics Advisory Network, RMIT (BCHEAN Register No. 1000448), in line with the *National Statement on Ethical Conduct in Human Research*.

Any complaints about your participation in this project may be directed to the Chair, Business College Human

Skilling the Bay Informed Consent Form given to scenario exercise participants (2013:22)

2.2 Usage Internationally

The following are recent and relevant international projects concerning environmental challenges, planning, policy and/or risk mitigation:

Guide to Planning and Staging Exercises (2011)

- From 'A Framework for Major Emergency Management' (2011) by the National Directorate for Fire and Emergency Management, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
- 'Scenario Exercises' are mentioned throughout the report, but the usage of 'exercises' is in emergency training and management, so the guide does not generally concern planning or staging 'scenarios' or 'scenario exercises', although it includes an Appendix on 'Developing the Scenario Narrative' (2011:39).
- While the 'scenarios' and 'exercises' referred to are all qualitative and narrative based ones, 'scenarios' and 'exercises' are mostly used to refer to scientific/mathematical/numerical 'scenarios'.

Using Scenarios to Assess Risks: Examining Trends in the Public Sector (2011)

- By the Crisis and Risk Network, Center for Security Studies, ETH Zurich (2011), and commissioned by the Swiss Federal Office for Civil Protection for ETC to compile this report "on critical infrastructure protection and on risk analysis to promote discussion and provide information about new trends and insights" (2011:1).
- This report is an excellent case study of how one country (Switzerland) undertakes a review of how its neighbours (Germany, UK, Denmark, Netherlands) use scenarios to assess risks, so that it may formulate improved policy responses around risk. It is the only relevant report on scenarios and risks in the context of what it states is "the lack of literature on the role and use of scenarios in risk assessment" (2011:5).
- The most relevant information it provides is in differentiating between two different types of scenarios that it argues are too often conflated in the literature on scenarios:

> despite the well-established use of scenarios in security planning, various aspects of this use remain under-researched. In order to fill parts of this gap, we distinguish between two different types of scenarios: one type is used for foresight activities and one is used in risk assessment. While there is a considerable amount of literature on foresight methodology in general and some for foresight in public policy in particular, little to no systematic literature on scenarios in risk assessment done in the public policy sector exists (2011:5)

- The report defines the differences between type 1 ['Scenarios in Foresight'] and type 2 ['Scenarios in Risk Assessment'] as stemming from the type of 'knowledge' that each type values and aims to create:

> First type scenarios are used mainly to develop robust strategies for the future, whereas the second is used for emergency (or contingency) planning. In the first type of scenarios participants are asked to be creative and imaginative in the foresight process whereas in the second type scenarios are understood as 'adverse event illustrations' and are thus based on 'secured' knowledge and experiences made in the past. While the aim of scenario-building as foresight tool is to push the limits of what we usually imagine as far out as possible the second type of scenario aims to depict the events occurring when a risk manifests as realistically as possible (2011:8)

- Having evaluated this relationship in case studies on Germany, UK, Denmark, Netherlands the report argues that

> it seems noteworthy none of the evaluated countries systematically thinks about combining the two types of scenarios that we identified (i.e. scenarios for foresight and scenarios for risk assessment). However, both approaches could potentially benefit from the other and foster improved (and institutionalized) exchange between experts trained to look into the future and those aiming to do risk assessment. For example, the more future oriented scenario exercises would gain political standing through a clear link to policy and planning – and the more planning oriented scenario processes could get potential input about issues that are beyond 'secure' knowledge and the projection of past experience (2011:22)

Participatory Methods Toolkit: A Practitioner's Manual (2005)

- NB this refers to two separate documents, both by the King Baudouin Foundation and the Flemish Institute for Science and Technology Assessment.
- *Scenario Building Exercise* is the most recommended reading for a brief overview of SEs: outlines a working definition of the term 'Scenario Exercise' within the constraint that there is no coherent body of literature that reviews, critiques and critically analyses scenarios.
- It also reaffirms that the literature is overwhelmingly about 'scenario' as quantitative scientific/numerical/numerical model, such as a climate change 'emission scenario' rather than qualitative or narrative based 'scenarios'.
- *Participatory Methods Toolkit: A Practitioner's Manual* is also highly recommended, but it is much more detailed and much of the information is already covered in this report.

IEA Training Manual on Integrated Environmental Assessment and Reporting (2007)

- 'Module 6: Scenario development and analysis' is from the Integrated Environmental Assessment Training Manual series, by the International Institute for Sustainable Development and the UNEP.
- A good example of a highly practical document, focused exclusively on practitioners and end users: its stated aim is to "help you develop scenarios and analyse them, either in terms of the impact they would have on existing policies, or the kinds of policies that would be needed in order for a particular scenario to unfold." It provides this instruction as "the basis for an entire process for developing and analysing scenarios." (2007:1)

Federal Emergency Management Agency

- FEMA has published some useful and highly practical guides to convening and coordinating scenario exercises. The two most recommended guides are:

1. *National Level Exercise 2012: Cyber Capabilities Tabletop Exercise* (undated)
   - "This cyber scenario based exercise was developed by the Federal Emergency Management Agency for use by private sector preparedness partners as a part of National Level Exercise 2012. The exercise is designed to increase understanding of cyber threat alerts, warning, and information sharing across sectors, and to test and evaluate government-private sector coordinating structures, processes, and capabilities regarding cyber event response and recovery. The Tabletop Exercise is an interactive exercise, complete with accompanying facilitator's notes and scripted video injects" from http://www.fema.gov/media-library/assets/documents/26845.
   - While the scenarios themselves are not of great use or relevance to the RMPP project, the document 'Facilitator Background Information' is of great use as it shows all the

background information, instructions and responsibilities for a facilitator who is running a SE.

2. *Communications-Specific Tabletop Exercise Methodology* (undated)
   - Joint publication the Department of Homeland Security.
   - This guide is intended to help local policymakers and Federal technical assistance programs plan, design, and conduct communications-specific exercises in collaboration with the emergency response community…Replicable nationwide, the Communications-Specific Tabletop Exercise Methodology may be tailored to the specific needs, realities, and organizational cultures of diverse localities…By incorporating the objective input of practitioners, the methodology develops realistic exercise scenarios, tests actual response processes and procedures, generates usable exercise results, and enables the identification and implementation of effective interoperable communications solutions. (N.D:1)
   - Much of the guide is too detailed and falls beyond the scope of the RMPP project, but it is a useful overview of how a major international emergency management organisation reviews different methodologies for doing table top exercises, which are the most likely form of exercise that will be used for the RMPP project

Report on the new methodology for scenario analysis**,** including guidelines for its implementation**,** and based on an analysis of past scenario exercises (2011)

- Produced by researchers from The Netherlands, Belgium, Germany, Austria for the international project *Climate Change Integrated Assessment Methodology for Cross-Sectoral Adaptation and Vulnerability in Europe* (CLIMSAVE 2011).
- The project rationale is that:

> decision-makers and other interested citizens need reliable science-based information to help them respond to the risks of climate change impacts and opportunities for adaptation. From this, it follows that the consolidation of such information needs to be founded in a holistic or integrated assessment system's view on the effects of our changing future. We therefore follow the principles of Integrated Assessment (IA), which is an interdisciplinary process that combines, interprets, and communicates knowledge from diverse scientific disciplines from the natural, engineering and social sciences to investigate and understand causal relationships within and between complex systems, providing tools to develop the information resources required (2011:4)

- The authors "translated" these requirements into the following recommendations for scenario development:
  - The process is highly transdisciplinary, involving scientists from a range of disciplines but also importantly involving stakeholders in every step of the scenario development process.
  - The process will aim at a two-way iterative process of dialogue and co-production of knowledge, allowing stakeholders to develop their understanding and test ideas, based upon their own hypotheses.
  - The resulting scenarios are highly integrated (2011:4-5)

- The report includes an overview of its own navigation through the methodological uncertainty of SEs, a review of the efficacy of how environmental scenarios have been used in prior projects such as MA, IPCC, and a frank account of its own process, results and lessons learned.

- It is quite a useful report on practice advise for using scenario analysis, including a comprehensive overview of the advantages and disadvantages of using Alcamo's Story-And-Simulation method for SE, which Alcamo defines as combining qualitative and quantitative scenarios (2008:124).
- The authors used SAS in the following procedure, based on their interpretation of Alcamo's schematic for using SAS (2008:138)

The Story-And-Simulation approach accounts for all steps considered essential to develop scenarios at a single scale. Important steps include the establishment of a scenario panel and scenario team (1); construction of storylines (3) that are quantified and revised (4-6) in an iterative procedure; and publication and distribution (10). The scenario team is a selection of 6-8 experts responsible for the coordination of the scenario development process and most steps in parameter quantification. The scenario panel is a small core group of key stakeholders that is assembled at the start of the project and that are responsible for the actual development of storylines. The composition of the scenario panel should be unaltered as much as possible to ensure continuity. Stakeholder workshops will take place at regular intervals, in this case 3 at approximately 9 month intervals. All members of the scenario panel will be invited to each workshop complemented by a number of additional stakeholders depending on the purpose of the workshop, and a number of scientists from (2011:29)

- These steps are listed in the following diagram in the report:

6.5 *Story-And-Simulation – linking models and stories*

Basics of the Story-And-Simulation approach

Figure 5 shows the graphical representation of the Story-And-Simulation approach a described by Alcamo (2008).

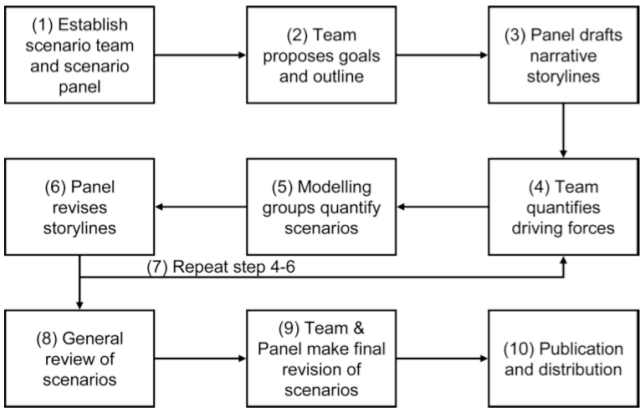
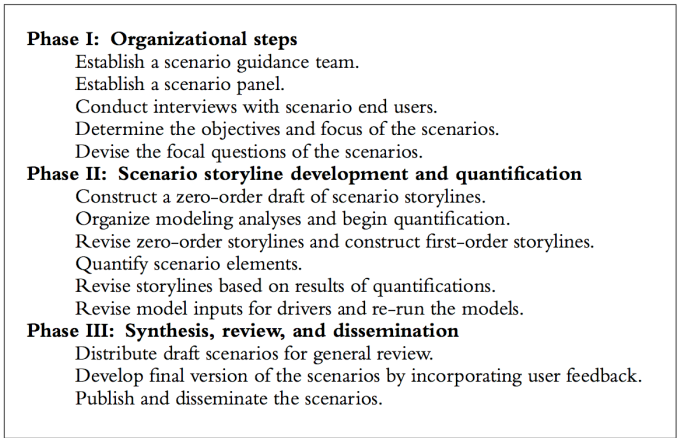


Figure 5: The Story-And-Simulation approach.

The sequence of using Alcamo's Story-and-Simulation approach in CLIMSAVE's scenarios, from CLIMSAVE (2011:28)

In his analysis of the Millennium Ecosystem Assessment, which used the SAS approach, Alcamo presents it as using the above steps in the above order of stages:



Phase I: Organizational steps
Establish a scenario guidance team.
Establish a scenario panel.
Conduct interviews with scenario end users.
Determine the objectives and focus of the scenarios.
Devise the focal questions of the scenarios.
Phase II: Scenario storyline development and quantification
Construct a zero-order draft of scenario storylines.
Organize modeling analyses and begin quantification.
Revise zero-order storylines and construct first-order storylines.
Quantify scenario elements.
Revise storylines based on results of quantifications.
Revise model inputs for drivers and re-run the models.
Phase III: Synthesis, review, and dissemination
Distribute draft scenarios for general review.
Develop final version of the scenarios by incorporating user feedback.
Publish and disseminate the scenarios.

Using Alcamo's Story-and-Simulation approach in Millennium Ecosystem Assessment's scenarios (Alcamo 2008:133).

• Of the "Key overall methodological lessons learnt", the number one listed one was that:

> Story-And-Simulation was, is and will continue to be the state-of-the-art framework of linking models and stories, and thus scientists and a range of other stakeholders. Overall, all projects have shown that the advantages strongly outweigh the disadvantages. On the one hand, the Story-And-Simulation approach is sufficiently flexible to allow for new tools to be included, and on the other hand, the approach is sufficiently strict to clearly separate the roles of stakeholders and scientists and allow for co-production of knowledge. (2011:8)

• Under this same heading of "Key overall methodological lessons learnt" is a sub-heading "Using fast-track scenarios can increase the number of iterations, but has drawbacks." This outlines what the authors found to be the main disadvantage of SAS: the iteration and relationship between stories and model output. They write that the:

> number of iterations is usually limited to 1. The use of existing scenarios as a starting point can successfully increase the number of iterations to 2-3, leading to more consistent products. The use of fast-track scenarios, however, comes at a cost in the storyline development. Two issues have been reported as problematic. Firstly, using a set of existing stories as a starting point can obstruct the process of taking ownership of the scenarios by stakeholders. Secondly, fast-track scenarios can lead to a set of scenarios that were termed by some as 'boring'. On the other hand, fast-track scenarios were beneficial for the development of quantitative scenarios since they provide a meaningful reference for the iteration process in terms of geographic focus and inclusion of regional perspectives, and they provide a back-up in case of delay in provision of interim results. Our recommendation is to experiment with using other types of short-cuts to speed up the process to draft storylines, for example use fast-track uncertainties, or use existing scenarios without presenting the entire storyline. (2011:9)

The next sub-heading immediately following on, 'The Story-And-Simulation approach has proven its success in practice', outlines the main benefits for using 2-3 iterations between stories and model output. These benefits are from the authors analysis of major international projects which used SAS, including SCENES, the Millennium Ecosystem Assessment, World Water Vision, GEO-4 and MedAction:

- Having stakeholders develop storylines led to strong feelings of ownership.
- Stakeholders regarded themselves as being the 'owners' of the storylines. This feeling increased with each additional iteration. Linking stories and models was a powerful

means to bring together scientists and stakeholders. Stories and models remain the most appropriate tools to engage scientists and stakeholders, and co-produce scenarios.

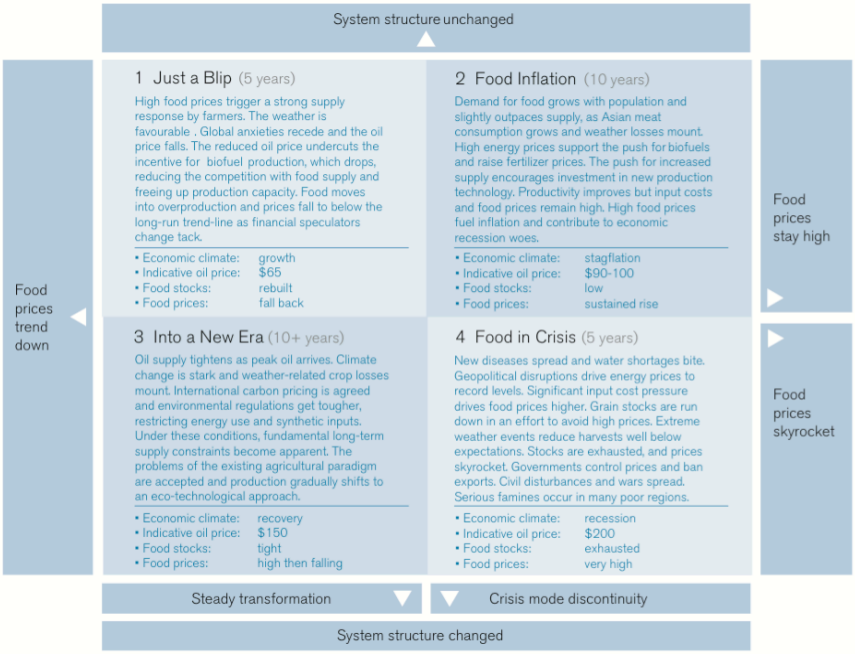
- A set of 2-4 consistent, creative, credible, and relevant storylines were developed. There are indications that the resulting products were believed to be credible, relevant, and consistent. These stories were successfully quantified and translated into model output.
- Iterating between stories and models is critical and was achieved in most projects. This is arguably the weakest link in the Story-And-Simulation approach. Beyond any doubt, it has been taken very seriously in all recent scenario projects. Yet, in most cases, more than one iteration proved to be impossible.
- Stories and model input/output changed after every iteration. The amount of change reduced with every iteration. It was particularly shown how input from stakeholders through the Fuzzy Set exercise changed with every iteration, and how changes became smaller, indicating an agreement between stakeholders and modellers.
- This could indicate that stories and models are more consistent with each other than without iterations. (2011:10)

Future of Food Supply (2008)

- This project is relevant as it used narrative based qualitative scenarios to explore critical intersections of risk, policy and planning around found security.
- The following excerpt outlines how their methodology of scenario development relates to the RMPP project:

> A subset of the project's research team identified the driving forces that, separately or in combination, will continue to exercise significant influence on political, economic and social developments. These break down broadly into four categories: the changing oil price, the growth of global demand for food, issues around current supply capacity (with a focus on the expansion of global production) and the global political and economic responses to change. Key uncertainties were subsequently identified around the main drivers, and the interdependencies between them were mapped. Story-lines were then developed from the resulting models and considered in three plenary research team discussions and bilateral consultations with expert sources on specific points. Two one-day workshops involving stakeholders from around the UK's wheat and dairy supply networks were held in January 2008. The level of understanding and experience represented by participants allowed the global scenarios to be further refined. The workshops also delivered an initial understanding of the UK interests that would come into play in each set of global circumstances proposed. The project's Stakeholder Panel made a valuable contribution to the scenario development in two discussions held in January and March 2008. A further set of (two-day) stakeholder workshops in March 2008 encouraged the UK wheat and dairy networks' participants to focus on the effects of the global scenarios on the UK's own food supply arrangements (2008:1).

- These are the four story-lines and scenarios in this excerpt in more narrative and contextual detail:



The four story-lines and scenarios in *Future of Food Supply* project, from Chatham House (2008:3)

> The discursive-analytical nature of scenario processes can help ensure attention is focused on different types of knowledge and uncertainty. This is particularly useful in the context of challenges that are too uncertain to be resolved by conventional methods of inquiry that depend on assimilating expert knowledge. Forecasting and modeling methods work with what is known and what is unknown. This can encompass 'what is likely', in terms of probabilities for example, but it is still essentially working in terms of the same basic dichotomy, which does not acknowledge the varied nature of 'knowledge'. In contrast, scenarios can help us to work with different kinds of knowledge, ignorance and uncertainty, for example, socially constructed ignorance or 'uncomfortable knowledge', i.e. what others know about but cannot be known here/by us/in this country/organization (Wilkinson and Eidinow 2008:3).

Having reviewed what scenarios are, and how they have been used in projects relevant to the RMPP project, this section outlines the different purposes and motivations for using scenarios. In the above quote, Wilkinson and Eidinow highlight one of the pivotal contributions that scenarios can make: toward working with and understanding "different kinds of knowledge" including going beyond the 'known-known' and 'unknown-known' (2008:8). Kosow and Gafner found that scenarios are an excellent means by which to explore what they termed is a "tension" between the "three poles" of "knowledge of the future, the limits of this knowledge, and the possibility of influencing the future." However, they also found that "this field of tension includes and demarcates not only the goals and functions of scenarios but also their limitations" (2008:17). In his article 'Developing qualitative scenario storylines for environmental change assessment' Rounsevell argues that one explanation for such limitations is due to the highly specific situations for which scenarios are useful. He describes them as having "an important role to play" in situations where there is "limited understanding of the causal relationships within a system that prevents quantification of these relationships in models." Within these constraints of not being "predictions" or seeking "truth", Rounsevell is still favourable in his assessment of their use value, due to the ability of scenarios "to open our eyes to different ways of perceiving our world" wherein they can "stimulate, provoke, and communicate visions of what the future could hold for us" (606).

Swart's article 'The problem of the future: sustainability science and scenario analysis' seeks to define the situation within which scenarios are most useful. He defines their use within the context of how

> sustainability science must consider the interplay and dynamic evolution of social, economic and natural systems—it requires an integrated and long- term perspective. It must address the sustainability process as tentative, open and iterative, involving scientific, policy and public participation. It must capture the possibility of structural discontinuity and surprise in socio-ecological systems. And it must recognize the critical importance of alternative, and sometimes competing, stories, beliefs, institutional contexts and social structures. Modern scenario methods are well-suited to these tasks. They can help to organize scientific insight into an integrated framework, gauge emerging risks, and challenge the imagination. They can provide a means for integration of descriptive and narrative elements, and qualitative and quantitative information. They ease communication with non-scientific audiences, and can engage diverse stakeholders as actors in scenario design and refinement (2004:142)

Henrichs also argues for the suitability of scenarios "to assess the prospects of future developments within complex and uncertain systems" that are based on "interactions between socio-economic and environmental developments." Like Swart, Wilkinson and Eidinow, Henrichs

locates this suitability in situations where scenarios can "provide an approach to reflect on and think through the possible implications of alternative decision pathways in a structured manner" that acknowledges different forms of knowledge, such as "expert knowledge and stakeholder perspectives." In these situations, Henrichs argues that "scenario exercises have become one of the key tools for bridging environmental science and policy" (2009:4).

In terms of developing this critical relationship between environmental science and policy, Henrichs expands upon his definition of when a scenario approach is most suitable. He defines the suitability according to three principal purposes that scenarios are used for (1) "research and scientific exploration," (2) "education and public information" and (3) "decision support and strategic planning." For the first context, he argues that scenarios are best suited to "bring together information from different research strands and scientific disciplines to better examine the complexity of environmental systems" in order to "better understand the dynamics of (complex) systems by exploring the interactions and linkages between key driving forces" (2009:7). However, he cautions that scenarios for this purpose "tend to focus more strongly on the scenario product themselves, rather than the process – and will first and foremost need to aim for credible outcomes" (2009:24). In the second context, scenarios are best suited to "highlight and explain the implications and long-term consequences of current trends and choices that may lie ahead" through "structuring, conveying and illustrating differing perceptions about unfolding current and future trends" (2009:7). The caveat for this purpose is that scenarios are contingent on incorporating "broad participation" wherein "stakeholders and decision-makers need to be involved" which he sees as being mutually exclusive for scientists and researchers' involvement, which then needs to be "limited to providing input and reflections" (2009:24). For the final context, scenarios are best suited for a range of related purposes, being "to solicit views and opinions about expected future developments, to 'test' different options for decision units to respond effectively to changing decision contexts, to evaluate the implications of specific decisions, to help prepare for risks, or to analyze the trade-offs related to specific future pathways" (2009:7-8). The consideration in this context is that scenarios are overly influenced by the interests of decisions makers, to the extent that they become "aligned" with their interests. Henrichs suggestion to remedy this is to ensure there is "a constant dialogue with those that take the decisions" (2009:24) to keep their interests in balance with the other considerations of the scenario.

In contrast, Wright and Cairns are not as prescriptive as Swart or Henrichs in defining what situations scenarios are suitable for. Instead of defining by purpose, he defines four criteria of process that should determine the suitability of using scenarios. These four criteria are that scenarios should used for a "problem" in ways that lend themselves to being:

- **Inclusive**: in that it involves and engages with all relevant stakeholders who are represented in the scenario team;
- **Democratic**: in providing an open forum for the expression of all views and opinions; scenario thinking does not respect hierarchy – the best insights can come from any member of the scenario team;
- **Non-selective**: in presenting a range of possible and plausible future conditions without making judgments on which is more or less likely to unfold in reality; and
- **Possibly threatening**: in that it will challenge both business- as-usual thinking and the individually held perspectives of scenario team members (Wright and Cairns 2011:63).

Alexander applies these criteria to the context of the purpose of a scenario according to what phase of a process it is for. While he provides the following table for the context of emergency management, it is broadly applicable to a range of other scenario contexts:

Table I Some uses of scenario methodology in civil protection and disaster prevention

Mitigation phase
Scenario building as a training method for emergency planners
Assessment of the vulnerability of structures and communities by exploring their susceptibility to damage and destruction
Reconstruction of past disaster impacts and responses in order to learn lessons for future preparedness
Preparedness phase
Scenario building and exploration as a training method for emergency response personnel
Study of the probable future effect of hazards by building conceptual models of impacts and responses
Scenarios for the probable performance of monitoring and alarm equipment
Warning and evacuation scenarios employed to design warning and evacuation systems
Emergency response phase
Study of the efficiency of emergency responses and disaster plans by exploring the progress of future post-disaster emergency operations
Logistical scenarios to estimate the efficacy and viability of certain relief operations
Post-disaster scenario reconstruction for debriefing emergency personnel
Recovery phase
Use of scenarios to estimate the magnitude and location of damage in future disasters for mitigation purposes and to calculate repair needs
Economic scenario modeling of post-disaster employment and unemployment patterns
Reconstruction phase
Use of scenarios to model the social and economic conditions that either inhibit or facilitate reconstruction
Financial and fiscal planning of reconstruction using economic scenarios

Uses of scenario methodology in civil protection and disaster protection, from Alexander (2000:95)

Ratcliffe takes a different approach, whereby the purpose of a scenario is defined by the following list of aims, that operate above whatever context a scenario is applied to:

- Establishing the goals and objectives of the agency concerned.
- Comprehending the mental models of the decision makers.
- Bringing to the surface trend-breaking developments in the business/organisational/ community environment.
- Correcting institutional myopia.
- Recognising fresh external signals of prospective change.
- Eliciting strategic insights and intuitions.
- Discovering the concerns of 'key players' about the future.
- Identifying burning questions of the moment.
- Confirming issues and trends.
- Assisting in understanding predictability, impact and uncertainty.
- Starting to form a strategic vision.
- Helping to construct a set of scenario logics.
- Capturing a range of perspectives.
- Tackling and reducing complexity.
- Determining competitive advantage and distinct competencies.
- Committing decision makers to the scenario-planning process.
- Diagnosing difficult decisions or awkward people that might hamper the process and defusing them.
- Setting the strategic agenda (2002:23)

Henrichs lays out a similar list of the principal aims and purposes of scenarios. However, while Ratcliffe's above list includes no overarching aim, Henrichs subsumes all his ancillary aims under

the one principal aim of scenarios, which is to "attempt to anticipate possible consequences of current developments and options to either prevent, counter, prepare for, enhance or benefit from future changes - and to better understand the implications of the uncertainties that surround our assumptions about how the future may unfold." The following aims then exist "under this general umbrella":

- Aiding in recognition of 'weak signals' of change;
- Avoiding being caught off guard – 'live the future in advance';
- Challenging 'mental maps';
- Raising awareness (e.g. about future risks or critical thresholds);
- Testing strategies for robustness using 'what if' questions;
- Providing a common language (e.g. by unveiling different perceptions and beliefs);
- Stimulating discussion and creative thinking;
- Providing better policy or decision support;
- Stimulating engagement in the process of change (2009:7).

The relationship between scenarios and policies may be used to illustrate how the purpose of a scenario may be defined according to the scenario aims. The IEA Training Manual laments that despite there being "a variety of ways in which policies can and have been addressed in a scenario exercise" they have mostly found scenarios that concern policy have not been adequately defined according to their specific purpose, as this purpose "has been an afterthought" whereby "appropriate purposes and the implications for designing a scenario exercise" have not been defined according to the scenario aims. In this insane, they recommend three framing questions to define such policy driven scenarios according to policy specific aims,

a) Are there existing policies you wish to explore as part of the scenario exercise?
b) Is there a preconceived end vision, or at least some aspects of a vision, i.e., specific targets?
c) Are the effects of a policy of such magnitude that they would fundamentally alter the basic structure of the scenario? (2007:15)

To answer the matrix of possibilities from these three questions, the training manual then uses the following table:

Combining the above, we can talk about eight cases:

Case	Existing policies?	Preconceived end visions?	Policies determine the scenario?	Potential uses
a	YES	YES	YES	Test particular policies to see if they can create the conditions under which end visions or specific targets can be achieved, while also considering the broader implications of the policies.
b	YES	YES	NO	Test particular policies to see whether and to what extent they can help to achieve end visions or specific targets under otherwise fixed conditions, while also considering the broader implications of the policies.
c	YES	NO	YES	Explore the role of particular policies in determining the broad nature of the future.
d	YES	NO	NO	Explore the effects of particular policies under otherwise fixed conditions.
e	NO	YES	YES	Identify policies that can create the conditions under which end visions or specific targets can be achieved, while also considering the broader implications of the policies.
f	NO	YES	NO	Identify policies that can help to meet specific targets under given conditions, while also considering the broader implications of the policies.
g	NO	NO	YES	Identify policies that may determine the broad nature of the future.
h	NO	NO	NO	Identify policies and their implications under certain given conditions.

Relationships between scenario types and policy, from IEA (2007:15)

4 How Scenarios Are Used

Section 4 of the report outlines recommendations for how to design, coordinate, convene and facilitate scenarios. It uses extensive quotes from the literature, to incorporate the full lists, recommendations and tables of instructions from practitioners and practitioner-theorists. The subsections are listed in roughly chronological order of the conception through to staging of scenarios: this process begins with questions which frame the greatest/most-variable decisions about scenarios (4.1), to how to develop the type of scenario (4.2), how to develop the narrative of a scenario (4.3), and how to stage a scenario (4.4). It should be noted that this is not a strict chronology: the literature advocates an iterative process rather than a set procedure or checklist of achieving a full design and staging of a scenario. Section 4 is focuses on practical considerations, in contrast to the proceeding sections which also concerned theoretical and conceptual considerations.

4.1 Framing Questions

At the outset, a scenario is informed by framing questions, which determine the following stages of determining the type, narrative, form and function of a scenario. Framing questions can be presented as a series of related "conflicts", building on those originally posed by Fahey & Randall (1998) which Ratcliffe outlines for the use of scenarios. These are whether a scenario should be:

1) **Present versus Future** – decision makers have to respect and reconcile simultaneously present realities with the logic of plausible futures which demands a thorough understanding and analysis of the driving forces of change**.**
2) **Closed versus Open-Ended** – scenarios can be constructed with very specific strategy decisions in mind, or they may be developed to ascertain which strategy decisions should be analysed.
3) **Grounded versus Imaginative** – good scenarios are both thoroughly researched and thoroughly imagined, whilst bad scenarios rely too much on uninformed speculation and are poorly researched. A balance between detailed study and unfettered creativity needs to be struck.
4) **Intellectual versus Emotional** – in similar vein, scenarios are necessarily an intellectual or analytical activity, but they must also capture the emotions of those who develop and implement them.
5) **Advocacy versus Dialogue** – good scenarios are likely to be forged when individuals advocate their point of view, argue how a plot might evolve, demonstrate the logics that underpin it, and illustrate its implications for the organisation's current and future strategies. Once scenarios have been selected, however, a reasoned dialogue among all those concerned is required to secure effective strategic planning.
6) **Scepticism versus Expertise** – expertise is naturally essential in the analytical process of scenario building, but because the future can be so different from the past a healthy scepticism should be maintained about the pronouncements, judgments and assessments of experts. This scepticism compels decision-makers critically to reflect upon each scenario's logics and its strategic implications.
7) **Quantitative versus Qualitative** – as essentially constructs of the imagination, scenarios are fundamentally qualitative in nature, but some estimate of the extent of quantitative differences between scenarios is important if strategy is to be correctly calibrated.

8) **Probability versus Plausibility** – one of the most contentious debates concerning the use and development of scenarios rages around the assignment of probability to the final scenarios. One school of thought (Battelle Management Consulting, for example) argues that not assigning probabilities is a 'cop-out' because probabilities give decision-makers important information on which to base their strategies. Another school (Global Business Network and SRI, for example) believes that assigning probabilities is a 'hangover' from the days when forecasters really thought they could predict the future. Unashamedly, this author views probability assignment as a 'dressing-up of prejudices' which can lead to a distortion of the process and a detraction from the basic purpose and function of the scenario building (2000:13-14).

To 'solve' these conflicts, the IEA Training Manual recommends a series of steps to determine where each scenario should be positioned on each scale, for example from 'Present versus Future' and 'Probability versus Plausibility'. The Manual advocates asking the following questions by the "core team" of scenario designers/conveners/facilitators working "in consultation with the funders and key stakeholders" if that is appropriate to the project:

- What are the issues we want addressed in the scenario project? If it is part of a larger assessment, how are these addressed in the other sections of the assessment?
- Are there existing policies we wish to explore as part of the exercise? Are the effects of these of such magnitude that they would fundamentally alter the basic structure of the scenarios?
- Do we have a preconceived end vision, or at least some aspects of a vision, such as specific targets, for the scenarios?
- Why is scenario development the appropriate approach for dealing with the problem?
- Who is the audience?
- What types of scenarios are needed to address the problem and to communicate to the audience? Would a backcasting or forward-looking approach be better?
- What time frame should be considered? Should the scenarios be narrative and/or quantitative?
- How are the scenarios to be developed connected with scenarios developed for higher levels (e.g., regional or global)?
- What do we want to have achieved by the end of the scenario process (e.g., new policy options, better understanding of a particular issue, better understanding of a region's most pressing concerns for the future)?
- What resources (e.g., time, money, people) are needed to achieve the goal and is it possible/desirable to make that investment?
- What is the expected role of the scenario team, and what are the expected roles of other stakeholders and participants? (2007:22-23)

The IEA Training Manual then advises that once all the questions have been asked and answered, that all the questions are returned to "in consultation with the participants" (2007:23). The section on working with participants is discussed in 4.4.3 and 4.4.4.

Since defining the key issues is the most difficult question, which also informs answers to all the following questions, the IEA Training Manual offers four additional questions to clarify the answer to what the key issues are:

- What are the key themes upon which the scenarios should focus;
- What, if any, are the key targets and/or goals that should be considered in evaluating the scenarios;
- What are the most useful indicators for describing the system of interest; which can help us to see if targets are being met; and
- What, if any, are the key policies we wish to explore as part of the scenario exercise? (2007:24)

However, the combined answer to these four questions is made problematic by IEA's caveat that "there is no correct answer as to which" of these questions "should be done first, or if they should be done together or as separate steps" on the basis that the four questions are "best treated at the same stage in a scenario exercise" because they are "intricately related" (2007:24). Consequently, the following section outlines different recommendations for the stages involved in designing a scenario.

4.2 Overview of Scenario Type Development

In line with the order of stages in the IEA Training Manual above, Alcamo also recommends 'Establish Focal Issue' as the first stage in scenario design. Importantly, he recommends this specifically for qualitative scenarios that intend to involve the participation of scenario exercise participants in later stages of the scenario design. For this first stage of 'Establish Focal Issue' Alcamo recommends phrasing the focal issue "as a crisp and clear question" which can range from being as "precise as a question requiring a yes/no decision" to "as general as the exploration of an emerging issue" (2008:24). In keeping with the intention to involve participants later on in the scenario design process, Alcamo recommends already interviewing the "different parties having interests in the scenario exercise" to refine this focal issue question by incorporating their feedback. The subsequent stages are, in order, to:

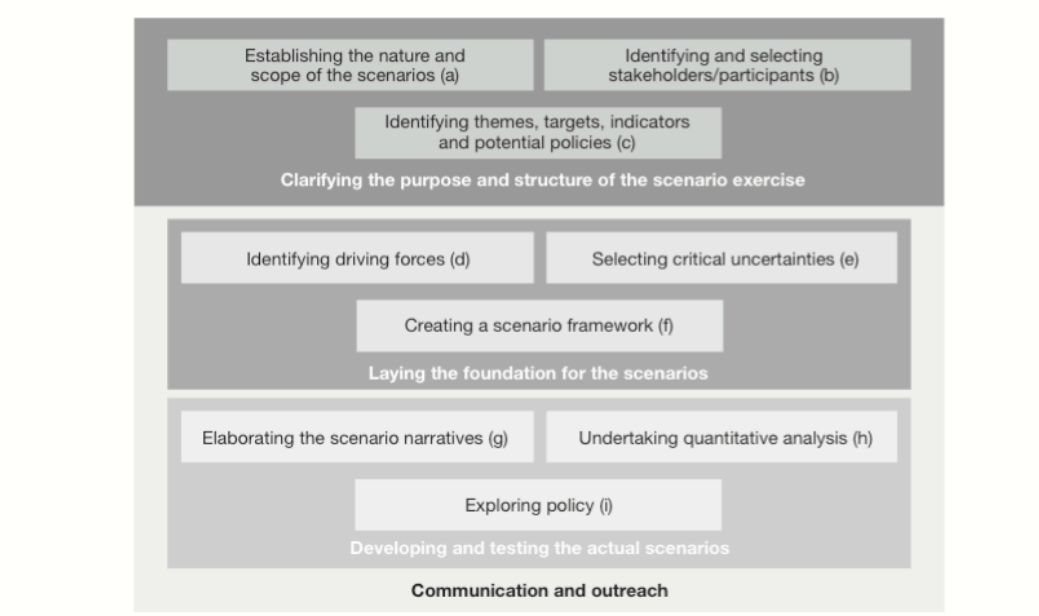
1) **Identify Driving Forces**: With respect to the focal question, scenario developers usually identify and discuss the main uncertainties, driving forces, and important factors that shape developments in the future state of the environment and society together with stakeholders and/or experts.
2) **Label Critical Uncertainties**: It has proven useful to identify those uncertainties and driving forces that are most uncertain and most important for the future development of a respective focal issue.
3) **Determine Scenario Logics**: Based on discussions of possible future developments of key driving forces, consistent scenario logics (or scenario skeletons) are outlined and sketched out. These scenario logics provide the backbone of the scenario building process.
4) **Elaborate Scenarios**: Building on scenario logics, the scenario developers then elaborate detailed step-wise changes and an image of the future. Once the step-wise changes of all relevant driving forces and their implications have been laid out, the outcomes are expressed in some non-numerical form such as written outlines, tables, pictures, or most commonly, storylines (2008:24).

Albert advocates a similar patterns of steps in his article on 'Participatory Scenario Development for Supporting Transitions towards Sustainability', based on his use of Jager's (2007) "simple framework of four main steps for developing scenarios." These four steps are:

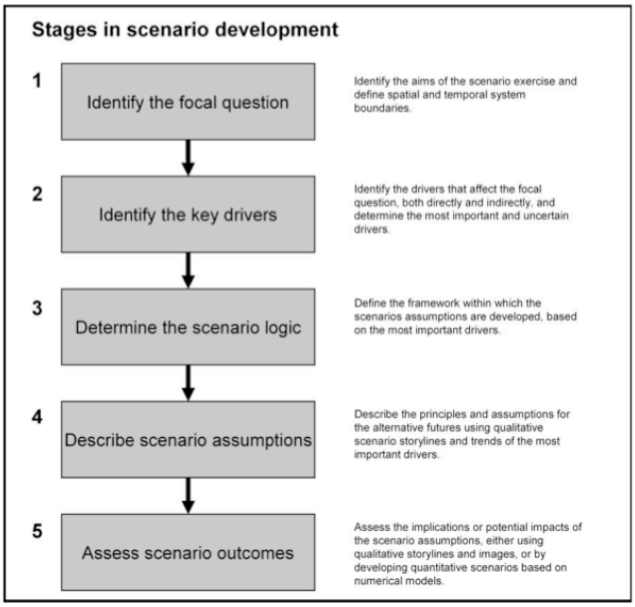
- The first step, 'Clarifying the Purpose and Structure of the Scenario Exercise', consists of the definition of the scope and issue of the scenarios, the selection of the stakeholders and participants, and the identification of themes, targets, indicators, and potential polices.
- The second step is termed 'Laying the Foundations for the Scenarios' and is comprised of the identification of the driving forces and critical uncertainties and the creation of a scenario framework.
- The 'Development and Testing of the Actual Scenarios' takes place in step three and involves the elaboration of the scenario narratives, the quantitative analysis, and an exploration of policy options.
- The last step is 'Communication and Outreach' (2008:5)

Like the IEA Training Manual in relation to the four stages for defining the key issue, Albert also acknowledges that these four steps do "not need to be carried out in this order and that some of the aspects may be forgone in particular scenario processes" (2008:5).

Figure 4: Steps in a generic scenario development process



Steps in a general scenario development process, from IEA (2007:21)



The five generic stages of scenario development, from Rounsevell (2010:610)

The scenario process in action

Stage 1: *Setting the Agenda* – defining the issue and process, and setting the scenario timescale

Stage 2: *Determining the Driving Forces* – working, first, individually, and then as a group

Stage 3: *Clustering the Driving Forces* – group discussion to develop, test and name the clusters

Stage 4: *Defining the Cluster Outcomes* – defining two extreme, but yet highly plausible – and hence, possible – outcomes for each of the clusters over the scenario timescale

Stage 5: *Impact/Uncertainty Matrix* – determining the key scenario factors, A and B

Stage 6: Framing the Scenarios – defining the extreme outcomes of the key factors, A1/A2 and B1/B2

Stage 7: *Scoping the Scenarios* – building the set of broad descriptors for four scenarios

Stage 8: *Developing the Scenarios* – working in sub-groups to develop scenario storylines, including key events, their chronological structure, and the "who and why" of what happens.

The scenario process in action, from Wright and Cairns (2011:22)

To determine whether to go through these four stages in chronological and/or non-chronological order, as outlined by the IEA Training Manual and Albert above, Henrichs recommends to first establish the kind of approach required for the scenario development, based on three principal kinds: deductive, inductive, and incremental:

> deductive approaches to scenario development are the most linear of these approaches and can be broken down into four main stages: identifying of main concerns about future developments; discussing main uncertainties, driving forces, factors and actors that might be expected to shape future trends and their interactions – and thus identifying the underlying scenario logics; elaborating the actual scenarios; and analysing the scenarios and their implications.

Only in the deductive approach does Henrichs advocate the linear/chronological progression through these four stages. In the alternative two approaches, Henrichs recommends iterative and non-linear development of the scenario. Inductive approaches, he argues,

> require similar steps as a deductive approach but apply a different method to developing scenario logics. Rather than systematically discussing and deducing driving forces, this variant of scenario development starts off by describing individual events or plot elements, and spins larger stories around these seeds. This approach calls for a greater degree of creativity that may be difficult to structure, but may result in more 'out-of-the-usual' scenarios.

While the last kind, incremental approaches,

> build on expanding and questioning a 'reference scenario'. A reference scenario is the future that scenario developers really believe, either explicitly or implicitly, will occur. This is usually a relatively non-threatening scenario, featuring no surprising changes to the current environment. Then, to contrast this 'reference', alternatives are explored by first identifying key threats to this pathway, and to vary those driving forces that appear most influential (2009:12).

Mahmoud advocates "a formal scenario development framework for use in environmental studies" in a similar iterative process to Alcamo and Albert's four-stage process above, although his is a five stage process. The order of steps is: "scenario definition, scenario construction, scenario analysis, scenario assessment, and risk management" (2009:802). Mahmoud argues that the final stage, risk management, is critical in assessing outcomes as it is the last stage. However, he locates this responsibility not with "the scientists involved in a scenario development study" but rather "primarily" with "decision-makers" and "stakeholders" who become responsible for risk management involving "the implementation of strategies for reducing vulnerabilities to risk, increasing resiliency to problematic conditions, and positioning resources to exploit opportunities" (2009:804). However, Mahmoud does not argue that stakeholders should be relegated to only participating in this final stage of the five stage process. Rather, he argues that "continuously involving stakeholders throughout the entire process can be important and desirable" due in part to their ability to provide "some feedback among all phases of scenario development" (2009:802). Across all these phrases in Mahmoud's development framework is uncertainty, which he argues is an essential consideration in order to "fully understanding the implications of scenarios." Due to the range of causes of uncertainty, from "lack of basic knowledge, errors in data, model structures, and model parameters, inadequacy in condition approximations, subjective judgment, inappropriate assumptions, ambiguously defined concepts" to "errors in projections of human behaviour", Mahmoud recommends that uncertainty is incorporated into the following three ways for his five stage development framework. For the principal of "understanding uncertainty" he asks those in the Scenario Definition and Scenario Construction phases to consider what "the sources of uncertainty to be considered" are. For those in the Scenario Construction and Scenario Analysis phases he takes with estimating uncertainty, by asking themselves what "the magnitudes of these uncertainties" are and how "they propagate from one phase of a scenario development process into another." Of the final way, of communicating uncertainty, those in the Scenario Assessment and Risk Management phases are asked to consider how can "uncertainty be communicated to stakeholders and decision-makers in" (2009:807).

4.3 Overview of Scenario Narrative Development

Developing the scenario narrative follows the completion of having determined the scenario type, as per the considerations outlined in Section 4.2. Mahmoud recommends that this scenario narrative development take place "once the scenarios have been defined" so that "detailed quantitative and/or qualitative information that reflect the ultimate outcomes of scenario

characteristics" can then be developed (2009:803). To inform the development of the narratives he recommends asking the following questions to the scenario 'storyline' writers:

- What are the causal relationships or external conditions that can be depended upon (e.g. predetermined elements)?
- What are the critical uncertainties in how the future might unfold?
- What are key assumptions about how different parts of the system work?
- What variables and situations are important and how should they be modelled?
- What are the spatial and temporal timescales necessary for decision purposes? (2009:803)

In the process of answering these questions, the scenario designers should "choose an evocative and memorable name for each scenario which succeeds in portraying the essential logic or story driving it" (Ratcliffe 2000:12). For this, Ratcliffe recommends "vivid and meaningful titles" for each scenario, as titles of this nature are more likely to become "useful shorthand when planners and managers meet in groups" and they "also stimulate interest and lead to better questions being asked." As a consequence, Ratcliffe argues that such titles "stand a much better chance of becoming accepted and used within the decision making and implementing parts of an organisation" (2000:12).

The Guide to Planning and Staging Exercises by the National Directorate for Fire and Emergency Management, Dublin, Ireland (MEM 2006) offers applied advice for such scenario title development in the context of emergency natural hazard scenarios. It is specifically aimed at scenarios which "set out the arrangements by which the Principal Response Agencies will work together in the management of large-scale incidents" and in providing "guidance on running internal and joint/inter-agency exercise programmes." The guide recommends that a scenario "narrative should be short; no more than 5-7 paragraphs" and that scenarios "should be":

- Specific, but not overly detailed
- Stated in present tense
- Written in unambiguous language – plain English
- Outline events to date in chronological order
- Finish with the current known situation (the Recognised Current Situation)
- For sudden emergencies (bomb blast, chemical explosion or spill) the narrative should be shorter than for events that have a slower build up, with some forewarning, e.g. a flood, ice and snow, etc.
- Consider the following when writing the narrative:

What has happened?
When did it happen?
Where did it happen/is it happening?
Who has been informed?
Who is telling you?
What has been/is being done about it?
What is the extent of fatalities/ injuries/ physical damage?
What are the relevant weather conditions?
What do we expect to happen next?
What other factors will influence the response? (MEM 2011:39)

4.4 Overview of Scenario Staging

4.4.1 Scale, number, and duration of scenarios

> Between two to four is the normal bracket of scenarios sufficient to explore the possible futures within which decisions will have to be taken, but there is the danger of always ending up with three scenarios (though, in practice, this is often the case). Inexperience with scenario building tempts those involved to generate a 'good' and a 'bad' at the extremes, and an 'average' in the middle, with a tendency to drift towards the middle, and treat it as the 'most likely' single-point forecast. All the advantages of a multiple-scenario method are then lost. At the same time, it is important to avoid drafting several scenarios that are simply slight variations on the same theme. An underlying danger, moreover, is that the participants endeavour to construct the 'right' answer in a single scenario. The true value of the scenario building exercise is stressed as being the experience of exploring a set of distinct and plausible futures that could unfold (Ratcliffe 2000:12).

The scale, number and duration of the scenarios all effect their narrative 'storylines' (Section 4.3) as well as the type of scenario (Section 4.2). This section considers scale, number and duration together, as the three properties are interrelated. Ratcliffe's above quote provides an important insight into the discrepancy between ideal and actual practice of scenarios. While he holds the "true value" of scenarios as being the actual exploration of "a set of distinct and plausible futures that could unfold", his experience of staging scenarios and review of the literature reveals that actual practice is inherently compromised, for instance by limited scenario design and limited variation between scenarios. Alcamo acknowledges these same limitations, although he does not advocate a 'more-is-more' approach to the scale, number and duration of scenarios. He reasons this on the basis that more scenario options increases "the difficulty to communicate the scenarios" alongside "the effort and resources needed for the scenario exercise." In response, Alcamo argues for a trade off between the minimum and maximum number of possible scenarios, as the designers should recognise that more scenarios do also mean "the greater the variety of views and possibilities of the future that can be represented by the scenario set" (2008:26). Alcamo's concluding recommendation in this regard is that "since these factors vary from project to project, no fixed number is recommended here" (2008:26). However the literature reveals that in practice, two to four scenarios is the most common compromise between these constraints, which is the number advocated in Ratcliffe's quote above, as well as by Albert, who reasons that "most authors propose sets of two to four scenarios as most effective to reflect the uncertainties and at the same time keep the number of scenarios at a practical size" (2008:10) and O'Brien, who concurs that "current evidence suggests that two or four scenarios work well with any greater number leading to levels of complexity that potentially dampens engagement" (2012:3). Like Ratcliffe, O'Brien also cautions against using three scenarios as he finds that this number "inadvertently promotes the idea that the 'middle' scenario is the most likely most probable future" (2012:3).

The number of scenarios is also determined by the scale of the scenarios themselves. Scale refers here to metaphorically 'mapping' issues and content from different scales: temporal, spatial, topical. For instance, scaling a national scenario about bushfires onto a particular region, such as South East Australia, or vice versa: scaling from South East Australia to Australia-wide. It does not refer to mathematically scaling data, as that applies onto to quantitative scenarios, not qualitative/narrative scenarios. To determine if and how scaling should be used, Alcamo provides four criteria and the questions they raise for scaling in scenarios analysis:

- **Purpose and potential users of the scenarios** – For what purpose and for whom are the scenarios developed and analysed? What are the particular spatial and temporal scales of interest to the potential users of the scenarios?
- **Factors/processes** – At which scale are the key relationships in the scenarios operating? At which scale can the driving forces of the scenarios be influenced? At which scale do processes affect the scenario development?
- **Actors/institutions** – At which scale can institutions influence developments in the scenarios? At which scale do actors impact the developments analysed in the scenarios?
- **Quantification/data availability** – At which scale are tools (models) to quantify developments available? At which scale is data collectable or available? (2008:32).

There is little coverage of the issue of scaling in the literature. One reason this is a problem is the IEA Training Manual found that scaling is applied due to the "common practice to use existing scenario studies as the starting point for developing new scenarios," through which existing scenarios from a prior and potentially separate project get 'scaled' onto the new scenarios. This guide provides an example of this practice as being when "a national scenario process builds on the [international] GEO-4 (UNEP Global Environment Outlook-4) scenarios" such that "the main drivers are identified in the global stories" created for the GEO-4 scenarios, which may not be applicable to the new national-level scenarios being developed, because "at the national level there could be additional driving forces that have to be considered." This manual advises again using any existing scenarios, such as this example of the GEO-4 scaling, because such scaling "might inhibit the recognition of other relevant signals of change, leaving the policy-maker vulnerable to developments that were not anticipated in the scenarios adopted" (2007:20-21). Such scaling was also used by Ratcliffe in "several" of his SEs, due to the common problem of limited resources and time, such that "existing scenarios prepared for previous projects were employed, sometimes with slight reorientation" (29).

To minimise this vulnerability caused by scaling, Alcamo recommends that "scenario developers should aim to keep scaling methods as simple as possible" and to "make scale implications and restrictions as transparent as possible to scenario users" as this will facilitate scenario users being able "to interpret or re-interpret scenarios at the scale they are most interested in" (2008:33). He further advises including a "clear definition of procedures and their possible drawbacks used in the scaling process" for instance by providing documentation of "scaling procedures in background and other documents." For Alcamo, clearly communicating this scaling process creates four additional requirements:

- noting in scenario storylines where scale implications may affect scenario outcomes;
- providing detailed descriptions of the methodologies used to transform information between different scales;
- reporting the scale of the original data/information used in the scenarios;
- graphically presenting overviews of major linkages between scales (2008:33).

In terms of the duration of scenario exercises, the literature seldom outlines recommendations for this. The literature implies a fairly conventional 9am-5pm table top exercise format, as inferred from descriptions of actual case studies of scenario exercises. What activities should take place in preparation, and post-scenario exercise, is covered in Sections 4.4.3 and 5.1 respectively. The sole account of the explicit structure of a scenario exercise is supplied by Wright and Cairns, from

their extensive experience staging scenarios for a diverse range of topics and situations. They advocate a scenario run over 24-hours because a:

> 24-hour model… offers an evening in which participants can discuss their emerging understandings, question one another, and raise new lines of inquiry for the next day. It also allows them to 'sleep on it', although experience shows that this often leads to people wakening very early the next day with some 'aha!' thought that brings a new bearing on the problem at hand (2011:24)

They then outline for following suggested timeline for this 24 hour model:

SUGGESTED TIMETABLE FOR A 24-HOUR SCENARIO PROJECT

If you are undertaking a short, exploratory scenario project, you can consider bringing a group together for one day and undertaking the "basic method", as set out in Chapter 2. However, our experience indicates that a one-day project has limitations, in that participants are required to work intensively throughout the day, and may become tired and less critical as the crucial stages of creative and challenging thinking are undertaken. Also, within an intense, single-day exercise, participants have little or no time to sit back and reflect upon their thinking.

We have found that a 24-hour scenario exercise is much more productive, with fresher minds at the crucial stages, and the chance for informal discussion and group reflection if an overnight stay is required. The following timetable outlines a typical set of timings that we have found appropriate for 24-hour exercises.

Day1: Afternoon (1.00 pm–5.30pm)

Stage	*Arrival and general introductions*		*12:00–13:00*
	Introduction to the Scenario Workshop		13:00–13:15
1	*Setting the Agenda*	Defining the issue and process	13:15–13:45
2	*Determining the Driving Forces*	Working individually, then as a group	13:45–14.30
3	*Clustering the Driving Forces*	Group discussion to develop, test and name clusters	14.30–15.10
		Tea/coffee	15:10–15:30
4	*Defining the Cluster Outcomes*	Extreme outcomes for each of the clusters over the agreed timescale	15:30–16:30

5	*Impact/Uncertainty Matrix*	Determining the scenario framing factors A and B	16:30–17.00
	Summary Day 1		17.00–17.15
		Reception, informal discussion followed by dinner	17:30 onwards

Day2: Morning (9.00 am–1.00pm)

Stage	*Welcome Back, overview of Day 1 plus overnight insights*		*09:00–09:15*
6	*Framing the Scenarios*	Defining extreme outcomes for the key scenario factors, A and B	09:15–9.30
7	*Scoping the Scenarios*	Building the set of descriptors for 4 scenarios	09.30–10.00
7b	*Stakeholder Analysis*	Determining the stakeholders and their place in each scenario	10.00–10.45
		Coffee/tea	10:45–11.05
8	*Developing the Scenarios*	Working in sub-groups to develop scenario storylines	11.05–12:00
	Group summary presentations and questions		12:00–12:45
	Session wrap-up and follow-up planning		12:45–13:00
		Lunch and departure	13.00

The suggested timeline for a 24 hour scenario project, from Wright and Cairns (2011:22)

The literature on scenarios is not forthcoming about the recommended number of participants, or whether they should be people who already know one another. In contrast, the literature on tabletop exercises in focus groups suggests 6 to 10 participants per scenario and 3 to 5 scenarios per project (Morgan 1997:34). Millward recommends similar quantities in her "systematic review of recent focus group research in psychology" which ranged from 6 to 12 and averaged 9 participants per scenario. In this same literature she also found "it is advisable to keep groups as small as possible whilst still being able to elicit the breadth of responses required." This stemmed from her findings that

> large groups are unwieldy to manage, allow free-riding and can be apt to fragment as subgroups form. Also it may be hard to obtain a clear recording of the session: people talk at different volumes and at different distances so the discussion may be difficult if not impossible to track. It is common practice to over recruit for each session by 20 per cent since it is inevitable that not all of those recruited will actually turn up. The group size on the day will therefore vary (2012:425-6).

Irrespective of the decided group size, Morgan prefers that groups composed of "strangers" instead of "allowing acquaintances to participate together" because acquaintances "often…rely on the kind of taken-for-granted assumptions that are exactly what the researcher is trying to investigate. This problem is even more severe when the assumptions among acquaintances include invisible boundaries around the subjects that they have tacitly agreed not to discuss" (Morgan 1997:37-38). Although the literature did not reveal any discernable statement about using strangers versus acquaintances, in the case studies discussion in Section 2 the average group size was around 6 participants, which is in line with Morgan and Millward's recommended group size.

4.4.2 Facilitation and Interview Techniques

> The group interview is a qualitative data-gathering technique that relies on the systematic interrogation of a number of individuals simultaneously in a formal or informal setting…In group interviews, the interviewer/moderator directs the inquiry and facilitates the interaction among the respondents in a structured, semi-structured or unstructured manner, depending on the purpose of the exercise…Group interview…results cannot easily be generalised; the emerging group culture may interface with individual expression; the group may be dominated by one person; and 'group-think' is a possible outcome. In addition, the requirements for interviewer (moderator) skills are said to be greater than those for individual interviewing because of the group dynamics that are present…Nevertheless, group interviews, exercises and activities of various kinds invariably form a central part of any scenario-planning process (Ratcliffe 2002:21).

This section is closely related to Section 1.4, on the 'Difference between Focus Groups and SEs', as much of the literature on facilitation and interview techniques is drawn from focus groups, as the literature on scenarios does not generally discuss these techniques, such as the statement in Ratcliffe's quote above on the facilitation techniques in response to a group being domination by one participant, which is discussed in Section 1.4. Ratcliffe argues that the importance of these techniques have come to be acknowledged because "interviewers are increasingly seen as active participants in interactions with respondents, and interviews themselves deemed to be negotiated accomplishments by both interviewers and respondents that are shaped by the contexts and situations in which they take place" (2002:22). In relation to the variables of interview techniques in Ratcliffe's quote above, Morgan poses the following three framing questions, for facilitators to determine the facilitation and interview techniques:

- Would a less structured interview or a lower level of moderator involvement produce more productive discussions on this topic among these participants?
- Would smaller groups produce more detailed data from each participant or would larger groups produce a wider range of ideas?
- Would it take a larger number groups to cover the participants' range of experiences and opinions on this topic or are there reasons to believe that a smaller number of groups will be sufficient? (1997:34)

On the first framing question of how 'structured' an interview should be, Ratcliffe provides three useful interview types and their definitions: structured, unstructured and semi-structured. For a structured interview

> the interviewer asks all the respondents the same series of pre-established questions with a limited set of response categories. There is generally little room for variation in responses, except where open-ended questions (which are rare) may be used. Moreover, there is seldom much flexibility in the way questions are asked and answered in the structured interview setting; a standard set of guidelines normally is employed; the interviewer plays a neutral role; little room is allowed for improvisation; and basically nothing is left to chance. …Given the highly behavioural and subjective nature of scenario planning, scant recourse is had to the fully structured interview" (2002:20)

An example of this approach is the project *South East Coastal Adaptation: Coastal urban climate futures in SE Australia from Wollongong to Lakes Entrance* (Norman et al 2013) discussed in

Section 1.4, as it used a fixed script of questions and topics, so that the responses could be standardised, and thus compared within and between all focus groups.

At the opposite end of the spectrum is the unstructured interview, which Ratcliffe argues can "provide a greater breadth of data than other forms of interviewing, given the inherently qualitative nature of the exercise." He defines it as being:

> where the interviewer has a general area of interest and concern, but lets a conversation develop within this area. In adopting the unstructured interview approach there are a number of issues that have to be addressed, such as: accessing the setting; understanding the language and culture of the respondents; deciding upon how to present oneself; locating an informant; gaining trust; establishing a rapport; and collecting associated empirical materials. In reality, it can be argued that few, if any, interviews are entirely unstructured, and so it is with scenario planning, that seemingly open-ended interviews, in fact, rest upon a predetermined, yet highly flexible agenda. (2002:19-20)

The last type, of semi-structured interviews, attempt to combine the advantages of structured and unstructured interviews, by employing "a basic framework, [with] a set of standard questions, and a given procedure" yet with the interviewer being "free to modify the format and order of questions as appropriate" as part of their improvisational and spontaneous modification of the real-time format of the interview. Of the three types, Ratcliffe finds that the semi-structured interview "plays a prominent part in the scenario-planning process" and offers significant scope of flexibility, while retaining some necessary structure" (2002:21). In his article 'Stakeholder participation for environmental management: A literature review' Reed points out that these highly varied and improvised skillsets are not often recognised for how difficult they are to facilitate:

> It is sometimes the most seemingly simple of methods, such as informal group discussion, which require the greatest expertise. A successful facilitator needs to be perceived as impartial, open to multiple perspectives and approachable. They need to be capable of maintaining positive group dynamics, handling dominating or offensive individuals, encourage participants to question assumptions and re-evaluate entrenched positions, and get the most out of reticent individuals. Such skills are difficult to learn and tend to be developed through years of experience, intuition and empathy (2008:2425)

In light of this, Alcamo recommends that "independent of the method selected, experience has shown that employing professional facilitators will help considerably in keeping participation 'on-track,' and at the same time reduce unintended influencing of participants by scenario developers" (2008:28-29).

Given this extensive skillset, Ratcliffe suggests some guidelines to be applied to any structured, unstructured or semi-structured interview. He argues that creating "a successful strategic conversation" requires that:

- The interview should open with an explanation of the purpose of the exercise, the approach being adopted and the use to which the information gathered is being put. It is important to stress the anonymous nature of the interview, and that the data and views gathered will be stored and applied by subject or issued in an unaccredited way.
- So far as is possible, the conversations are conducted in an open-ended manner, with a general, and not specific, line of questioning, designed to

promote a free flow of discussion, in which the interviewee, rather than the interviewer, sets the agenda.

- The task of the interviewer is to establish him/herself as a good listener, yet, at the same time, a constructive participant in the conversation. Not always an easy balance to achieve, much will depend on the relationship that is established between the parties, and the level of trust that is reached.
- The interviewer must see him/herself as an active instrument in the conversation, but also try to be non-directive, retain a critical awareness of their own hidden assumptions, and avoid overlong, leading or biased questions (2002:24-25)

Wright and Cairns offer somewhat similar guidelines, although they are more prescriptive, as they describe them as "ground rules" and advocate that them being agreed to by participants, as well as the facilitator/interviewer, and adhered to at all times:

1) When discussing issues as a group, use a "round robin" approach, where each member gets to express her/his opinion in turn, working clockwise around the group and starting with a different person at each issue. Note: If the person sitting in the opening position of a clockwise order happens to be a dominant individual with set opinions, start at the other end and run anti-clockwise!
2) As opinions are expressed, allow only questions of clarification, such as "Why do you think that …?", "What would happen if …?", "Who do you think would …?"
3) Accept that the outcome of the round robin may be consensus, majority/minority viewpoints, or complete fragmentation. Conflict of ideas is to be encouraged.
4) Take note of all generated viewpoints and build them into your consideration of the broadest range of possibilities.
5) Throughout the process, do not allow any idea to be challenged or excluded on the basis that it is "wrong" or "nonsense", unless it can be proved so without doubt and with everyone's agreement.
6) Roles should be allocated at the outset as necessary. As a minimum, groups should agree a Chair to guide the process, an assertive Timekeeper to keep it flowing in accordance with the agreed timetable, and a Scribe to take notes and keep control of the paperwork (Wright and Cairns 2011:24-5).

When considering his three interview types of structured, unstructured or semi-structured interview, Ratcliffe appears to implicitly favour semi-structured interviews based on fixed questions. His article 'Scenario planning: strategic interviews and conversations' expresses his reflections and insights as Director, Faculty of the Built Environment, Dublin Institute of Technology, Dublin. It concerns 12 scenario planning exercises he conducted on "built environment futures" that involved "a particular exploration of the use of the foresight principle through scenario-planning techniques in the framing, testing and implementation of those policies" relating to the built environment (2002:19). In all these scenario exercises he used two principal lines of questioning, including the 'seven-questions' approach, adapted from the approach coined and used by the Institute of the Future (Amara and Lipinski, 1983). It involved asking the following seven questions:

- If you could pose three questions to a clairvoyant who can foretell the future, what would you ask?
- In the best possible world what would you hope for?
- In the worst possible world what are your greatest fears?
- What pivotal events from the past few years provide good lessons for the future?

- What major decisions with long-term implications are faced at the moment?
- What major constraints do you experience inside/outside the organisation/ system?
- If all constraints were removed, and you could direct what is done, what would you do?

Each question can be seen to applicable to the context of the scenario due to the relatively 'open-ended' nature of the questions. To increase their relevance to the specific context of a scenario, Ratcliffe recommends that each be "tailored" in line with the "time, location, agency, issue and individual concerned (2002:25). In the 12 scenario planning exercises that form the basis of Ratcliffe's case studies in this article, this 'seven-questions' approach was supplemented by additional questions and criteria that arose in each scenario from his following general guidelines for creating successful strategic conversation through facilitation and interview techniques. These guidelines are:

- Such strategic conversations are best conducted in surroundings familiar and comfortable to the interviewee.
- It is almost always wise to interview 'two-in-hand', with the principal interviewer supported by the assistant, not merely to take notes, but also prepared to interject a question if, for any reason, it is necessary. One interviewer is too few, and three are too many.
- The best way of opening a strategic conversation has been found to be a short set of questions along the lines: How did you arrive in your present position? What did you see as the initial challenge? Has that changed?
- Likewise, a suitable way of concluding: What might you have done differently? What would you wish to be remembered for? (the epitaph questions)
- If possible, it is always advisable to tape the conversations. On the positive side it: allows the interviewer(s) to concentrate on questioning and listening; permits questions effectively formulated to be recorded accurately for future use; provides a reliable and unbiased record; affords direct quotes to be made; and supplies a permanent record for others to use. On the negative side, it: may adversely affect the relationship; inhibit or distract the respondent; reduce reliability on the responses; and take up considerable time and effort in transcription. In all the strategic conversations conducted as part of the studies undertaken the only refusals to be recorded were from two or three very senior public officials. If it is not possible to record the interview, good note-taking becomes critical.
- The time allowed for a strategic conversation is usually set at an hour. In practice, however, the majority of sessions exceeded this, with some running to two or more hours.
- Two shorter interviews with the same person, at different stages of the scenario process, are sometimes more productive than one extended session.
- It is important to stress the confidential and non- attributable nature of the interview. And, if a quote, reference or credit is desired to be used, then clearance will be sought first.
- Seek quality of conversations, not quantity. As previously mentioned, most scenario exercises can be performed with a maximum of 20 interviews, and some successfully completed with as few as four or five.
- Recognise that analysis of the conversations can be a very time-consuming process. It is usual to allow several hours to evaluate each interview (2000:26).

4.4.3 Stakeholder Participation

> One of the most important reasons for involving stakeholders in scenario development is to enhance the legitimacy and impact of scenarios. This can be a crucial factor in the usefulness of scenarios to support public decision making. At the same time, stakeholder participation can help scenario developers tap into the expertise and creativity of stakeholders or experts that would otherwise not directly contribute to the scenario exercise. Involving experts, scientists and stakeholders who have a deep understanding of aspects of the issue analysed, allows scenario developers to access inside knowledge or perhaps data that would otherwise not be available. Moreover, involving stakeholders can guide emergent (social) learning processes within public, research or policy communities. Yet involving stakeholders in scenario analysis can also complicate the scenario development process. In particular, broad participation is complicated and time-consuming. Also, scenario developers should be mindful of the motivation of stakeholders' in participating in the scenario exercise; under some circumstances the scenarios could become biased towards the particular interests of the stakeholders (Alcamo 2008:27).

The motivation that Alcamo draws attention to, that of enhancing the legitimacy and impact of scenarios, is common to scenarios with little to no stakeholder participation, through to those with a great deal of stakeholder participation. This motivation is also more pronounced in environmental scenarios, where the aim is more likely to be to inform policy or change practice in response to environmental challenges, wherein a "deeper level of involvement is necessary if the aim is strategic planning as compared to scientific research (Alcamo 2008:28). Reed accounts for the qualities that motivate stakeholder participation in environmental scenarios as stemming from how

> environmental problems are typically complex, uncertain, multi-scale and affect multiple actors and agencies. This demands transparent decision-making that is flexible to changing circumstances, and embraces a diversity of knowledges and values. To achieve this, stakeholder participation is increasingly being sought and embedded into environmental decision-making processes, from local to international scales. Widespread acceptance and promotion of participation has partly been driven by increasing public scepticism about science, increasing knowledge and interest in environmental decisions (2008:2418).

To increase the likelihood of successful stakeholder participation, he then identifies seven principles for their participation:

- Stakeholder participation needs to be underpinned by a philosophy that emphasises empowerment, equity, trust and learning
- Where relevant, stakeholder participation should be considered as early as possible and throughout the process
- Relevant stakeholders need to be analysed and represented systematically
- Clear objectives for the participatory process need to be agreed among stakeholders at the outset
- Methods should be selected and tailored to the decision-making context, considering the objectives, type of participants and appropriate level of engagement
- Highly skilled facilitation is essential
- Local and scientific knowledges should be integrated

- Participation needs to be institutionalised (2008:2419) requiring the creation of "organisational cultures that can facilitate processes where goals are negotiated and outcomes are necessarily uncertain" (2008:2426).

Operating at a more applied level, Alcamo suggests it is first necessary for the scenario designers to decide which manner of stakeholder participation is most suitable, given the advantages and disadvantages of the following three levels of participation:

a) Stakeholders and experts are informed about the results of the scenario exercise. The weakest form of 'participation' is to simply inform stakeholders and/or the general public of the scenario exercise and its findings. This type of participation usually occurs towards the end of the scenario exercise when final results are available. The outcome of a scenario exercise should be disseminated in a language accessible to lay-people (e.g. using brochures, the Internet, information events, etc.).
b) Stakeholders and experts are consulted during the scenario exercise. A more interactive form of 'participation' is to consult with stakeholders during the scenario exercise, either after the scenarios have been completed or are near completion (e.g. to review or to comment) or during the scenario development process (e.g. to provide input). This type of participation usually also occurs towards the final stages of a scenario exercise. However, earlier consultation can help in defining the frame/context of the scenario exercise. Stakeholders should be given adequate opportunity to provide their opinion or input to the exercise (e.g. public hearings, Internet discussions, opinion polls, questionnaires, etc.). Scenario developers should be explicit from the outset about how the consultation will shape the scenarios.
c) Stakeholders and experts are actively involved in the scenario exercise. In this level of involvement, stakeholders are actual participants in the scenario exercise. They provide not only input for the scenario development or comments on the final results, but co-produce the scenarios. If this type of participation is chosen, it should continue throughout the entire scenario exercise (2008:27).

In reference to the above three levels of stakeholder participation, Ratcliffe found that stakeholder participation was fraught with difficulties in the 12 scenario planning exercises he conducted on built environment futures. Two of the 12 scenario projects featured Alcamo's middle-level of stakeholder participation (b) above, whereas the other 10 featured the low-level of stakeholder participation (a) above being done 'in-house' by "a small project team of three or four, with one person, the researcher, taking responsibility for the final product" (2002:29). Of the two featuring middle-level stakeholder participation, Ratcliffe writes that

> Even here, the 'story-lines' were written up by a professional journalist, who had been present during group meetings and workshops concerned with the previous stages described above. In these two instances, there was an iteration between the group identifying the scenario logics of three or four different futures, the writing-up of alternative draft scenarios by the journalist, then back to the group for further discussion, amendment and refinement. This was repeated twice in both cases. Indeed, this process gave rise to considerable contention, and even, at times, conflict. In one study, in fact, it almost led to a breakdown of the process (2002:29).

To minimise the likelihood of this situation, Alcamo recommends a careful screening process when selecting stakeholders, including of "their institutions, and the interests of their institutions" as well

as of their "backgrounds and potential unwillingness to be open to new and unexpected outcomes." He offers the following criteria for selecting participants (2008:28):

a) What function will the stakeholders have? What role do they play in decision-making, planning, or other aspects of the issue being analysed?
b) What scale are they interested in? What is their sphere of concern and influence with regard the issue analysed?
c) Which group do they belong to? Are they part of a particular thematic or political network?

Once these criteria have been worked through by the scenario planners, Alcamo advocates clearly defining the stakeholders' roles and "the ownership of the final scenarios" (2008:28) and ensuring this is understood by each stakeholder. One limitation of this is that it may hinder the ability of stakeholders to feel they are co-owners and participants in the full extent of the scenario process. In response, he recommends the following five ways to still maintain stakeholders' genuine participation in the process:

> **Interviews of focus groups** – Scenario developers could interview a small group of participants and discuss the issue raised by a moderator in order to provide input to the scenario or sometimes complete scenario storylines.
> **Stakeholder/scenario panel workshops** – Group(s) of stakeholders develop a set of qualitative scenarios via several rounds of discussions. Possible approaches include organising a series of parallel small group discussions and plenary meetings, or organising a large number of small groups discussing specific topics, which are then brought together to develop and discuss the complete picture.
> **Gaming workshops** – Scenario developers work with stakeholders at a workshop in which simulation gaming techniques or training games are used as tools to discuss and develop scenarios. Sometimes participants assume roles and play through the 'if-then' aspects of a scenario.
> **Policy exercises** – A flexibly structured process that involves both scientist and policy makers (and possibly stakeholders). Usually this process comprises several rounds of preparations–workshop–evaluation in order to formulate and test policy scenarios.
> **Story and Simulation approach** – An iterative approach to develop combined qualitative and quantitative scenarios. (2008:28-29)

4.4.4 The Role of Participants in Scenarios

> The key learning from undertaking scenario method is derived from interaction between involved actors. Each participant must engage in their own analysis of the problem, must consider what they see as the driving forces that underpin it, and must engage in considering the range of possibilities for their future impact and outcomes. More importantly, the participants must actively engage in: sharing their analysis with others, explaining their reasons for thinking as they do, and listening to and engaging with other members in order understand their rationale…This sharing of ideas is not directed at developing some shared understanding and a single viewpoint on the issue. Rather, it is about opening up strategic conversation around differences of opinion, values, beliefs and priorities. This active involvement is…crucial to a successful outcome, whereby the involved and affected parties 'own' not only the problem, but also the analytic process and the outcomes of it (Wright and Cairns 2011:11).

The considerations for stakeholder participation discussed in Section 4.4.3 also apply for the role of participants in scenarios, given that their conduct during the actual exercise is pivotal to all parties feeling they have come to "'own'" something of "the problem" in Wright and Cairns' argument above, alongside the "analytic process and the outcomes of it" from the SE. Wilkinson and Eidinow see this issue of collective 'ownership' of a scenario as requiring "practitioners and participants…to consider the wider philosophical assumptions of everyone involved." They argue that this consideration, importantly by both practitioners and participants, ought to "be part of the planning of any scenario project, as well as shaping its ongoing conduct" in the form of the "project's intended realization" via "the implementation of policies intended to arise from the project" (2008:2). Wright and Cairns suggest that this may occur through guiding the participants involvement prior to, during, and following the SE for two different scenario types. For a "basic level" scenario, they recommend that:

> before coming to any scenario workshop, participants should be asked to undertake some initial reading on the issue that will form the focus of the event…At a basic level, if you are running a one-day scenario project in order to explore the 'limits of possibility' for a predetermined uncertainty of which all are aware, you can ask participants to do homework on it, or you can direct them to specific readings Wright and Cairns (2011:26).

For a much more complex scenario where there is much less known about what the key issue is or how it will be addressed in the scenario, they recommend that:

> you will need to set up some more in-depth prior investigation…If you are following this approach, you should identify the broadest range of key decision-making, power-holding and directly-affected stakeholders, and arrange to conduct a series of semi-structured interviews with them. The use of a set of interviews also allows consideration of the degree of convergence/divergence that exists amongst key decision-makers in relation to specific issues. The degree of such agreement or diversity can provide early indication as to whether such issues are largely predetermined in terms of outcomes, or represent critical uncertainties (2011:27).

This more complex scenario offers much higher levels of participant involvement and prospective 'ownership' as they recommend that these semi-structured interviews with the participants, prior to the scenario commencing, should be transcribed and subject to content analysis in order "to draw out common topics and themes, which are then used to inform the topics and themes of the scenario exercises" (Wright and Cairns 2011:27). The collated contend analysis of the structured interviews are then compiled into an anonymised report (that is, with no attribution of who said what) which is then provided to participants before the scenario sessions to debrief them on what the scenario sessions will concern in detail.

4.4.5 The Element of Surprise

> Scenarios are good tools for anticipating and planning for surprises. Various surprising future developments can be assumed and their consequences played out as part of the scenario exercise. As part of the exercise the robustness of different policies and strategies to these surprises can be examined. For example, an input to a scenario exercise could be the assumption of a drought of unprecedented duration, and the scenario could explore the impacts of this event on regional water availability and water quality. This scenario could then be used to anticipate the strategies that would be most effective in coping with the impacts of this drought (e.g. additional above-ground

> or below-ground water storage, import of electricity to compensate for shut-down hydroelectric and thermal power plants, etc.). Investigating surprises as part of a scenario analysis can also help identify so-called 'weak signals' of impending problems, i.e. developments that could possibly have been imagined but came as a surprise to most people. In this way a scenario analysis can serve as a type of early warning system (Alcamo 2008:29).

The last consideration in scenario staging is an under-acknowledged strategy that brings together the considerations outlined in Sections 4.4.1 to 4.4.4. Surprise is at the heart of scenarios, not only because they concern potential, and inherently unknowable futures, but also because they are about exploring 'known-knowns' as well as 'unknown-knowns.' A scenario that can incorporate surprises is one that is more likely to have at least a semi flexible structure, and capacity for spontaneity and improvisation. While Alcamo sees these are resolutely positive, he has found that surprises are "usually omitted" from scenarios. He explains that this is because

> scenario developers do not want to undermine the credibility of their scenarios by including disputable assumptions on surprises. Since surprises, by definition, reflect radical departures from developments expected or even imagined by most people, incorporating surprises in scenarios could alienate the potential users of these scenarios. Another reason for not including scenarios is that sometimes scenarios are specifically requested to be 'surprise-free,' since it is difficult enough to develop responses or policies for a surprise-free future. It may be less important to include surprises if the system is well understood and the problem has a comparatively narrow scope or time horizon (2008:30).

Regarding the difficulty Alcamo here identifies in reconciling stakeholders' desire for scenarios to be 'surprise-free', with the intrinsic benefit of surprises approximating the inherent unpredictability of the future, Alexander is also adamant that they should be included. He offers some suggestions for how this can be done, and also how a facilitator can improvise a scenario with them

> updates can be given to discussants, which either introduce chance factors or provide basic information which it was deemed expedient to withhold at the outset. In fact, in real emergencies the ability to make decisions is limited by the piecemeal arrival of essential information, and this important factor needs to be built into scenarios that aim to simulate such conditions. The course the instructor can hold back critical information and release it at strategic moments in order to boost the discussion or alter participants' views of the developing situation. Information on the speed or intensity of impacts can be altered in order to fit, or indeed to stimulate, participants' capabilities as managers. Skilful use of the ability to supply information selectively at different points in the discussion can help accustom trainees to the need to make decisions in the absence of critical data, as they will inevitably have to do so in real emergencies (2000:93)

He adds that this is particularly apt for scenario about emergencies (including natural hazards) because in these real-world situations a "shortage of time for decision making is a common aspect of sudden emergencies" so that in scenarios "it is useful to face students with scenarios containing problems that must be resolved within a specified period, for example, nine or ten minutes for a one-page scenario" (2000:93).

> The context-dependency of using scenarios makes it difficult to establish a standard recipe for success. Indeed when the aim is to support decision-making or trigger learning processes, it is difficult to determine and measure success. Is it enough, for example, if scenarios trigger lively discussions for a day? Or should they lead to longer-term changes in behaviour, which are hard to measure? Can it already be seen as a success if policy-makers start to think about longer-term consequences and if scenarios help to better manage conflicts between policy-makers and key societal stakeholders? Or has a scenario exercise only been successful if it really impacts on decision-making processes? And if so, what is the time perspective one might allow for a successful uptake of a set of scenarios in the context of decision making? (Henrichs 2009:30)

The extent of this context-dependency on evaluating scenarios is such that no uniform system of measurement or recommendations exists in the literature. Instead, this report argues alongside Henrichs above quote, that scenarios be evaluated according to the content- and context-specific aims and purposes of a scenario. However the criteria for evaluating scenarios may be considered more broadly, with some general trends emerging in the literature, according to Henrichs, Albert, Ratcliffe and Rounsevell. The most important criteria for a successful scenario according to Henrichs is that it be "perceived to be credible according to standards of good scientific practice" He places this as "first and foremost" with the other criteria of legitimacy and saliency being "helpful, but not as important." Albert also applies the same criteria of credibility, salience, and legitimacy, though he adds the last criteria of creativity. Although he doesn't not prioritise them like Henrichs does, he links them together on the basis that "scenarios tend to be influential in policy to the degree that they are perceived as simultaneously credible, salient, legitimate, and creative by the scenario users" (2008:9). Rounsevell also uses four criteria, with similarly terminology, being "creativity, rigor, internal coherence, and plausibility" (2010:606). Like Albert, he does not prioritise them, although it can be inferred that they follow a rough order of importance, as he has listed them in the same order as Alberts listed his four criteria. However the "four distinct but related sub-criteria for credible scenarios" that Albert lists, in order of importance, are largely the same as the four principal criteria that Rounsevell lists, in no overt order of importance. They are, according to Albert, plausibility, internal consistency, comprehensiveness and rigor, which he defines as:

- the degree to which the audiences perceive the scenarios as plausible, or at least 'not-implausible'. Plausible scenarios are considered feasible and attainable within a given timeframe and are based on a sound and empirically verified analysis of the existing conditions. Only plausible scenarios are considered capable of serving as a basis from which the users can further develop knowledge and understanding and failure in attaining plausibility thus risks easy dismissal by scenario users.
- …internal consistency both within each scenario and among the set of scenarios. Internal consistency involves that the assumptions and causal relationships are consistent with existing information and that the scenarios 'grow logically (in a cause/effect way) from the past and the present'.
- …comprehensiveness [that is] the degree to which the set of scenarios produced covers the range of available alternatives or possibilities…Scenarios should highlight competing perspectives and describe generically different alternatives rather than variations on one theme.

- …high degrees of transparency and scientific rigor in the process of scenario development and its documentation. Since scenarios usually deal with complex issues that allow for multiple perspectives and mental models, the rationale for choosing a particular set of impact factors and the assumptions about causal relationships inherent in both qualitative and quantitative scenarios must be made transparent. Sufficient documentation is needed to make the scenario development process retraceable by experts, decision makers, stakeholders, and lay citizens (2008:10).

Henrichs offers an important caveat for the evaluation of scenarios, especially with regard to their credibility. As al scenarios are inherently "speculative", he finds it impossible for them to "fully comply with standards of good scientific practice" on the grounds of being reproducible or validated. Consequently, he recommends "a high degree of transparency regarding the process, the underlying reasoning assumptions and the used methodology, but also plausibility with regard to defining assumptions, choosing data and applying models" (Henrichs 2009:31) to counter for their intrinsically speculative basis. Rounsevell also make suggestions for improving the reception and import of scenarios. He makes the following six recommendations, which "if addressed" have the potential to "enhance the credibility, legitimacy, and saliency of future environmental change assessment":

a) The influence of personal beliefs such as political ideologies should be made more explicit in scenario development and reported transparently to improve credibility;
b) Alternative pathways that result in the same (equifinal) future outcomes should be discussed and compared;
c) Better methods to validate scenario assumptions such as the use of geographic and temporal analogues would enhance the credibility of scenario storylines;
d) Further consideration needs to be given to the uncertainty that surrounds storyline assumptions and the implications of this for quantitative scenarios, e.g., conditional probabilistic futures and Bayesian approaches;
e) Stakeholder engagement should be used to better define normative visions of future worlds and the alternative development pathways to achieve these visions;
f) Participatory methods, with their high saliency and legitimacy, merit wider application, but should be developed further to increase their credibility (2010:614).

To conclude, Ratcliffe (2002:29) offers six "very practical lessons of a general nature" for the entire process from conceiving to staging to analysis scenarios. They may be considered as an overall framework that encompasses the issues and considerations discussed in this report, being to:

Stay focused. Ideally, the scenarios should be developed within the context of a focal question, and this question should remain at the forefront of all participating in the exercise.

Keep it simple. Sometimes short exercises, with restricted aims, limited issues and straightforward plots are the most successful. It is rarely an exhaustive inquiry, using sophisticated research tools and creative writing skills, that is required. Comprehension, communication and application among those involved are normally much more important.

Keep it interactive. Maintaining enthusiasm and commitment for the exercise among those participating is paramount. Discussing, exploring, arguing, experimenting, challenging, testing, sharing should be the characteristics of productive group activities within the scenario process.

Pass on ownership. Participants should clearly derive a sense of ownership of the scenarios and the policy options that result, but so too should the decision- makers, for whom or by whom the original strategic question was posed.

Communicate effectively. To help bring alive, provoke response, and make memorable the scenario exercise it is worth considering the use of various techniques including dramatisation, role playing, creative writing and multi-media presentations.

Have fun. Generally speaking, if the scenarios do not generate a sense of fun and enjoyment for those taking part, then they are probably not being conducted properly.

6 References

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