‘Cracks in the System’: Problematisation of the Future and the Growth of Anticipatory and Interventionist Practices

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Abstract

This paper will outline and discuss the growth of anticipatory and interventionist practices in ‘niches’ where policy-as-usual is being modified. Four niches are described: initiating and achieving ‘sustainability transitions’; industry adaptation and transformation strategies; governing emerging technologies to enable responsible innovation; and experimentation with planning and policy-making approaches for more uncertain futures (e.g. in climate change adaptation). Intervention by foresight practitioners in such developing niches is recommended. In doing so, the paper also outlines: 1) the rapidly evolving social context for applied foresight work; and 2) emerging methodological approaches, and associated action frameworks combining futures methods with prescriptions for interventionist actions, which are being developed. These approaches are argued to be responses to the increasing problematisation of the future generated by climate change and other important wicked problems. Such changes also make visible a potential shift away from technocratic, or ‘modernist’, styles of planning and policy towards a new ‘anticipatory interventionist paradigm’.

Keywords: applied foresight, sustainability, systemic inquiry and change, transitions, emerging technologies, governance models

Introduction

The early twenty-first century presents a challenging, yet potentially exciting, context for futures work (Markley, 2011; Slaughter, 2010a). In a recent assessment of this context Markley (2011, p.166) argued that "the whole futures research enterprise needs to be rethought for a new era". Indeed, if we adopt Bell's (1997, p.112) position that futures studies centrally involves "the construction and evaluation of alternative futures for the purpose of increasing human control over the future" such issues begin to become clear. 'Human control' appears to be constrained in the contemporary context of ecological issues (e.g. climate change) and compounding problems in other domains (e.g. the global economy). Furthermore, such control can be hampered by the tendency of major societal challenges to become 'stuck' (Kahane, 2010).

New approaches to doing futures work in this context are suggested by responses to these issues in other fields. In her contribution to the debate about the role and practices of sociology in the context of global warming (e.g. see Urry, 2010), Shove (2010) advocated greater focus on interventions "designed to exploit" the "cracks in the system" *within* niches "opening up within and at the margins of policy-as-normal" and where "knowledge is on the move". This approach was contrasted with other key perspectives in this debate. Others see society's salvation in sociology "coming to the rescue", or alternatively see society's salvation as lying in a major 'shock' (e.g. due to further changes to the climate) that disrupts the status quo and demonstrates the need for change (Shove, 2010). The 'thoughtful intervention' approach advocated by Shove is similar to the soft intervention approach used in Constructive Technology Assessment (CTA). In CTA interventions, "there already exist openings and possibilities for change which are then stimulated and orchestrated rather than sought after" (Te Kluve, 2011, p.20). Similar perspectives are voiced in debates held in the futures studies community. In this paper I contend that opportunities for 'thoughtful intervention' by futures practitioners are increasing in the context of growing niches "within and at the margins of policy-as-normal".

This paper concentrates on a central related trend, the increasing 'problematisation' of twenty-first century futures (Anderson, 2010), and emerging responses to this development. An increase in anticipatory and interventionist practices is evident in these responses. Indeed, the "problematization of the future as indeterminate or uncertain has been met with an extraordinary proliferation of anticipatory action" (Anderson, 2010, p.777). As will become clear the context of sustainability challenges, such as climate change, is central to this. In describing these changes, I aim to outline for futures practitioners: 1) the rapidly evolving social context for applied foresight work; and 2) emerging methodological approaches, and associated action frameworks combining futures methods with prescriptions for interventionist actions, which are being developed.[1] Future practitioners could adopt or seek to contribute to the refining of these innovations and practices. In doing so, I aim to increase futures practitioner and scholar awareness of the kinds of interventions that could be instigated.

The paper is structured as follows. First, an outline of recent theorisation and discussion of the increasing 'problematisation' of the future is presented, along with related 'cracks in the system' (to adopt Shove's terminology). Evolving practices

and changes in 'policy-as-normal' within each expanding 'crack' are described, and presented as 'niches' in which futures enquiry and related actions are growing. Third, the preceding sections are discussed with a focus on the development and potential roles of applied foresight. Finally, conclusions are presented, arguing in particular that the expansion of the 'niches' should be seen as points for interventions by futures practitioners, in which enquiry into possible futures can be assisted.

New Contexts and Openings for Change

The concept of the 'problematisation' of the future was recently developed by Anderson (2010). Whilst the future has always been – and will always be – a problem, "problematization of the future as indeterminate or uncertain" (Anderson, 2010, p.777) refers to contexts in which 'the future' is seen to herald greater, potentially more troubling, disruptive novelty and the inevitability of related surprises is more widely acknowledged.[2] Such futures "may bring forth bad surprises" (p.780), such as major 'tipping points' in the climate system.

Furthermore, with the future seen to potentially be radically different, the present must be "continuously assayed for the futures that may be incubating within it and emerge out of it" (p.782), and particular action logics – of 'preemption', 'precaution', and 'preparedness' for future changes (that cannot be avoided) – are becoming more widely adopted and advocated for (Anderson, 2010). Similarly, I have previously noted that "the increasing future orientation caused by the issue of sustainability and the climate change debate appear to be generating a new politics of the future" (McGrail, 2010, p.37), and many others have noted that increasing complexity tends to diminish the power of prediction (e.g. Raskin et al, 2004).

Indeed, the contemporary context of sustainability challenges is central to this problematisation. This context features many 'wicked problems', which can be contrasted with 'tame problems' (those readily defined and solved). A 'wicked problem' is a "complex issue that defies complete definition, for which there can be no final solution, since any resolution generates further issues, and where solutions are not true or false or good or bad, but the best that can be done at the time" (Brown et al., 2010, p.4). Such problems are contested, with conflicting perspectives on how to tackle them. Furthermore, it is uncertain at best whether these problems, e.g. climate change (Auld et al., 2011), can be addressed through smooth, wholly positive, transitions such as towards a 'post-car' mobility system. Others argue this is an unrealistic expectation and we face "constrained choices" (e.g. Dennis & Urry, 2009).

Anderson (2010) makes important, linked, observations. He argues "different styles of disclosing and relating to 'the future' in relation to 'the present'" (p.782) are emerging in response. Previously dominant approaches, such as probabilistic prediction, are being supplemented by new approaches often framed as being more 'possibilistic' and giving greater consideration to potential 'wildcards'. The future in this approach is centrally "disclosed and related to as a surprise" (Anderson, 2010). Second, anticipatory action, where the future is the cause and justification of action, is argued to be growing due to the problematisation of futures. This has been noted in other fields, including Science and Technology Studies (Borup et al., 2006; Nelson et al., 2008; Te Kluve, 2011). Similarly, business professors advocate greater scenario planning, 'war gaming', contingency planning (e.g. Moss Kanter, 2010, 2011; Nussbaum, 2011), and developing 'peripheral vision' (Day & Schoemaker,

2005). Moss Kanter (2010) remarked that "surprises are the new normal and they are not fun".

The potentially far-reaching impact of increasing 'problematisation' of the future is further highlighted by Wright's (2004) *A Short History of Progress* and consideration of contemporary challenges. Wright shows that faith in, and notions of, progress in Western cultures have hardened into an ideology which expects irreversible changes in one direction only – towards improvement ('onwards and upward'). This perspective is being challenged by the current outlook. Wright also challenges this perspective, calling for more long-term thinking and use of the precautionary principle, one of the action logics noted above.

Expanding 'cracks in the system'

This section outlines the related expansion of four important 'cracks in the system', in which the future can be seen to be problematised. I observed the accelerating development of these in my own research (e.g. on nanotechnology) and consultancy work.

First, there is increasing recognition that current societal trajectories are not sustainable and of the limits of policies aimed at creating incremental change. Rotmans and Kemp's (2003) earlier observation that "there is a consensus that the existing trajectories in transport, energy, and agriculture are not sustainable, but the alternatives are not clear or deemed unsatisfactory by experts" is today even more valid. Oil production and energy generation are important examples. The Chief Economist of the International Energy Agency, Fatih Birol, has publicly acknowledged the peaking of conventional oil supplies. UK business leaders have begun to engage on 'peak oil' and secured government commitments to working on contingency plans to protect against key risks (Anon, 2011a). Many others have recently identified a potential perfect storm of food, energy and resource challenges, particularly in the context of emerging markets growth over the coming decades (Dobbs et al., 2011). New information technologies and studies are also increasing awareness of externalised social and environmental costs (e.g. see http://www.teebweb.org for an example). Whilst this crack has recently been partly 'closed-over' by economic issues there is expanding awareness of sustainability pressures.

Where such understanding exists, major questions become how to purposefully shift the trajectories of key systems onto more sustainable paths, and how to agree common goals and conceptualise viable alternatives. Linked with this, the *prospective* nature of such sustainability transitions necessitates futures analysis (Farla et al., 2012). Whilst some continue to see these challenges as being, essentially, amenable to further technological innovation (sometimes termed 'technological fixes') and market forces (e.g. see Charlton, 2011; Lynas, 2011), there is increasing acknowledgment of the need for 'deeper' change in diverse areas such as in mobility (Elzen & Wieczorek, 2005; Vergragt, 2004) and the built environment.

Second, there are signals that industry vulnerabilities and related systemic challenges are starting to be constructively grappled with by more sectors. Recognition of exposure to these challenges is resulting in collaborative initiatives to jointly address problems in diverse industries such as food and agriculture, shipping, insurance, and footwear and apparel.[3] For example, the Sustainable Shipping Initiative has "brought together 16 leading organisations from all parts of the industry" to create innovations so that the industry is "fit for a future of higher

[oil] prices, greater transparency, climate uncertainty and consumer pressure" (Draper, 2011). This is an important shift from reactionary lobbying and other forms of resistance to change. Central drivers are increasing uncertainty and the size and complexity of issues, which create challenges seen as being too large for an organisation to address independently. These drivers generate greater willingness to collaborate on 'system-wide' projects and openness to formerly unlikely alliances (Al-Shawaf, 2011; Draper, 2011). Similarly, in Australia the Sustainable Food Summits have stimulated collaboration between industry players and stakeholders.

Third, complex challenges are increasingly being faced in the governance of new and emerging science and technologies. These challenges have been most evident in the controversies surrounding gene technologies (e.g. genetically-modified crops) and, to a lesser extent, nanotechnology and synthetic biology. Governance challenges in the development of emerging technologies are related to broader trends, including recognition of the need to incorporate social considerations in the development of technologies, and the questioning of key assumptions such as that social progress can be equated with technological progress. For example, Barben et al's (2007, p.980) review of government nanotechnology policies found they generally "do not presume the automatic provisions of social goods from NSE [nanoscale science and engineering] research". Further, as Ozdemir et al (2011) assert "the traditional belief that the scientific trajectory is linear has been replaced with an understanding that innovations emerge from a series of strategic decisions made over time by people with a vision of the future(s)". Consistent with this view STS research has shown that technoscientific futures are often highly contested (Brown et al., 2000). Indeed, in the case of nanotechnology Te Kulve (2011) notes that "in contrast with earlier emerging technologies... there is a lot of anticipation surrounding how it might, or should, become embedded in society".

Related emerging policy-making frameworks include 'responsible management' (Australian Government, 2008) and 'responsible development' (Australian Government, 2010). A associated shift away from technology-push approach is also tentatively emerging in other technological domains, for example in 'gerontechnology'– use of new technologies to assist the aged (Tegart, 2010). Tegart (2010, p.ii) advocates both earlier consideration of ethical issues (e.g. the potential loss of personal privacy due to new monitoring systems), and involving the aged in defining their needs and solution development. This embraces new governance aspirations of 'co-design' and participatory foresight (Ozdemir et al., 2011).

Fourth, greater recognition of the limits and perils of a predictive-orientation is emerging. An important context for this is adaptation to environmental change, particularly climate change. Such adaptations "can involve significant foresight, and hence, people adapt in anticipation or in expectation of change" (Adger & Brown, 2009, p.119). Furthermore, the common assumption that effective adaptation to future climate requires precise predictions is being questioned by some leading scientists and policy experts (e.g. see Dessai et al., 2009; Pearce, 2008). Dessai et al (2009, p.75) recommend that decision-makers systemically examine the performance of climate adaptation strategies and activities "over a wide range of plausible futures" and to adopt strategies that are "sufficiently robust across these alternative futures". As Hulme (2010, p.271) further remarks, "the accuracy of climate predictions is limited by fundamental, irreducible uncertainties" which "arise from limitations in knowledge, from inherent physical randomness and from

human intentionality".[4] Similar perspectives have emerged in water governance – particularly in relation to climate change. Consistent with these examples, scientists studying ecosystems, global and local climate change, and biodiversity loss consistently highlight limits to the accuracy of predictions, such as due to non-linear phenomena and processes (e.g. Baird, 2010; Hansen, 2005, 2007; Rockström et al., 2009a; Rockström et al., 2009b).

Related 'Niches' with Emerging Anticipatory and Interventionist Practices

This section considers each of these 'cracks in the system' and related shifts from policy-as-normal. Each 'crack' is presented as a distinct 'niche' in which futures enquiry and broader anticipatory action is experimented with and becoming more important.

Initiating and achieving 'sustainability transitions'

This 'niche' relates to the dual recognition of wicked, persistent sustainability problems and the limits of traditional policy interventions. Consequently, further consideration of how to successfully intervene and initiate large-scale, longer-term change is emerging.

One emerging model called 'transition management' (TM) was recently created in The Netherlands and adopted as an environmental policy framework. It is one framework in the rapidly emerging field of 'sustainability transitions' research (Farla et el., 2012).[5] TM is informed by complex systems and governance theory (Loorback, 2010). A 'transition' is defined as "processes of structural change in societal (sub-) systems", such as in energy supply or agricultural production, over many decades (Loorback, 2010, p.166). Practitioners argue that TM is "innovative for two reasons: It offers a prescriptive approach toward governance as a basis for operational policy models, and it is explicitly a normative model by taking sustainable development as long-term goal" (Loorback, 2010, p.163). TM is suited to the "early phases of the policymaking processes or those processes in which a deadlock requires breakthroughs" (Loorbach, 2010, p.178). However, TM can also be viewed in the context of 'third-generation' environmental policy in which governments aim to be more facilitative – by establishing processes, collaboratively setting goals, and bringing stakeholders together (Grin et al., 2003; Vergragt, 2004) – and related shifts towards being less reliant on 'command and control' regulation and adopting a mix of policy tools (Long, 1997).[6] TM has recently been experimented with in the Netherland, UK and Belgium, in such areas as energy and healthcare (Loorback & Rotmans, 2010), and here in Australia for urban water management (see Brown & Keath, 2008; Ferguson, 2010). TM is a growing example of 'policy networks' governance (*Table 1*). Similar to TM, the UK government is supporting the Transition Pathways to a Low Carbon Economy project examining energy transitions, which combines technical analysis with assessment of the effects and acceptability of alternative 'transition pathways'.

Table 1. *Three general governance paradigms*

	Classic steering (top-down, command-and-control)	Market model (bottom-up)	Policy networks (processes and networks)
Level of analysis	Relationship between principal and agent	Relationship between principal and local actors	Network of actors
Perspective	Centralised, hierarchical organization	Local actors	Interactions between actors
Characterisation of relationships	Hierarchical	Autonomous	Mutually dependent
Characterisation of interaction process	Neutral implementation of formulated goals	Self-organization on the basis of autonomous decisions	Interaction processes in which information and resources are exchanged
Foundational principles	Classic political science	Neo-classical economy ('rational economic man')	Sociology, innovation studies, neo-institutional political science ('bounded rationality', uncertainty, interacting, etc)
Governance instruments	Formal rules, regulations, laws	Financial incentives (subsidies, taxes)	Learning processes, network management (e.g. experiments, demonstration projects, vision building at scenario workshops, and strategic network building)

Source: Elzen & Wieczorek (2005, p.657)

The TM framework involves a range of futures methods and anticipatory actions. TM adopts a long-term perspective for short-term development (i.e. developing long-term visions and backcasting from them); develops 'transition arenas', and 'transition agendas' which focus on alternative 'images of sustainability' (plural) and associated possible 'transitions paths'; and seeks to mobilise actors and instigate associated experiments (Loorback & Rotmans, 2010).[7] In a 'transition arena' "a broadening network of diverse actors" is built-up, in which "a common language and future orientation" is developed such as a shared vision to enable and inspire action (Loorback & Rotmans, 2010, p.237-8). Related to this, core to TM is establishing a network of 'frontrunners' that is relevant to achieving a particular transition (Loorback & Rotmans, 2010).[8] Additionally, a learning-by-doing approach is adopted based on recognition of uncertainty and complexity (Elzen & Wieczorek, 2005; Loorbach & Rotmans, 2010; Rotmans et al., 2001). Scenario construction is often an important part of TM (Wiek et al., 2006), and it is used in combination with

other futures methods to identify potential change pathways. The major activities, although not a fixed sequence, are presented in *Figure 1* below.

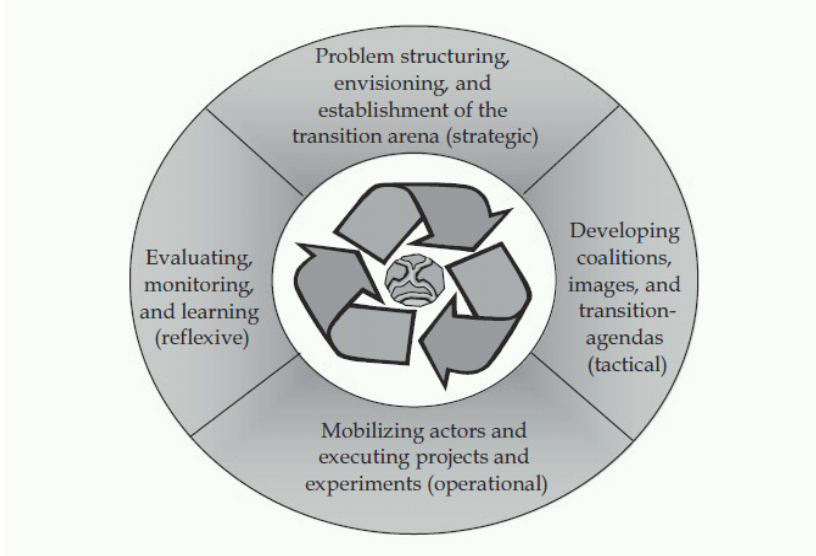

Figure 1. The transition management cycle
Source: Loorbach (2010, p.173)

Another related practice is 'bounded socio-technical experiments'. Such experiments aim to "try out the elements of a future system transformation *before* attempting to change the entire system" (Vergragt, 2004) [Emphasis added]. Vergrant (2004) highlighted such experiments with hydrogen fuel-cell vehicle systems, defining these as being: informed by a shared long-term vision; aimed at higher-order learning (e.g. about the technology, stakeholders' needs, and the conditions for success/failure); undertaken by diverse, relevant stakeholders; and bounded in space and time. Scenarios are also often used to emphasise necessary actions (Hegger et al., 2007). These experiments focus on 'socio-technical systems' rather than single technologies (i.e. encompassing additional elements such as institutions, user practices). Such experiments can be the focus of governance policies – called 'strategic niche management' – which aim to stimulate and support radical innovations through new 'niche' formation (Kemp et al., 1998; Schot & Geels, 2008). That is, new 'spaces' must be created so that experiments are sufficiently protected from market conditions, with the associated challenges of evolving these into successful market niches and, then, contributing to broader systemic change (Caniëls & Romijn, 2008).

Industry adaptation and transformation strategies

A second 'niche' exists in the collaborative processes being used to cope with increasing complexity and uncertain developments, and to generate innovation. It is not surprising that this niche exists: alliances and networks are a common strategy for evaluating and managing emerging technologies (van Lente, 2010). As van Lente (2010, p.106) observed, "when uncertainty is brought about by indeterminacy,

it cannot be reduced by getting 'information'" and "reduction of uncertainty now asks for collaboration and coordination", and it can therefore be "important to take the same direction as others are taking". This strategy can "reduce all kinds of uncertainties: about feasibility of technological options, about market assessments, about the possible future actions of competitors" (p.107) and help 'modulate' the strategic games within industries. The growth of uncertainties in the wider environment noted in Section 2 appears to be stimulating much wider adoption of such strategies.

'System innovation' is a related emerging approach being used for system-wide engagement and change. It has been adopted by research and advisory groups. For example, Forum for the Future defines 'system innovation' as "a set of interventions which shift a system onto a more sustainable path".[9] They state that to achieve this "we look at the whole system and how its different parts join up, we bring together key organisations to identify areas where we can intervene to create widespread change, and we plan multi-faceted action addressing behaviour, technology, policy and business practice". Trend analysis, visioning and scenarios are used. For example, the first two stages of the Sustainable Shipping Initiative involved creating a persuasive case for change via trend identification, horizon scanning, and scenario development, and then creating an industry vision from which new initiatives will be derived. Others such as Geels (2006) view 'system innovation' as being a long-term process (taking 20 or more years) that goes well beyond what can be achieved through 'system optimisation' or incremental change to realising a complete change "from one socio-technical system to another" (see *Figure 2*). Such deeper socio-technical change is needed to address structural problems in sectors and generate 'factor 10' (or more) improvements in resource/environmental efficiency. Research is being conducted on the dynamics of such transformative change, such as in industrial innovation (e.g. Geels, 2006) and emerging areas such as eco-housing (e.g. Smith, 2007).

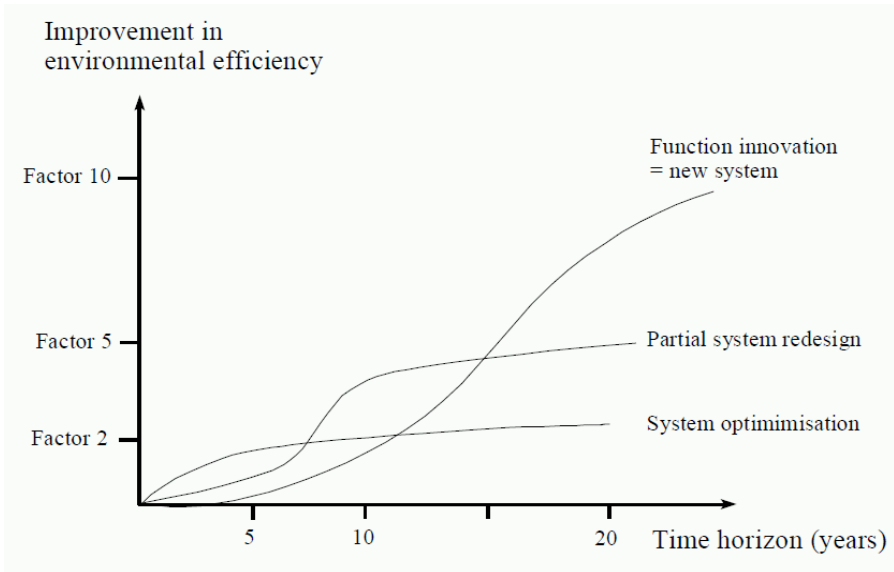

Figure 2. The promise of 'system innovation'

Source: Geels (2006, p.164; citing Weterings et al., 1997: 18 [Publication in Dutch])

A similar approach is being pioneered through the Sustainable Food Lab (SFL) project. SFL is a tripartite collaboration of business, non-profit and public organisations in the agriculture industry and global food system established in the mid-2000s. SLF began with a group of influential group of industry leaders (i.e. who acted as 'frontrunners' in the TM framework) whom recognised a need to collaboratively address problems in food systems.[10] Similar to 'system innovation' models, two central propositions are: 1) collaborative learning can incubate innovation given the right process, careful creation of 'safe spaces' "in which players who do not always agree could come together to explore possibilities for collaboration and learning" (Hamilton & Seville, 2008), and participation of key players; and, 2) key issues in global food systems cannot be addressed by one organization alone. Also like 'system innovation' practices, SFL adopts a theory of change based on multi-stakeholder, participatory platforms which has recently become more common. However, there are various challenges including legitimacy, 'getting the whole system in the room', and in realising impactful innovations (Eisenstadt, 2010). Challenges also can be faced when involving direct competitors and diverge groups who see the world very differently in projects (Anon, 2011b; Senge et al, 2007).

Governing emerging technologies to enable responsible innovation

A third rapidly growing 'niche' exists around the governance of new and emerging science and technology (NESTs). A range of anticipatory practices are increasingly being used, including: 'ELSI' research (Ethical, Legal, Social Implications), particularly for NESTs deemed to have high disruptive potential;[11] 'upstream' public and stakeholder engagement which seeks non-expert and user feedback on the potential development and applications of NESTs (often presented as possible scenarios); and attempts to create integrative 'anticipatory governance' (AG) frameworks (McGrail, 2010). AG explicitly aims to achieve the "cultivation of a societal capacity for foresight" (Barben et al., 2007), and has initially been experimented with in the United States for nanotechnology research and development.[12] AG builds on earlier technology assessment practices, which first emerged in the 1980s, and the "various [other] attempts to adopt and adapt existing [technology] assessment and management tools and approaches, or to develop new ones like the foresight exercises since the early 1990s" (Propp & Rip, 2006). Moreover, AG seeks to go beyond technocratic approaches, such as roadmaps, quantitative risk assessment, and cost-benefit analysis, which often dominate assessments (Ozdemir et al, 2011). This can be achieved by prescribing consideration of public values during engagement activities and by coupling scenario development work with engagement activities.

In Europe, the practice of Constructive Technology Assessment (CTA) has emerged over recent decades seeking to improve anticipation and learning in technological change. CTA aims to broaden technological development, and to help realise the over-arching goal of 'better technology in a better society' by expanding the design criteria that are used and including more actors in technology development (Rip & Te Kulve, 2008). CTA practitioners draw on insights from

studies of the dynamics of technological development and describe it as a "soft intervention" that attempts to modulate ongoing developments (Rip & Te Kulve, 2008, p.50). Rather than focussing on the supply or diffusion of technologies, 'societal embedding' is concentrated on (Schot & Rip, 1996; Te Kluve, 2011).[13] CTA often involves creating new 'loci' and 'spaces' for interactions between involved and concerned parties (e.g. those commercialising and concerned about particular new technologies), and often uses 'socio-technical' scenarios to support workshops due to the 'fictional' character of emerging technologies (Rip & Kulve, 2008; Te Kulve, 2011). In CTA, 'socio-technical scenarios' aim to "embody and further articulate emerging patterns in [actor] interactions" that "will shape further development" (Rip & Te Kulve, 2008, p.50-1) – termed 'endogenous futures' that are viewed as embedded in the present situation – and these alternative scenarios become a starting point for identifying challenges and strategising.[14] Based on their experience, Rip and Te Kulve (2008, p.67) argue that these scenario workshops "can create openings for responsible innovation". More broadly, Rip (2004) argues that "it is important to create visions of possible futures [e.g. of nanotechnology futures], so as to stimulate reflection and broaden the scope of strategic choices".

Here in Australia, similar anticipatory practices are part of the new National Enabling Technology Strategy (NETS), which initially concentrates on biotechnology (including synthetic biology) and nanotechnology (Australian Government, 2010). NETS activities include 'upstream' public engagement, and 'technology foresighting' (e.g. interactive 'foresight workshops' with industries such as building products and the aged care sector in which uptake is desired, and technology roadmap development). An example public engagement activity was the forum held at the 2011 Adelaide Festival of Ideas that discussed regenerative medicine, 'synthetic meat', and 'vertical farming' and their socio-cultural, safety, and environmental dimensions. Whilst the broader, interventionist agendas of CTA and anticipatory governance are yet to be adopted there are signals of change in policy-making and programs.

Alternative policy and planning approaches for more uncertain futures

Moves away from 'predict and plan' (or 'predict and control') approaches, recognising uncertainty, also present a 'niche'. In these spaces experimentation with policy and planning methods can occur. An example is water governance; the systems affecting the use, development and management of water resources (e.g. administrative and social systems) and water services delivery. Theorists working in this area have recently highlighted the need to be more capable of adapting quickly as new and uncertain circumstances emerge (e.g. Ison, 2010). Linked with this adaptive water governance models, such as for the Murray-Darling Basin (e.g. Allan, 2008; Ison, Russell, & Wallis, 2009; Knowles, 2011), are being adopted. Approaches to water management in some regions have moved away from seeking to reduce uncertainty (e.g. via large infrastructures, such as dams) towards creating new water provision regimes that can better *respond to* uncertainties where change has become an important dynamic (Godden et al., 2011; van der Brugge & van Raak, 2007). Similarly the US Water Utility Climate Alliance recently reviewed planning methods water utilities can use to incorporate climate change uncertainties (Means et al., 2010). Other water governance experiments are emerging, globally, in an accelerating quest for new practices (Godden et al., 2011). The use of related

adaptive management in environmental management has also rapidly grown.[15]

As noted in Section 2 explicit attention on alternative futures is emerging in climate change adaptation (Quay, 2010). A good example of this is the Victorian Centre for Climate Adaptation Research (VCCAR). VCCAR's report on scenarios for climate adaptation (Wiseman et al., 2011) was "triggered by numerous conversations with climate change adaptation policy makers and practitioners reflecting on their greatest challenge: how to make well-considered, well-informed decisions about adaptation priorities in the context of a swirling and ever-expanding cloud of evidence about climate trends and risks" (p.7).[16] Wiseman et al (2011) identify scenario planning as an important set of tools for defining "responses to the escalating risks of climate change". However, whilst scenarios are being used by climate adaptation policy-makers and practitioners to engage stakeholders, build "shared understanding of climate change risks, challenges and priorities", and to "strengthen capability and resilience", other uses can be problematic due to preferences for prediction-oriented approaches – such as for deciding on and implementing specific policy options and investment pathways (p.160). This highlights recurring problems which are familiar to members of the futures studies field.

Additional climate change adaptation examples are the use of community-based participatory futures approaches (e.g. community scenario writing and community visioning processes), and 'retrofitting' practices to adapt cities to a different future climate. Gidley et al (2009) showed that community-based approaches enact innovative "collaborative engagement between futures researchers and climate-vulnerable communities", challenging the dominance of empiricist-predictive trends and associated use of expert scenario methods (e.g. complex modelling of possible futures). Participatory futures techniques can be seen as part of an alternative approach to adaptation centred on social learning (Collins & Ison, 2009).

New retrofitting concepts and practices are also being conceptualised and experimented with. 'Metrofitting' is a provocative example (Fry et al., 2009), which is consistent with the preparedness action logic. Specifically, the 'Metrofitting' concept argues urban planners, governments, and others, must consider the implications of further climate change for cities and, therefore, begin to comprehensively prepare for coming problems. According to Fry et al (2009) such responses must be "preventative, adaptive, social, economic, technical and cultural". The proposed starting point is one futures practitioners could aid: it "is not a physical engagement with the city or just drawing up a pragmatic agenda, but the act of imagining what a metrofitted city might be like" and creating new narratives and images of the future (p.6).

Discussion

The previous sections reveal important emerging developments and themes. Three aspects focussed on here: central themes in the identified 'cracks' and 'niches'; evidence of the influence and potential roles of the futures field; and developing shifts in how futures are considered and shaped in society (applied foresight, more broadly).

First, there is increasing recognition of potential disruptive threats, rising complexity, and uncertainty in each of the identified cracks and niches. This is clearly shaping both the behaviour of firms in a wide range of industries, as well

as the governance strategies (e.g. for governing emerging technologies) and planning practices (e.g. in urban planning) being adopted. This is consistent with theorisation of the problematisation of the future, and related adoption of new actions and frameworks to cope with such change (e.g. greater collaboration; use of planning and policy methods that recognise, rather than conceal, uncertainty). This 'problematisation and response' dynamic is important and encouraging. Furthermore, across many domains and practices there is a focus on enabling larger-scale changes and innovations (e.g. using 'transition management', 'system innovation' or other techniques to try to breakthrough deadlocks and address 'stuck' challenges). That is, seeking to develop new actionable frameworks for shifting whole systems and broader societal trajectories. The use of futures methods for identifying and presenting imperatives for transformation (e.g. to gain commitment to 'transitions'), and in envisioning solutions is also notable. A related, important theme is in the importance of thinking and acting in terms of whole, complex systems (rather than parts). Finally, the other fields and disciplines reviewed here provide insights into how contexts featuring increasing change and uncertainty are currently being handled, or could potentially be better handled.

Second, the earlier outline provides insights into the influence and potential roles of the futures field. It suggests that, contrary to the claim that the futures field "has been so apparently ineffective in helping to avoid a new default future of 'overshoot and collapse'" (Slaughter, 2011a), it has been very effective at helping to pioneer new ways of – and methods for – thinking about the future. These are clearly being adopted and adapted outside the field in efforts to help avoid this 'default future'. Indeed, this is consistent with Slaughter's (2012, p.124) recognition that new "niches are required in which extended enquiry into possible futures can take place, be valued and applied" (such as those outlined above) and partly validates his more optimistic claim that "under the growing pressures of global emergency, futures/foresight work can emerge from the margins, as it were, and take on new and distinctively social forms". Other emerging applied foresight work is also increasingly prevalent in environmentalism (McGrail, 2011). Greater collaboration between those doing pioneering work in these growing 'niches' and the futures studies field may help to nurture and mature new ways of shaping and thinking about possible futures. Perhaps more importantly these evolving 'niches' indicate territories that futures researchers and futurists could proactively seek to inhabit – collaborating with other disciplines and groups in creating quality futures work, such as in the creation and use of forward views in the governing of emerging technologies (see *Table 2* below). An important risk, however – as noted by Gidley et al (2009, p.450) – is that the reputation of futures field could be tainted by the broader take-up of futures methods if they are often poorly applied.

Table 2. *Practices and potential roles for futures practitioners in the identified niches*

Purpose of anticipatory practices / strategies	Futures methods / tools used	Potential roles for futures practitioners	Example practices and concepts
Non-incremental change towards preferred futures (e.g. initiating transitions towards sustainability)	▪Vision-building (e.g. 'images of sustainability') ▪Scenario construction and analysis ▪Backcasting from visions	▪Involvement in emerging 'transition' experiments (e.g. facilitation work): adopting a 'change leadership' role ▪Pioneering futures work in sustainability planning, strategy and sustainability science ▪Promoting horizon scanning practices (e.g. stimulate innovation) ▪Theorising large-scale change processes	▪Transition management ▪Strategic niche management ▪Prospective analysis of potential 'transition pathways' ▪Higher-order learning (enabling innovation)
Responding to new or emerging 'systemic' threats and challenges (esp. within business/ industry contexts)	▪Environmental scanning, trend and scenario analysis to persuasively make 'case' for change ▪Vision-building	▪Pioneering forms of 'participatory foresight' – i.e. integrating futures methods/tools in new collaborative processes ▪Co-designing and facilitating multi-stakeholder processes ▪Facilitating the emergence of greater 'depth' responses to major problems	▪System innovation (esp. collaborative processes) ▪Collaboration and coordination strategies (e.g. alliances); network management

Purpose of anticipatory practices / strategies	Futures methods / tools used	Potential roles for futures practitioners	Example practices and concepts
Improved governance of innovation (esp. emerging technologies) and knowledge production	▪Scenario construction ▪Engagement exercises using scenario methods (e.g. with publics or other stakeholders, discussing these scenarios)	▪Leading greater use of futures methods in modulating innovation processes towards shared goals (e.g. climate change mitigation) and for managing uncertainties inherent to innovation trajectories ▪Helping enable broader normative approaches in policy and technology governance ▪Evaluating claims ('promised' futures, actor expectations)	▪Early public engagement ▪Constructive technology assessment ▪Prospective ELSI analysis (i.e. normative dialogue and analysis of the Ethical, Legal, Social Implications of new and emerging science and technology [NESTs]) ▪'Anticipatory governance' of NESTs
Policy and planning for complex, uncertain futures (e.g. in urban planning, environmental planning, local communities)	▪Scenario planning (and, linked with this, use of contingency planning) ▪Community-based scenarios and visioning ▪Monitoring (e.g. emerging changes) and evaluation	▪Helping to enable a shifts from 'predict-and-control' based policies towards scenario-based approaches ▪Broadening approaches to climate futures (beyond empiricist-predictive model) ▪Monitoring (emerging issues analysis, etc)	▪Decision-support techniques and 'social learning' ▪Adaptation policies and programs (especially climate adaptation) ▪Adaptive management ▪Participatory community futures

Finally, in the context of sustainability challenges and wicked problems, the changes and innovation noted here suggest a shift away from technocratic, or 'modernist', styles of planning and policy-making towards what could be termed an 'anticipatory interventionist paradigm'. Many of the domains reviewed have tended to be dominated by technocratic planning and policy-making (e.g. water governance,

technology assessment and policy, urban planning). That is, being centred on a 'predict and plan' or 'predict and control' approach (an overall prediction-orientation), defining 'fixed futures' for realisation (e.g. a roadmap), disengagement with – or concealing of – uncertainty, and so on. An alternative paradigm is indicated and developed by the practices and innovations outlined in the previous sections and associated historical changes. It includes: constructively engaging with uncertainty; using new techniques to enable more inclusive assessment of policy options and decision-making; normative interventions (e.g. enabling consideration of public values in the governing of technological change) and greater related engagement with risk (e.g. putting greater effort into anticipating harmful future outcomes and identifying ways to prevent or forestall these [Homer-Dixon, 2006]); and developing new capacities to monitor and respond to change. Linked with this, as Guston (2008, p.940) asserts, "giving up on prediction does not mean giving up on anticipation"!

Whilst there is clearly still some way to go for a full paradigm shift to occur, such changes currently appear promising. An associated shift away from being mostly reactive – whilst also developing far greater adaptive capacity – is essential in the context of twenty-first century sustainability challenges. So too is a normative longer-term orientation, which some of the innovations and practices adopt (e.g. transition management). As such, the growing 'niches' also represent important opportunities for the futures field to influence change.

Conclusion

This paper has presented an outline of the rapidly evolving social context for applied foresight, and described the associated growth in experimentation with new methodological approaches and associated action frameworks. In each context, or 'niche', we appear to be seeing increasing 'problematisation' of the future and, consequently, much more anticipatory action. These new practices are also important experiments with different ways to shift whole systems and broader societal trajectories. Whilst it is early days in the process of developing and refining such methodologies and practices, the fact remains that these are rapidly emerging in many important domains. Additionally, the growing prevalence of important action logics such as 'precaution', preparedness for change, and preemption (Anderson, 2010) is also clear in many niches, such as in governing emerging technologies to enable responsible innovation. Further, Anderson's (2010) identification of the greater focus on the potential for *radically different* futures to emerge, and increasing monitoring of the present for futures that could emerge from it, sums up much of contemporary foresight – and the growing demand for this work.

The contemporary context also appears to be expanding 'niches' for futures work and applied foresight. These expanding niches should be seen as points for thoughtful, proactive intervention by futures practitioners to assist enquiry into possible futures and its productive applications (e.g. to achieve committed, effective action on environmental issues). Challenges such as energy system transitions, climate change adaptation, and effective governance of emerging technologies demand greater organisational, community and social foresight, and are increasingly prominent issues. They call for effective futures thinking, policy-making and more anticipatory planning. Consideration of these niches and the related methodological and process innovations may also provide glimpses of the forms and functions of applied foresight in the twenty-first century. Futures practitioners could adopt,

or contribute to the refining of, these innovations and practices. In these niches practitioners can also contribute to deeper shifts in planning and policy-making, which point towards a potential new 'anticipatory interventionist paradigm' – and away from the currently dominant technocratic mode. Furthermore, such interventions in 'policy-making-as-usual' indicate ways the futures field could help to address key challenges, including those relating to human-made global warming.

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Notes

1. Four generic responses to change are evident in these approaches: 1) pre-empting change (identifying an emerging unwelcome change and proactively seeking alternatives to this), 2) embracing change, 2) adapting to change, and to a much lesser extent 4) reacting to change (i.e. effectively 'bouncing off' change with limited planning or foresight).
2 I thank one of the reviewers for correctly pointing out that the future has always been a 'problem'.
3 Examples include the Sustainable Food Laboratory (http://www.sustainablefoodlab.org/), Sustainable Shipping Initiative (see http://www.forumforthefuture.org), the insurance industry Climatewise Initiative (http://www.climatewise.org.uk/), and the Sustainable Apparell Coalition (see http://www.apparelcoalition.org/), The Sustainable Apparell Coalition's vision is "an apparel and footwear industry that produces no unnecessary environmental harm and has a positive impact on the people and communities associated with its activities", bringing together a coalition of companies, NGOs, universities and government agencies.. As is clear in these examples sustainability is often a central focus.
4 Hulme (2010, p.271) – a senior climate scientist – further notes that whilst "some of these uncertainties can in principle be quantified (even if they can't be eliminated), but many simply cannot" and, consequently, argues in this essay that "we must resist the lust for certainty" and not be "seduced by the allure of climate models predicting our far future". Foresight "cannot be limited to the over-reaching and hegemonic claims of physical prediction" (p.271), he asserts.
5 Readers interested in this research field are also directed to a special issue appearing in 2012 in *Technological Forecasting and Social Change* (Farla et al., 2012), and a forthcoming outline of the field (Markard et al, Forthcoming).
6 Linked with this, shifts away from central government implementing policies in top-down manner have lead to "increasingly diffuse policymaking structures and processes" – known as 'governance' – along with a search for modes of governance that "reduce the lack of direction and coordination associated with gover-

nance networks in general, and increase the effect of existing forms of government and planning in the context of long-term change in society" (Loorback, 2010, p.161).

7 An example is this process is the "roof transition" project produced the vision of "functional" roofs that contribute to local sustainability (e.g. green roofs to clean air, use for energy generation, and so on) in the Netherlands and the creation of new businesses and experimentation with new business models for realising the vision (Loorbach & Rotmans, 2010).

8 Similarly in relation to 'strategic niche management', which is discussed later, Smith (2007, p. 429) notes that "historical experience suggests radical changes begin within networks of pioneering organizations, technologies and users that form a niche practice on the margins of the regime" and, further, "studies suggest these 'niche' situations (e.g. niche applications, demonstration programmes, social movements) provide space for new ideas, artefacts and practices to develop without being exposed to the full range of selection pressures that favour the regime".

9 See http://www.forumforthefuture.org/the-lab

10 The Sustainable Food Lab (SFL) is facilitated by Adam Kahane and Hal Hamiliton and also applies Otto Sharmer's Theory U change model. SFL adopts the approach pioneered by Kahane's consultancy Reos Partners: "working with team of leaders who all share a concern for particular problem(s) in the system they are part of… who realise the only way to make progress on the issues they care about is to work together" (http://www.youtube.com/watch?v=jpG-EqupE5M&feature=related).

11 Formal ELSI analysis, alongside early scientific work in important emerging domains, first emerged around the Human Genome Project in the 1990s. As noted at http://www.genome.gov, "five percent of the annual budget of the NHGRI is dedicated to examining ethical, legal and social implications (ELSI) related to human genome research, incorporating specific recommendations into the activities of NHGRI and providing guidance to policymakers and the public".

12 Significantly, Guston (2008, p.940), also contends that "understanding from the social world — concepts such as precaution and anticipation — can help to remove unpredictability as a roadblock [e.g. for policy or decision-making]."

13 Societal embedding generally refers to three dimensions: *admissibility* (acceptability according to the rules and standards set by the government or by a sector), *integration* (in industries and markets), and *acceptance* by the public (Te Kluve, 2011).

14 The concept of 'endogenous futures' is similar to Bell's (1997) concept of 'dispositionals', which are "real present possibilities" such as the "present capacities of individuals, groups, and society as a whole for change and development".

15 The Resilience Alliance's outline of 'adaptive management' (AM) similarly notes a core focus on uncertainties in this approach that is used for environmental management. This approach has been developed over the past four decades. Like 'transition management', AM typically embraces a learning-by-doing approach –

with the experience gained then being used for future planning and management. However, AM has been difficult to achieve in practice (Allan & Stankey, 2009).

16 Much like practicing futurists (or foresight practitioners) the authors of this report similarly assert that "we live in an age where predictions and decisions based on the extrapolation of past trends or overly linear mathematical models are likely to be unhelpful, misleading and *maladaptive*" (p.7) [Emphasis added].

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