

FRAMING THE CHALLENGE OF CLIMATE CHANGE ADAPTATION FOR VICTORIAN LOCAL GOVERNMENTS

HARTMUT FÜNFELD

Centre for Urban Research, School of Global, Urban and Social Studies,
RMIT University, GPO Box 2476, Melbourne, Vic. 3001, Australia.

FÜNFELD, H. (2013). Framing the challenge of climate change adaptation for Victorian local governments. *Proceedings of the Royal Society of Victoria* 125(1/2): 45–55. ISSN 0035-9211. Correspondence: hartmut.fuenfeld@rmit.edu.au

Climate change adaptation, although dependent on our understanding of current and future climatic trends, is predominantly a social and institutional process. This becomes evident when studying how organisations actually respond to and prepare for climate change impacts. This paper explores the notion of framing climate change adaptation as a process of organisational development and change in the local government sector. Local governments, as the tier of government closest to the community, provide a raft of services to residents and businesses, many of which may be affected by the impacts of a changing climate. Local governments in Victoria and elsewhere have been at the forefront of assessing climatic risks and opportunities, as well as devising strategies and response measures to address these risks. The growing evidence of adaptation planning in the local government sector suggests that adaptation can be framed in many different ways, although a risk management perspective is frequently applied. Increasingly, adaptation to climate change is conceptualised as an ongoing, flexible process that needs to be fully embedded in the local and organisational context. This paper discusses the conceptual and organisational framing of climate change adaptation, illustrated by examples of the diversity of adaptation approaches taken by local governments in Victoria.

Key words: climate change, climate change adaptation, framing, local government, organisational change.

THIS paper provides an overview of the local government sector's efforts towards adapting to the impacts of climate change at an organisational level. From the perspective of Victorian local government, the paper discusses possible answers to three questions that, in the recent literature, are considered essential for framing and better understanding the sector's needs, capacity and institutional context for climate change adaptation.

1. What is the role of local government in adaptation (e.g. Kennedy et al. 2010; Pillora 2010; Gero et al. 2012)?
2. How is adaptation framed in local government (e.g. de Boer et al. 2010; Dewulf 2013)?
3. How is local government in Victoria adapting to climate change in practice (e.g. Measham et al. 2011; Municipal Association of Victoria 2011)?

To discuss these questions I draw on three examples from Victoria. These are based on recent empirical social research funded through the Victorian Centre for Climate Change Adaptation Research (VCCCAR; see VCCCAR 2012). However, before discussing

the questions listed above, I explore climate change adaptation within the context of local government responses to climate change more broadly, as a background to the discussion.

LOCAL GOVERNMENT RESPONSES TO CLIMATE CHANGE

Climate change adaptation is on its way to become embedded in local government planning and decision-making practices, adding to a strong record of the sector taking a lead with climate change mitigation and sustainability. Since the early 1990s, many local governments have taken climate change issues on board by conducting greenhouse gas emissions inventories, developing action plans for reducing carbon emissions and by encouraging residents and businesses to do the same (Mukheibir & Ziervogel 2007; Bassett & Shandas 2010). In Australia alone, estimates show that local governments participating in the Cities for Climate Protection program (run by International Council

for Local Environmental Initiatives (ICLEI)–Local Governments for Sustainability) reduced their greenhouse gas emissions by 18 million tons of carbon dioxide equivalents between 1998 and 2008, saving them Au\$95 million in reduced energy costs (ICLEI Oceania 2008). Although further action is necessary and possible, local government climate change mitigation efforts have proven to lead to significant emissions and financial savings that demonstrate what local government as a sector is capable of achieving, provided a clear business case and political will. Cities and municipalities in many other industrialised countries have similarly positive climate change mitigation records to show that they have moved beyond lip service to achieving tangible outcomes in emission reductions (Bassett & Shandas 2010).

But what is the situation in regard to climate change adaptation? A recent study that explored, among other issues, attitudes and expectations towards adaptation in coastal communities showed strong preference for a significant role for government in adaptation (Barnett et al. 2013). Local government is the level of government closest to the people, which puts it in an ideal position to deal with climate change impacts (Pillora 2010; Measham et al. 2011). On the one hand, this statement is somewhat of a truism; however, on the other hand, it points to the fact that climate change impacts will ultimately, and most immediately, be experienced at the local scale, by people living in particular neighbourhoods and local government areas.

At least since the publication of the Intergovernmental Panel on Climate Change's Fourth Assessment Report (IPCC 2007), it is evident that climate change is inevitable, already underway and that, due to lags in the climate system, at least some impacts of climate change will occur even if immediate reductions in global greenhouse gas emissions could be achieved. Climate change has become a reality that is hard to challenge on scientific grounds, and climate change adaptation has become a necessity (Hunt & Watkiss 2010; Climate Commission 2011). Recent studies show that at least half of all councils had undertaken some sort of climate change risk assessment (Gurran et al. 2011; Webb & Beh 2013), although evidence of local government adaptation action (as opposed to planning and preparation) is much more limited.

Local climate change impacts will take effect in a number of different ways across a geographical area. For example, it is known that the on-the-ground

health impacts in cities of a projected increase in extreme heat days of >35°C are not only dependent on physical factors, such as the microclimates of urban areas and the urban heat island effect (Oke 1982; Wilby 2008), but also to factors of equal (or potentially greater) significance such as how sensitive people and other living creatures are to the increased frequency of heat days and what capacity they have to adjust their behaviour according to their exposure and sensitivity to heat (Kovats & Ebi 2006; Hansen et al. 2011). People's ability to adapt to heat is tied to a complex set of factors that reside within individuals and communities, including individual sensitivity to heat and the health and support services that are available and accessible in a community (McMichael et al. 2008). The latter influences, for example, whether individuals are able to keep cool, know to make time to rest during peak hot times and have access to clean drinking water to counter dehydration. Many of these factors are directly linked to socioeconomic factors, such as age, income and employment status, which exhibit significant spatial differentiation in urban areas (Kovats & Ebi 2006; Harlan & Ruddell 2011).

WHAT ROLES FOR LOCAL GOVERNMENT IN ADAPTATION?

Local government provides important support services to the community, including critical local infrastructure, such as roads, footpaths, street lighting, parks and recreational areas, and individual or community services, such as libraries, social programs and support for children, parents and elderly people. These services may be significantly affected by a range of climate change impacts, such as higher average and extreme temperatures, changing rainfall patterns, more frequent and more intense bushfires, sea level rises and coastal erosion. Local governments have a duty of care to ensure that service disruptions are minimised, that harm to people is averted and that unnecessary costs (both financial and non-financial) resulting from climate change impacts are avoided where it is possible to do so with reasonable effort (Baker & McKenzie 2011). Local governments can address this by incorporating climate change considerations into a range of 'decision entry points' to adaptation, such as strategic planning, land use planning, development decisions, asset management decisions or social, economic and environmental plans (Webb & Beh 2013, p. 27).

Beyond managing such organisational and community-level risks, local governments have an opportunity to ‘keep an ear to the ground’ and engage with individuals and business and community organisations to develop appropriate adaptation responses. In the above heat wave scenario, local government may have a key role in adaptation because it has the ability to control or influence local environmental and socioeconomic factors that contribute to the on-the-ground social and health-related impacts of heat waves.

FRAMING ADAPTATION IN LOCAL GOVERNMENT

Against this backdrop, we may want to ask, ‘What have local governments done to date to adapt to current and future climate change and how have they approached adaptation?’ A rapidly growing body of evidence shows that: (i) many Australian local governments are taking adaptation seriously and have committed resources to adaptation; (ii) the practical and operational side of adaptation is difficult to navigate; and (iii) in order to deal with the complexity of adaptation planning and decision making at an organisational level, the sector has started developing innovative methods and tools (Gardner et al. 2010; Booth & Cox 2012; Webb & Beh 2013).

However, before exploring some examples in more detail, it is useful to reflect on the ambiguity of the concept of adaptation and discuss how adaptation can be framed and interpreted by a public sector organisation such as a local government (Fünfgeld et al. 2012). How can a large, compartmentalised organisation make sense of a cross-cutting and intrinsically complex issue such as adapting to climate change?

Based on recent research on adaptation in the local government sector in Victoria (VCCCAR 2012), two observations can be made. First, adaptation, seen from a whole-of-organisation point of view often means better risk management that incorporates climate-related risks. Climate change impacts are likely to have tangible effects on the operations of a whole organisation while at the same time having quite specific consequences for different parts of the organisation and the services they provide to the community. The ways these impacts manifest across the organisation and its services are often quite messy and unpredictable. For example, a hailstorm may

cause the asset maintenance unit to do overtime to quickly repair damaged buildings; the parks services branch may be tied up for a couple of weeks cleaning up fallen trees etc., while community services may not be much affected by the very same hailstorm at all. Many extreme weather events, such as extreme hailstorms, will ultimately affect the financial bottom line of a local government as a whole, through the destruction of assets and the cost resulting from service outages and unplanned operational activity. At the corporate level, climate change adaptation may mean transferring some degree of risk to others (e.g. to insurance companies by purchasing adequate insurance). Organisation-wide financial impacts can mean that planned projects, service upgrades or maintenance schedules may need to be revised or cannot go ahead for some time due to budgetary constraints following an extreme event. Beyond these organisation-wide effects on the financial bottom line, the capacity of each department, each business unit in an organisation, may be affected quite differently by climate change impacts.

However, in the context of climate change, the main future challenge will be that extreme climatic events will occur more frequently and with greater intensity, which means that ever-scarce government and community resources may still be tied up in the recovery from one extreme event while another event is already occurring. If gradual, slow-onset climatic changes are added to the mix, such as prolonged drought or sea level rise, communities may be in a position where they need to deal with a volatile and differentiated mix of climate change-related stresses on systems that can be logistically very difficult and costly to manage. Given this context, including climate change considerations in organisational risk management processes in a systematic way can be a useful mechanism to initiate organisational-level climate change adaptation. In recent years, climate change risk management, modelled on the ISO standard (Standards Australia 2009), has become a major vehicle to help progress adaptation in local government and in other sectors (Fünfgeld & McEvoy 2011; Jones & Preston 2011). Risk management provides a framework for the identification and evaluation of multiple potential impacts of climate change, for which treatment options can be identified and individual and organisational-level responsibilities for monitoring be allocated. In many local governments, risk management constitutes the main framing of climate change adaptation.

A second important observation is that climate

change impacts are likely to affect different parts of an organisation differently. Therefore, adaptation requires people from different backgrounds, different disciplinary traditions and with different job roles and responsibilities to work together within an organisation and across organisations. This can be a challenge, not least because inevitably people are likely to enter the discussion on adaptation with very different views about the purpose of the endeavour (Fünfgeld et al. 2012). For example, for a community services officer climate change adaptation may be mainly about reducing the vulnerability of disadvantaged residents to heatwaves and other extreme weather events. Conversely, for an engineer working in asset development, adaptation may be about ensuring new council-owned buildings are designed to an improved standard that incorporates temperatures projected for 2050 and 2070. For a biodiversity coordinator, the main concern may be to protect endemic species under threat of extinction under particular climate change scenarios.

The question of what adaptation means to an organisation is essentially one about articulating a purpose, or multiple purposes, for adaptation. Interpretations of purpose are inevitably tied to values intrinsic to the individuals involved and influenced by a vast array of factors, including community expectations, dominant political views and short-term opportunities and constraints. Although organisational values are typically articulated in vision and mission statements and strategic plans, the value sets that individuals bring to the table are often less transparent. In local government, politics is typically only made explicit in the council chamber, among local elected members. Here, values and beliefs (e.g. with regard to accepting climate change as a fact or not) may be consciously articulated. However, within the local government bureaucracy, individually held values and political views may be articulated in passing at best; more often, they are likely to get unconsciously voiced in discussions and become apparent in preferences for how to go about day-to-day routines and processes, so called decision making.

ADAPTATION AS A NEGOTIABLE CONCEPT

These observations show that, in essence, adaptation is predominantly a concept, a way of interpreting and framing a set of organisational responsibilities for

responding to local and regional climate variability and change. Accepting the subjective and normative nature of adaptation, it becomes evident that, in order to devise effective adaptation measures and help others do so, the meaning and purpose of adaptation need to be discussed, articulated and negotiated within any given local context. The negotiable and necessarily local nature of adaptation suggests that it would be impossible to devise a blueprint set of adaptation measures for all local governments (or other organisations), as has been the case with climate change mitigation where international protocols for greenhouse gas emissions accounting have been developed. Adaptation, it appears, does not lend itself to such prescriptive handling, where predefined outcomes can be achieved by following a set of prescribed measures. Adaptation is intrinsically context specific and its meaning and purpose need to be articulated, clarified and negotiated within a given social, economic, institutional and political context.

LOCAL GOVERNMENT CLIMATE CHANGE ADAPTATION JOURNEYS

If adaptation is so much dependent on institutional context, organisational values and the individuals involved in it, how then do local governments manage to ‘do adaptation’? How can a compartmentalised organisation, with multiple organisational objectives, navigate the practical side of organisational and community-level adaptation, including negotiating the adaptation purposes most appropriate in the local context?

Over the past 5 years, at least half the local governments in Victoria and other states have taken formal steps towards adaptation planning (Gurran et al. 2011; Webb & Beh 2013). Most of the better-resourced councils in metropolitan areas, peri-urban areas and larger regional and rural councils have conducted some form of adaptation planning, such as conducting climate change risk assessments or developing an adaptation plan or strategy.

In the following section, I explore the adaptation planning processes in three local governments. These organisations’ adaptation journeys were studied as part of the research VCCCAR (2012) project mentioned above through document analysis, focus groups and semistructured key informant interviews, and each step of the organisations’ adaptation planning process was matched with and mapped

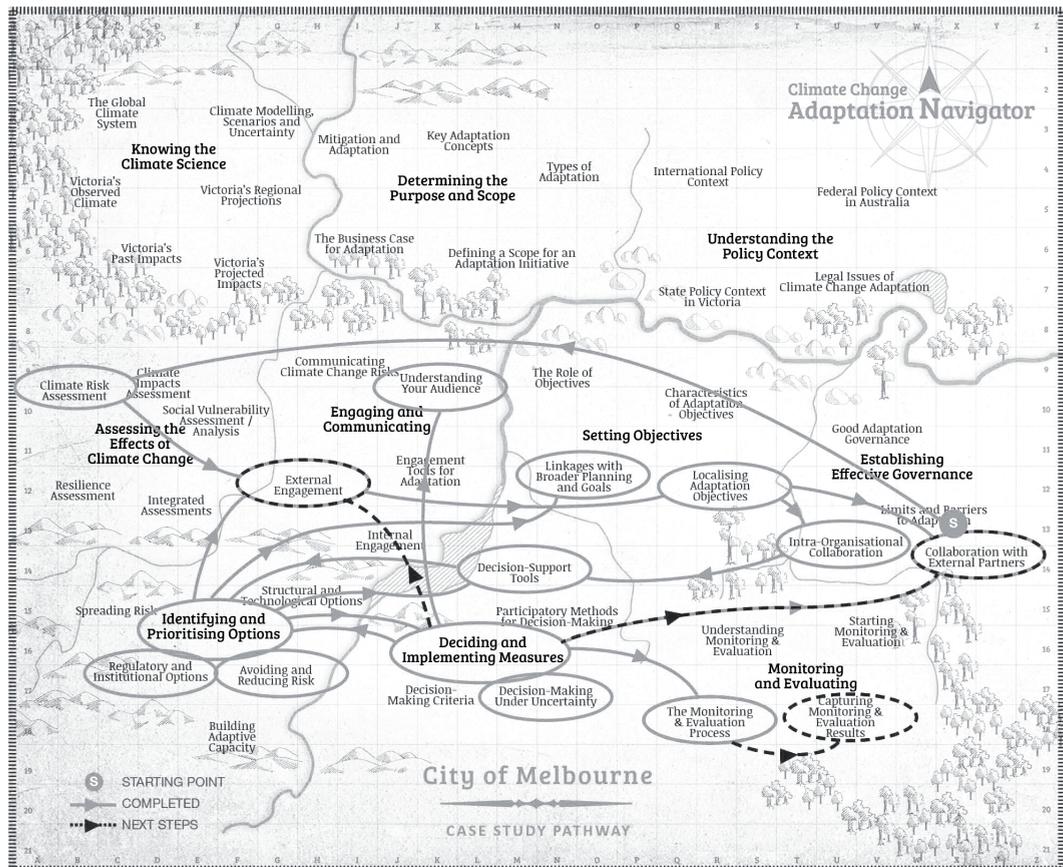


Fig. 1. Climate change adaptation journey taken by the City of Melbourne (as of June 2012). 'S' represents the starting point in the process; the orange line represents the adaptation process to June 2012. The blue dotted line represents adaptation activities planned to be commenced in the short term. (Reproduced with permission from <http://www.adaptation-navigator.org.au>, accessed September 2013.)

onto one area of a visual climate change adaptation framework developed as part of the project, called the Climate Change Adaptation Navigator. The results are conceptual maps of organisational climate change adaptation journeys that show differences as well as similarities between the approaches taken.

Adaptation planning in the City of Melbourne

The first example is the City of Melbourne (Fig. 1). The location and social and economic fabric of the City of Melbourne's local government area, with its central business district, high volumes of tourists and state capital functions, poses unique challenges and opportunities for adaptation planning.

Since 2007, the City of Melbourne has recognised the need to adapt to climate change impacts by engaging with external partners. When mapped onto the Adaptation Navigator framework, the City of Melbourne's adaptation planning activities exhibit an emphasis on identifying and prioritising adaptation options (Fig. 1). In 2007, the City of Melbourne commissioned a climate change risk assessment process, following extensive consultation with external stakeholders responsible for different aspects of city management and service provision. The risk assessment identified options for addressing climate change risks across the organisation, which were further analysed and discussed with stakeholder and expert groups. The four key risk areas identified

were: (i) less rainfall and increased evaporation; (ii) extreme heatwaves; (iii) intense rainfall, hail and wind storms; and (iv) sea level rise. In 2009, the options for dealing with identified risks were compiled in a Climate Change Adaptation Strategy (City of Melbourne 2009). In 2010, the Climate Change Adaptation Strategy was supplemented with a Climate Change Action Plan, which was endorsed by the Council. The action plan hands over responsibility for discrete adaptation actions to different branches of the organisation. Key actions of the action plan were integrated into the City's organisation-wide risk register, which requires each branch to report actions to mitigate and minimise risks on an annual basis. Since then, the City of Melbourne has implemented a range of priority adaptation measures while also considering options for monitoring progress and continued effort to engage with external partners and the local community. Adaptation measures have included commissioning the development of a sea level rise inundation visualisation tool, which integrates future sea level rise models with extreme rainfall runoff models. A heat wave response plan has been developed and implemented to minimise the risk of serious negative health effects arising from heat waves. Planned future activities focus on monitoring and evaluation and increased community and stakeholder engagement on climate change adaptation (City of Melbourne, pers. comm., 2012).

Adaptation planning in the City of Greater Geelong

A second example is the City of Greater Geelong (w. 2). Here, the need to develop a plan of action for climate change adaptation was identified in the City of Greater Geelong Greenhouse Reduction Strategy in 2008 (City of Greater Geelong 2008) and was also identified as an outcome under the Sustainable Natural and Built Environment strategic direction in the City of Greater Geelong's City Plan 2009–2013 (City of Greater Geelong 2012). This provided a strong anchoring of the City of Greater Geelong's initial adaptation efforts in the organisation's strategic planning process.

The Adaptation Navigator conceptual map (Fig. 2) shows a more spread out and more linear adaptation journey than that of the City of Melbourne, with a convergence on internal engagement. This reflects the City of Greater Geelong's focus on building internal capacity for adaptation by gradually integrating climate change adaptation considerations into all

aspects of organisational planning and decision making. In 2010, a consultant was brought in to help develop a Climate Change Adaptation Strategy. A Stakeholder Engagement Plan was produced, which also facilitated support for the Adaptation Strategy from the City's Executive and elected Councillors. Significant effort went into engaging across the organisation and getting a better understanding of staff members' perception of climate change-related risks by conducting an in-house survey, interviews and an internal briefing paper on climate change adaptation. This phase of intensive internal engagement culminated in an in-house climate risk assessment workshop, during which key climate change risks and priority adaptation actions were identified across the organisation. Workshop outputs fed into the development of the Climate Change Adaptation Strategy (City of Greater Geelong & NetBalance 2011a) and a road map for how the strategy could be implemented (City of Greater Geelong & NetBalance 2011b). In 2011, the City started implementing adaptation measures that were flagged in the adaptation strategy, including developing an in-house tool kit and process for assessing climate change risks for all of the City's projects and activities. The Climate Change Adaptation Toolkit (Eyre et al. 2012) was developed in collaboration with a consultancy and academic partners.

Planned future adaptation measures include the roll-out of the adaptation planning process outlined in the adaptation tool kit across the organisation, as well as a number of specific adaptation actions on coastal adaptation.

Adaptation planning in the City of Greater Bendigo

The third example is the City of Greater Bendigo in central Victoria. The City of Greater Bendigo's Adaptation Navigator map shows an approach focused on determining the scope for adaptation, internal and external collaboration and gaining a better understanding of the City of Greater Bendigo's options and responsibilities for adaptation within the existing policy context (Fig. 3). Rather than beginning the adaptation process with a climate change risk assessment (a typical process taken by many other local governments), the City of Greater Bendigo decided to invest substantial effort upfront on clarifying the purpose and goals of adaptation and engaging in a process of thorough internal discussion about these goals and how they could be

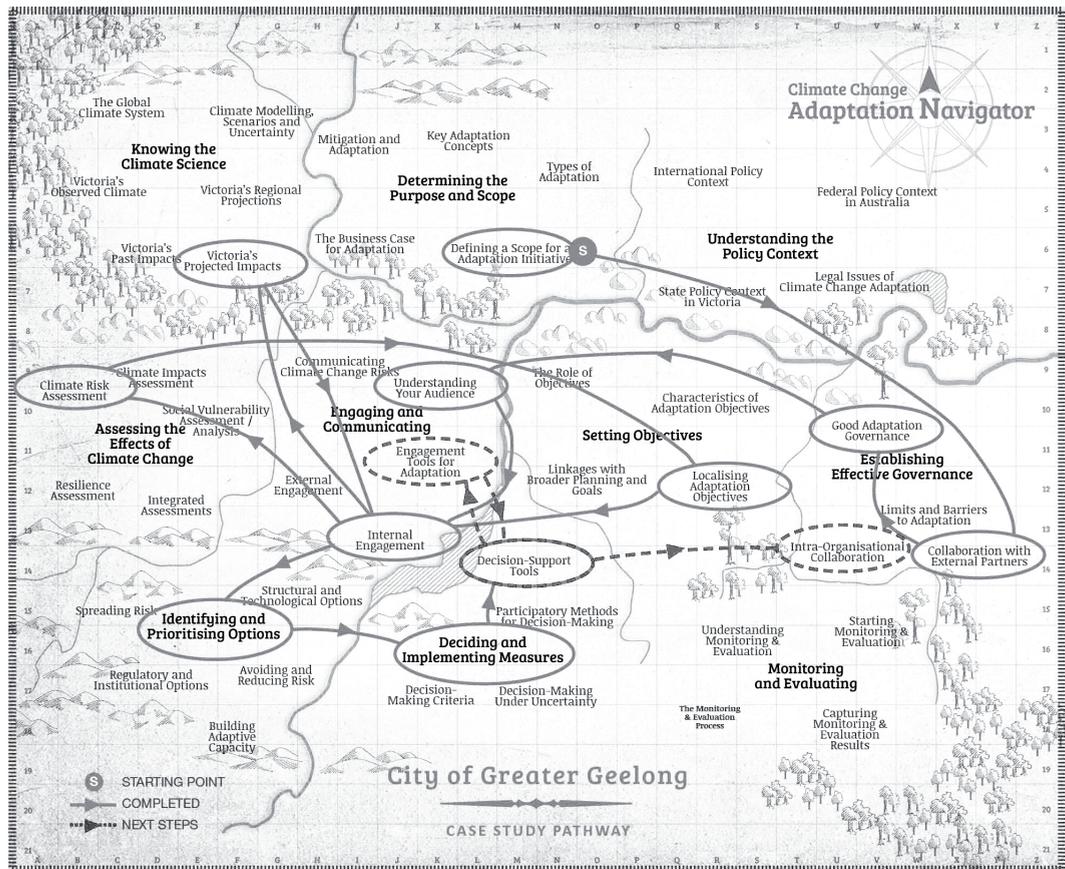


Fig. 2. Climate change adaptation journey taken by the City of Greater Geelong (as of June 2012. ‘S’ represents the starting point in the process; the orange line represents the adaptation process to June 2012. The blue dotted line represents adaptation activities planned to be commenced in the short term. (Reproduced with permission from <http://www.adaptation-navigator.org.au>, accessed September 2013.)

achieved. One of the first activities that the City of Greater Bendigo engaged in as part of its adaptation effort was to create a sense of collaboration by conducting an adaptation activity mapping in order to get an understanding of the different projects and initiatives related to adaptation that were already underway across the organisation. The goal of this exercise was to demonstrate that adaptation was not entirely new to the organisation, and that the City of Greater Bendigo had adapted to changing climatic circumstances for some time (e.g. during the decadal drought of 2001–2010). In parallel with this baseline mapping of existing activities, a series of facilitated group discussions was organised with the assistance of the research VCCAR project (VCCAR 2012),

with the joint objective of: (i) generating information on the framing of organisational adaptation; and (ii) engaging right from the start with staff from across directorates to scope out the adaptation process. Among other activities, an internal policy paper was produced to describe the current adaptation policy context and Council obtained funding from the Victorian State Government for a regional project to analyse the current and potential future vulnerability to climate change in the region. With a strong internal foundation for adaptation and increased clarity regarding the goals of adaptation, the City of Greater Bendigo plans to conduct an in-house climate change risk assessment in order to identify and prioritise adaptation options and, subsequently,

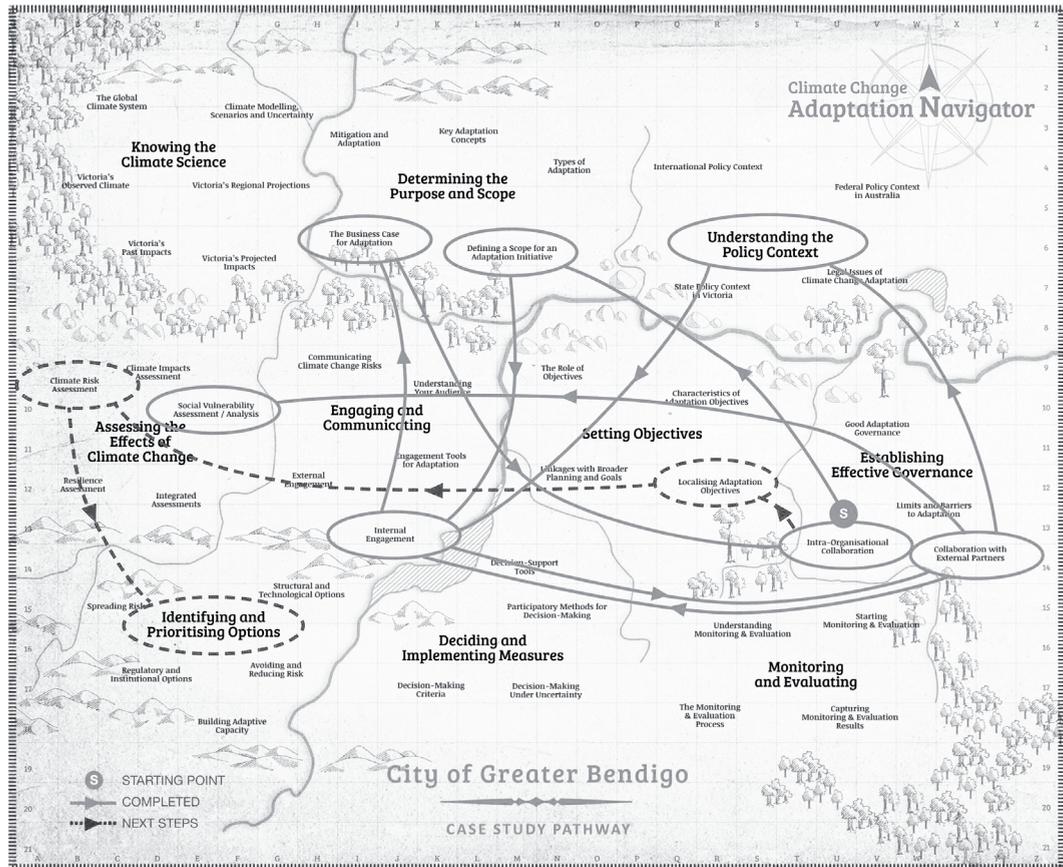


Fig. 3. Climate change adaptation journey taken by the City of Greater Bendigo (as of June 2012. 'S' represents the starting point in the process; the orange line represents the adaptation process to June 2012. The blue dotted line represents adaptation activities planned to be commenced in the short term. (Reproduced with permission from <http://www.adaptation-navigator.org.au>, accessed September 2013.)

to begin implementing adaptation activities across the organisation and in collaboration with the community.

CONCLUSIONS

The three Victorian local government examples provide empirical evidence for conceptualising and framing climate change adaptation predominantly as a context-specific process. In order to make progress with adaptation, it seemed imperative that each organisation develop its own, individual adaptation strategy that takes contextual organisational factors into account. The adaptation journey maps

show that between the three local governments studied, substantial differences exist in terms of how adaptation has been tackled and where the emphasis of effort has been placed. Such diversity of approaches is encouraging and confirms emerging views about organisational adaptation, which emphasises the need for facilitating wider processes of organisational learning and change that go beyond climate change issues (Berkhout et al. 2006; Berkhout 2012). Looking at it in this light, climate change adaptation provides a dynamic opportunity for governments and other organisations to instigate positive organisational change and development. If well facilitated, adaptation may be able to help organisations to transition to more integrative

and less-compartmentalised institutional models, where links between departments are strengthened and cross-cutting communication and engagement encouraged. In this regard, the emerging evidence of climate change adaptation from local governments is encouraging. In most cases, the actual organisational and individual drivers for such organisational governance and culture change are still obscure and difficult to unravel. Further social research in this area can produce important insights that can assist other organisations to deal more effectively with complex contemporary challenges, such as climate change.

ACKNOWLEDGEMENTS

The author's research mentioned in this paper was funded by the Victorian State Government through the Victorian Centre for Climate Change Adaptation Research. The author acknowledges the contributions of the following members of the project team: Darryn McEvoy, Sophie Millin, Jana-Axinja Paschen, Ray Ison, Philip Wallis, Rodney Keenan, John Handmer, Joshua Whittaker and Adriana Keating.

REFERENCES

- BAKER & MCKENZIE., 2011. *Local Council Risk of Liability in the Face of Climate Change—Resolving Uncertainties: A Report for the Australian Local Government Association*. Available from: <http://210.193.178.189/~media/publications/local-govt/alga-report-final-pdf.pdf>, accessed September 2013.
- BARNETT, J., WATERS, E., PENDERGAST, S. & PULESTON, A., (2013). *Barriers to adaptation to sea-level rise* (p. 85). Gold Coast. Available from: http://www.nccarf.edu.au/sites/default/files/attached_files_publications/SD1104_Barnett_2013_Barriers_adaptation_sea-level_rise.pdf
- BASSETT, E. & SHANDAS, V., 2010. Innovation and climate action planning: perspectives from municipal plans. *Journal of the American Planning Association* 76: 435–450.
- BERKHOUT, F., 2012. Adaptation to climate change by organizations. *Wiley Interdisciplinary Reviews: Climate Change* 3: 91–106.
- BERKHOUT, F., HERTIN, J. & GANN, D. M., 2006. Learning to adapt: organisational adaptation to climate change impacts. *Climatic Change* 78: 135–156.
- BOOTH, P. & COX, R., 2012. *Research and Evaluation Conducted in Collaboration with the Australian Local Government Association and State and Territory Associations. Final Stage 3 Synthesis Report*. Available from: http://www.nccarf.edu.au/settlements-infrastructure/sites/www.nccarf.edu.au/settlements-infrastructure/files/AC-CARNSI_STAGE_3_REPORT_FINAL_AUGUST2012_0.pdf, accessed September 2013.
- CITY OF GREATER GEELONG. (2008). *Greenhouse Reponse 2008-2011: Greenhouse Reduction Strategy and Local Action Plan*. Geelong: City of Greater Geelong. Available from: <http://www.geelongcity.vic.gov.au/common/public/documents/8cbcc5e3cd6e6d8-greenhouse-reponse.pdf>, accessed September 2013.
- CITY OF GREATER GEELONG., 2012. *City Plan 2009–2013: 2012–2013 Update* (p. 79). Geelong. Available from: [https://www.geelongaustralia.com.au/common/Public/Documents/8cf1205b3745030-City%20Plan%202009-2013%20\(2012-13%20Update\).pdf](https://www.geelongaustralia.com.au/common/Public/Documents/8cf1205b3745030-City%20Plan%202009-2013%20(2012-13%20Update).pdf), accessed September 2013.
- CITY OF GREATER GEELONG & NETBALANCE, 2011a. *Climate Change Adaptation Strategy*. Geelong: City of Greater Geelong. Available from: <http://www.geelongaustralia.com.au/common/Public/Documents/8ce5879f7f85db8-Climate%20Change%20Adaptation%20Strategy.PDF>, accessed September 2013.
- CITY OF GREATER GEELONG & NETBALANCE, 2011b. *Climate Change Adaptation Strategy: Summary And Roadmap*. Geelong: City of Greater Geelong. Available from: <http://www.geelongaustralia.com.au/common/public/documents/8ce587dc4fd671a-Climate%20Change%20Adaptation%20Strategy%20Summary%20and%20Roadmap.pdf>, accessed September 2013.
- CITY OF MELBOURNE, 2009. *City of Melbourne Climate Change Adaptation Strategy*. Available from: http://www.melbourne.vic.gov.au/About-Council/PlansandPublications/strategies/Documents/climate_change_adaptation_strategy.PDF, accessed September 2013.
- CLIMATE COMMISSION., 2011. *The Critical Decade: Victorian Climate Impacts and Opportunities*. Available from: http://climatecommission.gov.au/wp-content/uploads/120719_VIC-report-web-version_final.pdf, accessed September 2013.
- DE BOER, J., WARDEKKER, J.A. & VAN DER SLUIJS, J.P., 2010. Frame-based guide to situated decision-

- making on climate change. *Global Environmental Change* 20: 502–510.
- DEWULF, A., 2013. Contrasting frames in policy debates on climate change adaptation. *Wiley Interdisciplinary Reviews: Climate Change* 4: 321–330.
- EYRE, S., NIALL, S., SILKE, F. & YOUNG, S., 2012. *Climate Change Adaptation Toolkit User Guide: A Comprehensive Guide to Planning for Climate Change Adaptation in Three Steps*. Available from: http://www.geelongaustralia.com.au/common/public/documents/8cf8a428e29d1fd-Climate_Change_Toolkit_User_Guide.pdf, accessed September 2013.
- FÜNFGELD, H. & MCEVOY, D., 2011. *Framing Climate Change Adaptation in Policy and Practice. Working Paper*. Melbourne: Victorian Centre for Climate Change Adaptation Research. Available from: http://www.vcccar.org.au/sites/default/files/publications/Framing_project_workingpaper1_240611_1.pdf, accessed September 2013.
- FÜNFGELD, H., WEBB, B. & MCEVOY, D., 2012. The significance of adaptation framing in local and regional climate change adaptation initiatives in Australia. In *Resilient Cities: Cities and Adaptation to Climate Change*, K. Otto-Zimmermann, ed. Dordrecht: Springer Science+Business Media. pp. 283–293.
- GARDNER, J., PARSONS, R. & PAXTON, G., 2010. Adaptation benchmarking survey: initial report. *CSIRO Climate Adaptation Flagship Working Paper No. 4*. Available from: <http://www.csiro.au/files/files/px5a.pdf>, accessed September 2013.
- GERO, A., KURUPPU, N. & MUKHEIBIR, P., 2012. *Cross-Scale Barriers to Climate Change Adaptation in Local Government, Australia: Background Report. [prepared for NCCARF]*. Sydney: Institute for Sustainable Futures, University of Technology. Available from: <http://www.isf.uts.edu.au/publications/geroetal2012climatebarrierslocalgovbackgrd.pdf>, accessed September 2013.
- GURRAN, N., NORMAN, B., GILBERT, C. & HAMIN, E., 2011. *Planning for Climate Change Adaptation in Coastal Australia: State of Practice. Report No. 4 for the National Sea Change Taskforce, Faculty of Architecture, Design and Planning*. Sydney: University of Sydney. Available from: http://www.seachangetaskforce.org.au/Publications/Planning_for_climate_change_in_coastal_Australia_State_of_Practice.pdf, accessed September 2013.
- HANSEN, A., BI, P., NITSCHKE, M., PISANIELLO, D., NEWBURY, J. & KITSON, A., 2011. Older persons and heat-susceptibility: the role of health promotion in a changing climate. *Health Promotion Journal of Australia* 22, 17–20.
- HARLAN, S.L. & RUDELL, D.M., 2011. Climate change and health in cities: impacts of heat and air pollution and potential co-benefits from mitigation and adaptation. *Current Opinion in Environmental Sustainability* 3: 126–134.
- HUNT, A. & WATKISS, P., 2010. Climate change impacts and adaptation in cities: a review of the literature. *Climatic Change* 104: 13–49.
- Intergovernmental Panel on Climate Change (IPCC), 2007. *Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva: Intergovernmental Panel on Climate Change.
- ICLEI Oceania, 2008. *Local Government Action on Climate Change: CCP Australia Measures Evaluation Report 2008*. Melbourne: International Council for Local Environmental Initiatives. Available from: http://archive.iclei.org/index.php?id=1505&no_cache=1&tx_ttnews%5Btt_news%5D=3563&tx_ttnews%5BbackPid%5D=9427&cHash=f935b27ccd, accessed September 2013.
- JONES, R.N. & PRESTON, B.L., 2011. Adaptation and risk management. *Wiley Interdisciplinary Reviews: Climate Change* 2: 296–308.
- KENNEDY, D., STOCKER, L. & BURKE, G., 2010. Australian local government action on climate change adaptation: some critical reflections to assist decision-making. *Local Environment* 15: 805–816.
- KOVATS, R.S. & EBI, K.L., 2006. Heatwaves and public health in Europe. *European Journal Of Public Health* 16: 592–599.
- McMICHAEL, A.J., WILKINSON, P., KOVATS, R. S., PATTENDEN, S., HAJAT, S., ARMSTRONG, B., VAJANAPOOM N., NICIU E.M., MAHOMED H., KINGKEOW C., KOSNIK M., O'NEILL M.S., ROMIEU I., RAMIREZ-AGUILAR M., BARRETO M.L., GOUVEIA N., NIKIFOROV, B., 2008. International study of temperature, heat and urban mortality: the 'ISO-THURM' project. *International Journal of Epidemiology* 37: 1121–31.
- MEASHAM, T.G., PRESTON, B.L., SMITH, T.F., BROOKE, C., GORDDARD, R., WITCOMBE, G. & MORRISON, C., 2011. Adapting to climate change through local municipal planning: barriers and challenges. *Mitigation and Adaptation Strategies for Global Change* 16: 1–21.

- MUKHEIBIR, P. & ZIERVOGEL, G., 2007. Developing a Municipal Adaptation Plan (MAP) for climate change: the city of Cape Town. *Environment and Urbanization* 19: 143–158.
- MUNICIPAL ASSOCIATION OF VICTORIA, 2011. *Supporting Victorian Local Governments Manage Climate Risks and Plan for Change*. Melbourne: Municipal Association of Victoria.
- OKE, T.R. (1982). The energetic basis of the urban heat island. *Quarterly Journal of the Royal Meteorological Society* 108: 1–24.
- PILLORA, S., 2010. *Australian Local Government and Climate Change. Working Paper*. Sydney: Australian Centre of Excellence for Local Government, University of Technology Sydney.
- STANDARDS AUSTRALIA, 2009. *Australian Standard AS/NZS ISO 31000:2009. Risk Management—Principles and Guidelines*. Sydney: Standards Australia.
- VICTORIAN CENTRE FOR CLIMATE CHANGE ADAPTATION RESEARCH, 2012. Framing multi-level and multi-actor adaptation responses in the Victorian context. Available from: <http://www.vcccar.org.au/framing-multi-level-and-multi-actor-adaptation-responses-in-victorian-context>, accessed September 2013.
- WEBB, R. & BEH, J., 2013. *Leading Adaptation Practices and Support Strategies for Australia: An International and Australian Review of Products and Tools*. Available from: http://www.nccarf.edu.au/sites/default/files/attached_files_publications/S3BWT1-Leading-adaptation-practices_0.pdf, accessed September 2013.
- WILBY, R.L., 2008. Constructing climate change scenarios of urban heat island intensity and air quality. *Environment and Planning B: Planning and Design* 35: 902–919.