



Environmental Sustainability Committee

January 28, 2019

10:30am

Council Chambers, Town Hall

359 Main Street

Agenda

1. Approval of the Agenda

2. Approval of Minutes

- a. Environmental Sustainability Committee Meeting, October 15, 2018.

3. Updates

a. Climate and Energy Initiative Update

- Staff Presentation
- Discussion
- Energy Planning Guide link:

http://www.downloads.ene.gov.on.ca/envision/env_reg/er/documents/2018/013-2083.pdf

b. Provincial Ban of Single Use Plastic Bags

c. Car Charging Station

d. Solar for Community Building (PW building)

e. MPS status

4. Round Table Discussion

5. Next Meeting: March 2019

6. Adjournment



SUMMARY

Climate & Energy Planning Staff

Planning and Development has been working over the current fiscal year at obtaining grant funding to enable the Town to consider augmenting its focus on environmental initiatives/projects. This work was carried out in accordance with the Town's Operations Plan, and its timing coincides with Council's recent reaffirmation of the need to be a more active participant in climate change action.

Through Staff's efforts funding sources have been secured towards a term staff position and a series of community-focused climate and energy projects collectively referred to as "Wolfville Inspire". The proposed initiatives will require the Town to commit to expenditures over the next two budget years, which will be built into the upcoming draft 2019/20 budget document. In order to meet the timelines of the FCM grant program and have the term staff person on board before April 1st, staff require Council's approval to proceed with the terms of the grant agreement.

This staff person and project contribute to the Town of Wolfville's further participation in the Partners for Climate Protection (PCP) program. Anticipated deliverables from this work include an updated inventory of GHG emissions (Milestone 1 of PCP program, see graphic right), greenhouse gas reduction targets (Milestone 2), a local action plan (Milestone 3) as well as the implementing and monitoring actions taken (Milestone 4 & 5).

Five-Milestone Framework



1. Establish a baseline GHG inventory and forecast



2. Set GHG reduction targets



3. Develop a local action plan



4. Implement the plan or set of activities



5. Monitor progress and report results

Draft Motions

- 1) *That Council approve the addition of a two year term Energy Coordinator staff position, at a maximum 2 year total of \$130,000 covering salary and benefits (\$65,000 annually), to be funded by way of FCM grant funding in the amount of \$92,800 and Town funding of \$37,200 over two years.*
- 2) *That Council approve spending to support "Wolfville Inspire" in the amount of \$60,000, to be funded by way of external grant funding secured by the Planning Department.*



1) CAO COMMENTS

The CAO supports the recommendations of staff. The proposed staff person and “Wolfville Inspire” initiative both serve to help deliver on Council’s Strategic Priorities.

2) LEGISLATIVE AUTHORITY

The Municipal Government Act Section 47 enables Council to make decisions in the exercise of its powers on behalf of the Municipality, which includes directing staff.

3) STAFF RECOMMENDATION

Refer to the draft motion.

4) REFERENCES AND ATTACHMENTS

1. Community Energy Investment Plan: The Way Forward, Town of Bridgewater ([link](#))
2. Economic Development Through Transformative Community Energy Planning: A Toolkit for Municipalities everywhere, Town of Bridgewater ([link](#))
3. Partners For Climate Protection, Federation of Canadian Municipalities ([link](#))

5) DISCUSSION

Planning and Development has been working over the current fiscal year at obtaining grant funding to enable the Town to consider augmenting it’s focus on environmental initiatives/projects. This work was carried out in accordance with the Town’s Operations Plan, and its timing coincides with Council’s recent reaffirmation of the need to be a more active participant in acting on climate change.

Through Staff’s efforts funding sources have been secured towards a term staff position (focused on climate mitigation) and a series of community-focused climate and energy projects collectively referred to as “Wolfville Inspire”. The proposed initiatives will require the Town to commit to expenditures over the next two budget years, which will be built into the upcoming draft 2019/20 budget document.

Climate Change – Change in the state of the climate that can be identified by changes in the mean or variability of its properties and that persists for an extended period – typically decades or longer.

Adaptation – The process of adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities

Mitigation – Efforts to stop, reduce or prevent the emission of greenhouse gases. Mitigation can mean using new technologies and renewable energies, making older equipment more energy efficient, or changing management practices or consumer behavior.

A more detailed workplan will be developed in the lead up to hiring the Climate Change and Energy Coordinator position, if approved.

Background

The 2018-2022 Operational Plan included initiating community energy planning. It states:

“Community Energy Planning

We will work toward the creation of a Community Energy Plan for the Town of Wolfville. The intention of the Community Energy Plan is to help define community priorities around energy with a goal of improving efficiency, cutting emissions, enhancing community resilience, managing future risks and driving economic development. This plan will complement the work being done on the Municipal Planning Strategy. This will be a multi-year initiative.”

As part of that process, Director Lake and Planner Banks seek opportunities for learning, peer-support, and financial opportunities to support a Community Energy Planning Process in collaboration with the Environmental Sustainability Committee.

That work has led to collaborating with Samantha Peverill from Quality Urban Energy Systems of Tomorrow (QUEST) towards resuming the Town of Wolfville’s work with the Federation of Canadian Municipalities (FCM) Partners for Climate Protection (PCP) program.

As part of the approach to the PCP program, the Town of Wolfville has applied for and obtained funding for an energy staff person, for 24 months, to move forward with the PCP program with activities that include:

- Updated Inventory of Greenhouse Gas emissions within the Town of Wolfville (Milestone 1 of PCP)
- Greenhouse Gas Reduction Target Setting (Milestone 2 of PCP)
 - Engaging the public on energy education and goal setting
- Develop a Local Action Plan (Milestone 3 of PCP)
 - Work with staff, community members and stakeholders to foster a feasible and collaborative approach
 - Research best practices and propose institutional changes
 - Develop and refine an economic plan for energy solutions and poverty reduction in the short and long-term, for the Town of Wolfville and residents (See Section 4 References, item 2: *Economic Development Through Transformative Community Energy Planning*)

To support work for climate and energy planning, we have aligned partners such as:

- Town of Wolfville – Environmental Sustainability Committee
 - Already assisting with grant applications
 - Steering committee & working groups as needed
- Acadia University
 - Partnering on electric vehicle charging station (Acadia Office of Sustainability)

REQUEST FOR DECISION #084-2017

Climate & Energy Planning Staffing

Date: 2019-01-08

Department: Planning & Development



- Developing a jurisdictional survey of energy planning approaches (Community Development Dept)
- Solar Nova Scotia and NS Community Building's Pilot Project
 - To develop community interest, and promote, opportunities to develop solar energy for individuals and collaboratively
 - Installing a solar array on the Community Development building to increase capacity and show leadership
- Town of Windsor (and/or other municipalities)
 - Incorporate a regional approach and collaboration (subject to service agreement)
- Town of Bridgewater
 - Presenter at Environmental Sustainability Committee
 - Learning partner and leader in climate & energy planning as:
 - economic generator
 - poverty reduction
- Clean Foundation – Transition 2050
 - Capacity building, leadership and collaboration on climate issues, which includes:
 - Developing a GHG inventory, identifying how to help residents retrofit their homes, developing approaches to reduce GHG emissions of municipal buildings, reducing emissions of vehicle fleets, and identifying other best practices
 - Municipal partners: Cumberland County, Chester, Inverness County, Windsor, West Hants

The additional funding obtained for the community focused “*Wolfville Inspire*” over the 2019-2020 and 2020-2021 fiscal years, includes:

- Partial Implementation of Local Action Plan (Milestone 4 of PCP)
 - Development of a marketing and promotions strategy to increase individual engagement and action towards a more sustainable future
- Hiring summer staff to conduct door to door research and relationship building with residents of Wolfville and Windsor to contribute to PCP Milestones 1-4, and determine:
 - Household energy use (aka. Inventorying GHG emissions, Milestone 1 of PCP)
 - Interest in transitioning to sustainable energy (aka. Setting GHG reduction targets, Milestone 2 of PCP)
 - Research and feedback towards a Community Energy Plan (aka. Research towards Milestone 2 & 3 of PCP)
 - Awareness of existing opportunities (aka. Early plan implementation, Milestone 4 of PCP)
- Partial Implementation of Monitoring (Milestone 5 of PCP)
 - Processing of data collected towards Community Energy Planning
 - Conducting follow-up survey with residents to inform future plans, at end of year 2 of this project



6) FINANCIAL IMPLICATIONS

The impact on the Town's finances will span two fiscal years. In total the amounts involved are:

FCM Grant Process

Total 2 year salary maximum (\$58,000 per year)	\$116,000
FCM contribution @ 80%	<u>(92,800)</u>
Town Contribution FCM application	23,200
ADD:	
Employee benefit costs for two years @ 12%	<u>14,000</u>
TOTAL Town Contribution	<u>\$37,200</u>

In addition to the funding of the two year term staff position, funding of up to \$60,000 has been secured by staff. This funding will be fully supported based on actual project costs, i.e. net cost to Town if \$60,000 incurred will be nil. Anticipated long term outcomes for this work are reduced carbon emissions due to reduced fossil-fuel use, positive economic benefits through minimizing energy costs, and economic generation to hopefully make the position sustainable long-term.

7) REFERENCES TO COUNCIL STRATEGIC PLAN AND TOWN REPORTS

This project aligns with the Town of Wolfville's Municipal Planning Strategy (MPS) - also approved as the Town's Integrated Community Sustainability Plan (ICSP) – which identifies sustainability and environmental concerns as key concerns for the community in section 1.3, 2.1 and 2.2

These sections embed elements of sustainability, as informed by The Natural Step (TNS) Framework into decision making and land use policies that reduce energy needs and pollutions while seeking to increase renewable resource use and protect the environment.

The Town of Wolfville is currently reviewing its MPS and sustainability continues to be captured in the updated document, including stronger links between GHG emissions, energy and land use. Support for GHG emissions reduction is also contained in the Town's 2018-2022 Budget/Operations, Council's Strategic Plan, and is to be applied to the Town's Asset Management Plan.

REQUEST FOR DECISION #084-2017

Climate & Energy Planning Staffing

Date: 2019-01-08

Department: Planning & Development



In addition, the Town of Wolfville's Environmental Sustainability Committee identified the Partners for Climate Protection program as an ideal path to achieving many of the environmental and sustainability goals outlined above and recommended further participation in the PCP program to Council.

This staff person and project contribute to the Town of Wolfville's further participation in the Partners for Climate Protection (PCP) program. Anticipated deliverables from this work include an updated inventory of GHG emissions (Milestone 1 of PCP program, see graphic right), greenhouse gas reduction targets (Milestone 2), a local action plan (Milestone 3), and early steps of implementation and monitoring (Milestone 4 & 5)

Five-Milestone Framework



1. Establish a baseline GHG inventory and forecast



2. Set GHG reduction targets



3. Develop a local action plan



4. Implement the plan or set of activities



5. Monitor progress and report results

8) COMMUNICATION REQUIREMENTS

A press conference/funding announcement will be forthcoming. No external communication is required, yet this project will include various awareness, education, and publicity campaigns to support community energy planning and reduction of environmental impacts over the 2019-2020 and 2020-2021 fiscal years.

9) ALTERNATIVES

1. Not approve the additional spending and dismiss the confirmed grants
2. Approve the additional spending with alterations to the workplan described.



**Town of Wolfville
Position Description
June 2018**

Position Title:	Climate Change & Energy Coordinator		
Reports to:	Director of Planning & Development		
Subordinate Staff:	N/A		
Salary Range 2018/19:	\$51,433 - \$65,643	Band:	Level 3 – Coordinators and Professional Level 1
Classification:	2-year/24 month term (full-time)		

To be updated: work toward - systems model with transportation and land use projections (where we should be going – see Bridgewater model). More focus on actual actions

Position Summary / Major Purpose:

Reporting to Director of Planning & Development, the Climate Change & Energy Coordinator will focus on the planning and implementation of municipal climate change and energy priorities. The primary responsibility will be working on the development and implementation of the municipality's GHG emissions reductions plan and advancing the Town's position in the Partners for Climate Protection Program.

Additionally, the Climate Change & Energy Coordinator will contribute to the development and implementation of municipal operational and institutional changes that will lead to operational savings and the reduction of GHG emissions. This individual may also be responsible for broader capacity-building and knowledge-sharing activities and deliverables, as required.

Under the Town's shared service agreement with the Town of Windsor, the Climate Change & Energy Coordinator will also provide services pertaining to GHG emissions reduction, approximately 1-2 days/week, to the Town of Windsor.

Core Expectations of the Role:

1. Under the direction of the Director of Planning & Development, and in conjunction with other municipal departments or external consultants, lead the development of the GHG emissions reductions plan for the Town of Wolfville and contribute to moving forward efforts in the Town of Windsor. This will include the following tasks:
 - a. Prepare for the planning process, including educating municipal employees, committees, and council on climate change issues.

- b. Create a vision and work plan for the planning process using a plan development-plan implementation framework to ensure (some) action can be taken during planning phase (low hanging fruit).
 - i. This should include a communications and branding exercise and formally engaging with the working group through the Sustainability Committee.
 - c. Assess the current situation through an update to the existing GHG inventories (community and corporate) in partnership with Acadia University and other Stakeholders.
 - d. Work with the Community and Council on setting targets (short, medium, and long-term) for GHG emissions reductions, pursuant to the inventory work.
 - e. Develop an Action Plan that includes GHG emissions reductions scenarios and co-benefits associated with each. This should also include how we will measure and monitor success/challenges. The Action Plan will require approval by Council.
 - f. Work on Plan Implementation - identify policies, actions, etc to implement the preferred GHG emissions reduction scenario – corporate and/or community. Integrate actions with other plans (MPS, Asset Management). Focus should be on value-added actions (e.g. \$ savings) that can ensure the continuation of the position beyond the 24-month period.
 - g. Measure and Monitor any actions that have been implemented within the 24-month contract. Ensure Measurement and Monitoring framework in place for use in the longer term.
- 2. Develop and promote the adoption of municipal operational and institutional changes that will ensure GHG emissions reductions over the longer term for the Town.
 - a. Research, propose, and implement operational and institutional changes required to implement recommendations from the GHG emissions reduction plan and ensure long-term impacts for the Town (e.g. ensuring the success of the Sustainability Committee’s working group, building momentum around the issue, effective communications, community engagement).
- 3. Conduct research and analysis for the purpose of developing and implementing municipal GHG emissions reductions initiatives, as per Core Expectation #1 and other GHG emissions reductions initiatives, as needed (e.g. leading public education program, preparing GHG inventories, organizing stakeholder consultations, coordinating policy research, helping to manage consultants, etc)
- 4. In conjunction with other municipal departments, ensure that the municipality:
 - a. Completes a self-assessment of the municipality’s performance and progress using the [*Maturity Scale for Municipal GHG Emissions Reductions*](#) at the beginning and end of the grant period.
 - b. Prepares and submits a project progress report (after 12 months) and a project completion report (after 24 months).
 - c. Requests disbursements from FCM at periodic intervals (after contract signature, 12 months, and 24 months).

5. Work with the Town of Windsor on developing and implementing the Core Expectations outlined in #1-4 for the Town of Windsor, appropriate for execution working there approximately 1 day/week. The role in Windsor will be formalized through an addendum to the existing Shared Services Agreement between the two Towns.

Skills/Knowledge/Capabilities

- Strong knowledge and experience in the areas of GHG emissions reductions, energy planning, climate change, sustainable development.
- Demonstrated understanding of climate change issues and sustainable development within the context of municipal government.
- Strong research and analytical skills (e.g. ability to conduct rigorous research, summarize findings, and present recommendations).
- Ability to conceptualize.
- Excellent writing and communications skills (e.g. ability to write succinct reports and prepare communications materials).
- Experience with GHG software and conducting GHG inventories for an organization.
- Good knowledge of general computer tools (Office, etc).
- Strong ability to multi-task, with attention to detail.
- Understanding of the program development process and how to implement new initiatives, including planning, costing, team building, implementation strategies, and building in feedback and evaluation techniques.
- Ability to handle confidential information
- Ability to deal effectively and courteously with Council, staff, outside agencies and the general public.
- Strategic thinking.
- Self-motivated.
- Attention to detail.
- Process-driven.

Decision Making

This position provides operational decision making advice to the Director of Planning & Development and also presents on issues, that will inform decision making, directly to Committees and Council.

Education and Training:

- University degree in engineering, environmental science, environmental studies, geography, urban planning or equivalent.
- Other relevant training considered an asset.

Related Experience:

- 1-2 years experience in a similar role considered an asset.

Approved by:

CAO

Date

Governance and climate change adaptation

State of the literature

July 31, 2018

Contents

Synopsis	Error! Bookmark not defined.
1. Objectives	2
2. Method	3
3. Results	3
Bibliography	16

Submitted in support of developing a Climate Resilience Framework for the City of Toronto.

Synopsis

Climate change is a symptom of a medley of other problems, ranging from the combustion of fossil fuels, to poverty and inequality, and from cultural norms to the structure of the economic system. This complexity, combined with disparate and often conflicting worldviews and perspectives, means that it is a challenge to arrive at a societal consensus on the definition of the challenge that climate change represents. Devising a governance regime and adaptation strategy to confront an existential threat to human existence in this context is therefore a thorny endeavour, complicated by factors which emerge in contested spaces, including shifting priorities, limited ambition and disputes on appropriate strategies.

The first insight from the literature review is that the dominant discourse within municipalities on climate change adaptation generally occurs within the paradigm of an incremental approach. Small, or sometimes large changes are made to existing practices, exemplified by the question of how much higher the dyke should be to account for additional flooding. The rate and scope of climate change is, however, not incremental and the required adaptive response associated with 3 or 4 degrees of warming globally needs to be profound, ambitious and rapid. Strategies or activities that reflect this urgency will need to address core assumptions of culture, behaviour, economic and governance; the climate change adaptation discussion needs to evolve from an emphasis on pipes to processes that can support those discussions.

The second insight is that multiple different perspectives are required in order to gain a robust understanding of the challenge and options of climate change adaptation, engaging diversity to understand complexity. In order to effectively elicit that understanding, a sophisticated governance structure and process is required to arrive at a common understanding of climate change and adaptive strategies. Dialogue between multiple perspectives, including indigenous peoples, can help instigate what is described as third-order learning, learning that questions foundational assumptions about society. This

questioning is critical to identifying solutions which are commensurate with the scope of the challenge.

Such a process is time-intensive and complex, meriting the same degree of consideration as the technical analysis underpinning adaptive strategies in a major infrastructure project. This process can be guided by the literature on collaborative governance, network governance and multi-actor governance.

The third insight is that the governance structures and adaptation strategies have to be nimble, in order to adjust to constantly changing circumstances, and to support risk-taking. These characteristics are antithetical to most government institutions which are premised on systematic planning, risk avoidance and predictable and controlled outcomes. Adaptive and resilience management are fields which have been applied primarily in the context of ecosystem management to date but can provide techniques and strategies on managing in the midst of uncertainty and complexity.

The ultimate objective is many small wins, characterized as continuous change. Small wins are unlike quick wins, in which people make fast and easy steps to solve simple issues. Small wins focus on deep changes in the way in which people understand climate change and the way in which they are adapting to climate change. Small wins have a small scope and occur quickly but not so quickly that they fundamentally undermine institutions or people, in the way that the more abrupt and larger scale transformational change likely does. Over time, the culmination of the small wins can more speedily sum up to a drastic alteration in status quo than can a dramatic policy change, which may inspire a rebound effect.

In order to support the objective of small wins, the organization needs to continuously stimulate people by encouraging experiments. For people to feel empowered and comfortable in advancing experiments, there needs to be a context and direction that is broad enough but is not paralyzing in its breadth, a delicate balance. Ongoing and frequent evaluation and revision provides real time course corrections as uncertainties are resolved or insights are collected. And finally, honest conversation cultivates trust, reliability and self-respect, which enables people to take risk and adjust to changing circumstances.

1. Objectives

The purpose of this paper is to provide a review of the current state of the literature on governance approaches and theory with respect to climate change adaptation, particularly in the context of municipalities. The literature review parallels a similar effort to investigate the state of practice by municipalities with respect to governance strategies. The objective of both papers is to provide insight on governance options to support the City of Toronto's efforts to implement adaptation strategies and to mainstream adaptation into operations and decision-making across the City.

2. Method

The literature review was undertaken by searching google scholar for related terms including climate change adaptation; governance; cities; mainstreaming; public sector; transformation; adaptive management/governance; wicked problems; organisational change; organisational structure; implementation; local government; integrated policy. The initial focus of the literature search was articles published in the past two years, and this was supported by a review of pivotal papers or books in relevant fields. Grey literature was also considered; similar terms were searched in a google search which selected for PDFs. All documents, including papers and books, were compiled in a web-based research management system called Zotero, and each document or paper was tagged or cross-referenced.

3. Results

A total of 154 papers were reviewed, with more than 80% of these being academic literature. This complete collection is available in a Zotero library.

Characterising the challenge: wickedness

Adapting to climate change joins a cadre of other societal challenges such as alleviating poverty and reducing inequality that are described as wicked problems (Termeer, Dewulf, & Breeman, 2013). This term does not refer to the characteristic of evil but rather distinguishes a class of problems which are intractable versus those which may be extremely complex but are ultimately tameable through engineering, science or other rational methods (Rittel and Webber 1973). Four specific characteristics of wicked problems are described, which provide insights into the governance and implementation systems required to successfully and proactively address the impacts of climate change.

1. **The definition of the problem is the problem.** The scope and implications of climate change cannot be precisely defined, and the breadth of the problem is far reaching. Different perspectives or worldviews have different takes, which cannot be easily reconciled. As a result, the formulation of the problem itself is the problem and different perspectives provide insights on different aspects (Australian Public Service Commission, 2018); for example, the water engineer, the climatologist; the farmer, and the social worker. The implication for governance is that dedicated and thoughtful processes are required to coalesce different perspectives around the problem.
2. **A problem of problems.** Climate change is a symptom of, and intertwined with, a cocktail of other problems that occur at different scales and different times and are continuously evolving. Climate change adaptation cannot be addressed in a standalone domain but must be integrated into the problem domain of associated problems, and these domains need to communicate on a frequent basis.
3. **Complexity begets uncertainty.** Efforts to adapt to the impacts of climate change often give rise to unanticipated outcomes and additional problems. In this context, success is difficult to define and difficult to measure. Because the problem is constantly shifting and evolving, governance strategies need to avoid becoming static and to be highly responsive.
4. **Urgency confronts uncertainty.** There is an urgency related to adaptation strategies, particularly in the context of major societal investments for which subsequent adaptation will be costlier, while anticipating the character of climate change impacts is inherently uncertain. This uncertainty challenges the urgency, particularly combined with pressure to give priority to economic interests in the short term. The characteristics of uncertainty and urgency are overlaid on political, physical and economic processes, which are in themselves difficult to align.
5. **VOIDS and crowdedness:** Because climate change adaptation is not a defined field or discipline, there are no shared rules, principles, values or norms (Robbert, Judith, Catrien, & Pavel, 2011). At the same time there is also institutional crowdedness with many organisations claiming a share of the climate change adaptation space, without a clear allocation of responsibility.

Focusing on processes, not pipes

Current discussions related to climate change adaptation are focused on incorporating consideration for the impacts of climate change into plans for infrastructure, essentially tweaking existing strategies to accommodate a new reality (Wise et al., 2014). This approach is characterized as incremental and such an approach does not keep pace with the rate and magnitude of climate change, which will overwhelm current practices, adapted or not. For this reason, many authors have focused on the notion of transformational change, with some indicating that in the context of 4 degrees of warming, no adaptation strategies, incremental or transformational, will be adequate (Smith et al. 2011).

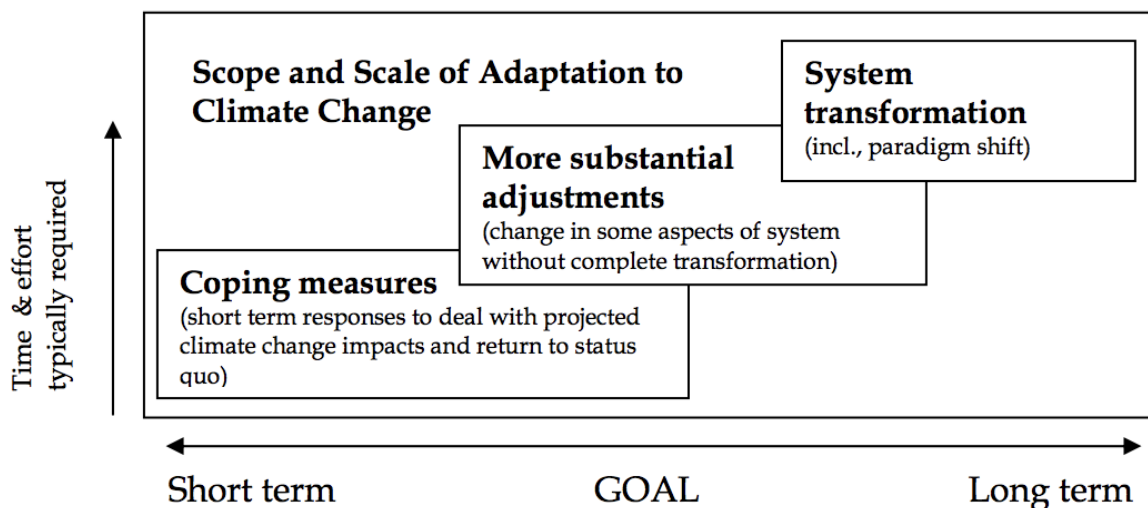


Figure 1: Illustration of different levels of ambition with respect to the response to climate change (Moser & Ekstrom, 2010).

The IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (2012, 436) defines transformation as:

“a fundamental qualitative change... that often involves a change in paradigm and may include shifts in perception and meaning, changes in underlying norms and values, reconfiguration of social networks and patterns of interaction, changes in power structures, and the introduction of new institutional arrangements and regulatory frameworks.”

There are many questions that arise with respect to the process of transformation, relating to enabling governance structures, the role of agency, power and politics; whether incremental change can lead to transformation; and whether transformational change is even possible.

Transformational change is focussed explicitly on governance processes that encourage learning, questioning of paradigms, leadership and co-production (Termeer et al. 2017), and not on the technical efforts such as the height of the sea wall or the size of pipes.

From incremental to transformational change

Transformational change is characterised by three dimensions: depth, scope and speed.

Table 1: Summary of the assumptions of the incremental–transformational change dichotomy on the three dimensions of change (Termeer et al. 2017).

Dimension	Incremental	Transformational
Depth of change	First-order change Improve existing practices in the same direction	Second-/third-order change Alter paradigms, values, and worldviews
Scope of change	Small scale, micro, parts of the system	Large scale, macro, system-wide
Speed of change	Slow, step by step, short term	Quick, big jumps, long term

Depth refers to the level of change. Superficial change implies changes in current practice without altering assumptions, whereas deep or in-depth change involves altering values and frames that underpin the system.

Various authors also refer to the depth of change in terms of orders or levels of learning. Incremental change is also defined as first order change (Bartunek & Moch, 1987), and single loop learning, when the current practice is improved; hazard and vulnerability assessments could generally be considered first order change. Second-order change, or double loop learning questions the assumptions underlying the system and seeks to reframe problems from a different perspective. Third-order change, or triple loop learning, refers to changing the way we change, root change or radical change, for example shifting

an analysis of a challenge from a western, reason-based worldview to an indigenous worldview.

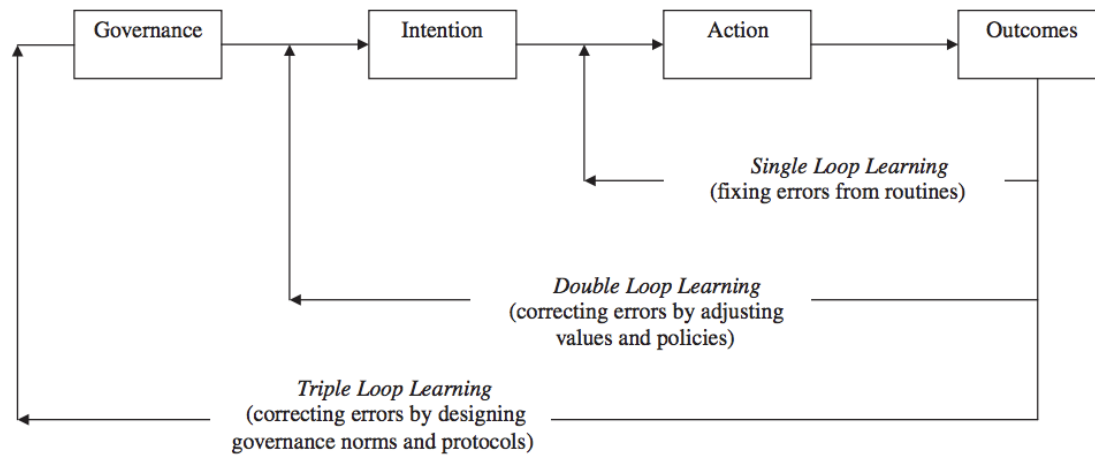


Figure 2: Orders of change (Armitage, Marschke, & Plummer, 2008)

From the perspective of climate change adaptation, transformational change occurs in the domains of second and third order change, in which actors reflect on critical assumptions, challenge norms and fundamentally revise their practice.

Scope refers to the scale of that which will be changed. Transformational change operates on the scale of entire domains or organisations whereas incremental change has a narrow or limited scope. Climate change implies a broad scope that touches every dimension of an organisation and therefore necessitates an equally broad scope.

The final dimension is the speed of change with the obvious implication that transformation change occurs more rapidly than incremental change, with the possibility of phase changes, in which a system shifts from one set of conditions to another in a short period. Climate change impacts have a long horizon, but because they are irreversible, adaptation needs to occur rapidly.

Or continuous change

Despite the emphasis on transformation change in the literature, Termeer (2017) argues that change that incorporates all three dimensions (deep, large scale and fast) is impossible or, if not impossible, destructive, citing the example that any organisation which argues it is

undertaking a cultural shift in the next few months is naïve. Deep change, which requires people to question “existing cultures, dominant rationalities and habitual practices” cannot be imposed across an organization in short order. It is possible to achieve “two of the three goals, but only at the expense of the third. This means that quick, in-depth change is only possible at the small scale; that large-scale, quick changes can only be superficial; and that in-depth, large-scale changes will take a very long time to materialise, if at all” (p. 564).

A third option that moves beyond the dichotomy of transformational versus incremental change is continuous change, consisting of in-depth change with a small scope at a high speed. In this paradigm, an organization is continuously adapting, learning, and improvising, without periods of stability or punctuated change. Factors which enable continuous change are as follows (Beer & Nitin, 2011):

1. **Staying in motion** means that the intervention stimulates people and gets them moving and generating experiments that uncover new opportunities.
2. **Having a direction** is important because both too much and too little focus can paralyse people.
3. **Looking closely and updating often** refers to the importance of encouraging a process of updating by improving situational awareness and closer attention to what is really happening.
4. **Conversing candidly**, stresses the inherently social character of change; only in cases in which trust, reliability, and self-respect can develop, people are able to continuously adjust to changing circumstances.

The long-term pathway evolves

At a high level, an organisational adaptation pathway can be conceptualised as a series of decisions, which are influenced by the historical, political and biophysical context (Wise et al., 2014). These decisions lead to subsequent decisions on a pathway that evolves over time. Good decisions stay within the adaptive pathway, while unfortunate decisions fall in the maladaptive sphere, imposing costs and resulting in the necessity of transformation. An implication of this conceptual framework is that highly detailed, long-term planning is unlikely to be helpful, as the utility of future is highly uncertain.

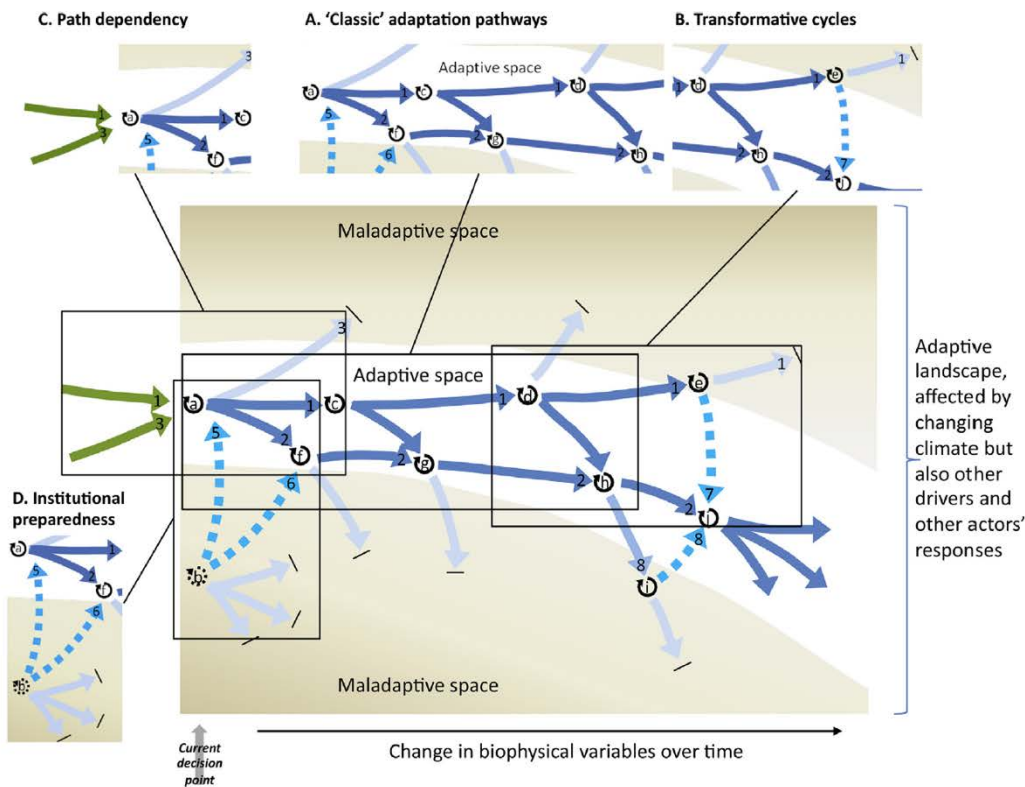


Figure 3: Adaptive decision-making in an organisation

Figure 3 illustrates a representation of the adaptive pathway for an organisation over time. The initial decision-point is influenced by historical pathways (green arrows), known as path dependency. The adaptive pathway is shifting due to changing climatic impacts and also due to changes in the social and institutional context; the maladaptive region results dead ends (grey arrows). Dashed blue arrows represent transformative change as decision-makers avoid costly maladaptive pathways.

The imperative for collaboration

The dispersion of power amongst stakeholders can be organised into three categories (Roberts, 2000). Authoritative strategies assign a problem to a group or an individual and others agree to abide by the resulting decisions. The source of this power can be derived from knowledge and expertise, coercion, organisational structure or other reasons. Authoritative strategies are efficient and timely but disregard a diversity of perspectives. Competitive strategies involve various entities seeking to demonstrate their superiority against any of a range of characteristics with an outcome that involves winners and losers. Competitive strategies can stimulate innovation and diversity of options but can consume

resources in duplicated activities. Collaborative strategies, deemed the most effective in the context of wicked problems, involve multiple perspectives focused on delivering win-win outcomes. The outcome is greater stakeholder support, but the process is typically front-loaded, intricate and resource-intensive.

The complexity of climate change and the requirement for in-depth change indicates that of these three strategies, the collaborative approach is the one most suited to climate change adaptation but is often least utilised. Governments, for example, are typically aligned with authoritative and hierarchical forms of organisation and control (Head & Alford, 2015), which are characterised at the extreme by silos, in which organisations and mandates are compartmentalised and stovepipes, in which information tends to flow vertically through an organisation. The scope of the challenge of and response to climate change is beyond the cognitive capacity of any one individual.

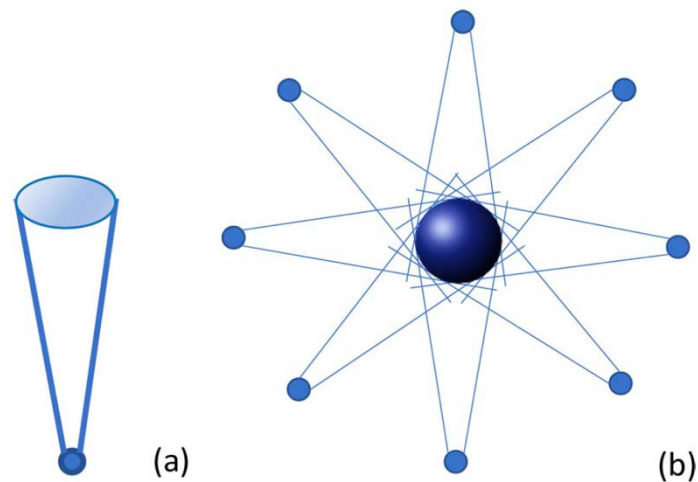


Figure 4: Individual versus combined perspectives (Head & Alford, 2015)

There are various challenges to collaborative approaches and limited successful governmental implementation (Chu, Schenk, & Patterson, 2018). Individuals or organisations with knowledge may not be willing to share, the integration of disparate forms of information or knowledge may appear overwhelming, worldviews or knowledge may conflict to the extent of limiting discussions or there may simply be inadequate time for a thorough process.

The discourse around climate change adaptation is typically framed around technology, infrastructure or funding problems but deeper analysis indicates that the problem is one associated with inequitable resource distribution, sociopolitical and governance challenges. In Canada, indigenous knowledge, with its emphasis on stories and relationships with all beings can provide unique insights (Arsenault, Diver, McGregor, Witham, & Bourassa, 2018).

In one case study, the authors illustrate how bringing together diverse social, institutional and scientific agents creates a broader understanding of heatwaves in Madrid in order to identify adaptation options (Head & Alford, 2015). In this case, fuzzy cognitive mapping, a participatory, semi-quantitative method, was used to develop an aggregated model to analyse different scenarios. Another example illustrates how a novel approach to flood management in Rotterdam emerged out of a collaborative process (Duijn & van Buuren, 2017).

Governance methods

A wide range of strategies and frameworks have been described in the literature (Table 2) that support governance in the context of wicked problems in general or climate change adaptation specifically. While each approach has its nuances, the various approaches emphasise firstly shifting from an authoritative or hierarchical strategy to an approach that incorporates multiple stakeholders with varying degrees of formality; *“A negotiated exchange between institutions on multiple levels, including the local, regional and national organization of the state and other actors”* (Keskitalo, Juhola, Baron, Fyhn, & Klein, 2016, p. 2). The second aspect is shifting from a structured planning process to a flexible dynamic process characterised by ongoing learning.

Table 2: Governance approaches to various climate change adaptation challenges

Challenge	Approach	Description	Key reference
Participants frame the issue in different ways.	Collaborative governance	A governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets.	Plotnikof, 2015

	Network governance	Engages networks of actors in order to collaboratively arrive at better policies. Focuses on managing the process of interaction between the actors to implement the policies, known as process management, and changing the composition of actors, their roles or reframing the issues, known as network constitution.	Klijn and Koppenjan 2000
	Multi-actor collaboration	Enables parties who see different aspects of a problem to constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible.	Gray 1989; Huxham 2000
Changing and unpredictable circumstances	Resilience management	Places the manager inside of the system being managed and presumes that probabilistic models are unable to predict systemic outcomes, focusing instead on maintaining the capacity of the system to cope with whatever the future brings.	Walker et al. 2002;
	Adaptive management	Accounts for the inherent complexity and unpredictability of system dynamics including devising measures or strategies that are robust (remaining functional under a range of different scenarios) or flexible; learning plays a central role	Folke et al. 2005; Pahl-Wostl 2007; Arnold, Gosnell, Benson, & Craig 2017
	Sense-making	Helps people are dealing with an unknowable and unpredictable world.	Weick and Sutcliffe 2001
	Causal maps	Displays the—intended and unintended—interlocking interactions and how mutual actions reinforce each other.	Weick and Westley 1996

As an example of the approaches described in Table 2, Figure 5 illustrates a conceptual map of an adaptive management framework. ICT refers to information and communication technologies, which play a crucial role is helping the participants relate to the content, through modelling and simulations. Social involvement refers to the participation of stakeholders who are tasked with framing the challenge and defining the boundary according to collectively agreed-upon ground rules. Their activities occur within

the broader context of a governance structure, which evolves continuously according to the outcomes of the process on the environment (technical qualities) and on society (relational qualities).

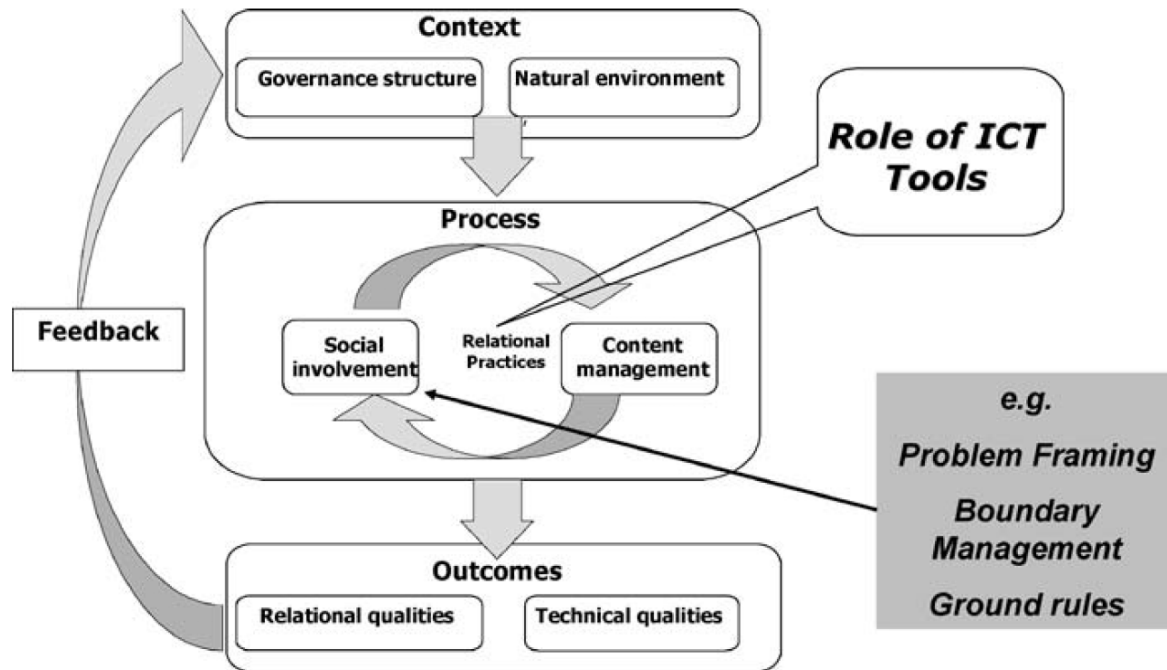


Figure 5: Adaptive management framework

Techniques for implementation

Based on a review of the organisational change literature, Termeer (2017) describes four sequential and parallel components that are key to supporting continuous change within an organisation. Storytelling (sense-making) is used to identify existing patterns of change and to amplify these as stories using multiple communications channels or techniques to inform and inspire. Organising connections (coupling) brings together experiments or innovations that occur in different contexts, regional, local, provincial or in different policy fields to stimulate social learning within the organization. Integrating seeks to build on the momentum of storytelling and to translate the social learning into adaptive practices. In cases in which the organization is hostage to vested interests or is too rigid to embrace new initiatives, a method called changing the context is applied by establishing radical new parameters or organizational policies or transposing staff into other organizations or new contexts in order to unfreeze or loosen up the system.

Aligned with Termeer's (2017) components described above, Beer & Nitin (2011) describes four design attributes of organisations that are critical to ongoing change. These include staying in motion, as interventions are used to stimulate people, generating experiments that uncover new opportunities. Having a direction provides a context for innovation so that people are neither constrained nor paralysed by a lack of focus. Looking closely and updating often refers to the need to evaluate continuously so that organization learning is fully integrated within all operations. In the field of adaptive management, this is described as "learning to manage by managing to learn" (Pahl-Wostl, 2006, p. 52). Finally conversing candidly stresses the inherently social character of change and the importance of trust, reliability, and self-respect so that people are able to continuously adjust to changing circumstances.

Structurally, organizations need to be able to assemble and reassemble project teams to address and confront emerging challenges or issues, while respecting dialogue and diverse perspectives.

Leadership

"The style is not so much of a traveller who knows the route, but more of an explorer who has a sense of direction but no clear route. Search and exploration, watching out for possibilities and inter-relationships, however unlikely they may seem, are part of the approach. There are ideas as to the way ahead, but some may prove abortive. What is required is a readiness to see and accept this, rather than to proceed regardless on a path which is found to be leading nowhere or in the wrong direction."

(Clarke & Stewart, 1997, p.15)

Leadership in the context of collaborative and adaptive governance varies substantively in comparison with leadership found in hierarchical or authoritative organisations; the orientation is bottom-up as opposed to top-down. The leader acts as a guide in helping the stakeholders undertake the collecting and defining of the problem, and the activities or strategies going forward, so that those who are led are actually leading (Australian Public Service Commission, 2018). This facilitative role requires a unique set of skills and the emphasis or mandate is on the process as opposed to the outcome (Klijn & Koppenjan, 2016). Further, in order to bridge the divide between entities within and beyond the

organisations, specific skills and expertise are required for working across organizational boundaries (Plotnikof, 2015).

A leader will be able to design a forum that can act as a holding environment for the stresses that emerge with the sharing of different perspectives and to be able to steer a course that doesn't necessarily provoke people and avoids diversions while examining uncomfortable and challenging issues in a safe and constructive space.

A novel strategy that can be effective in a variety of organisations, including those which are particularly ossified, is the introduction of the policy entrepreneur. Policy entrepreneurs are “advocates for proposals or for the prominence of ideas” who are willing to take risks and to invest time, energy, reputation, and sometimes money” (Brouwer & Huite ma, 2018).

Conclusion

There is a gap between the focus of the literature on climate change adaptation and governance and the current state of practice in municipalities. The literature describes an imperative for transformational change, applied according to various strategies, while municipalities are focussed on incremental adjustments to the status quo, primarily in the engineering and infrastructure realms.

At its essence, climate change adaptation is a governance and organisational challenge in the context of extreme complexity and contested definitions. In order to engage this challenge, substantive processes are required that involve a diverse set of perspectives and that are nimble enough to evolve in rapidly evolving context.

Bibliography

Armitage, D., Marschke, M., & Plummer, R. (2008). *Adaptive co-management and the paradox of learning*. *Global Environmental Change*, 18(1), 86–98.

<https://doi.org/10.1016/j.gloenvcha.2007.07.002>

Arnold, C., Gosnell, H., Benson, M., & Craig, R. (2017). Cross-interdisciplinary insights into adaptive governance and resilience. *Ecology and Society*, 22(4). <https://doi.org/10.5751/ES-09734-220414>

Arsenault, R., Diver, S., McGregor, D., Witham, A., & Bourassa, C. (2018). Shifting the framework of Canadian water governance through indigenous research methods: Acknowledging the past with an eye on the future. *Water*, 10(1), 49.

<https://doi.org/10.3390/w10010049>

Australian Public Service Commission. (2018). *Tackling wicked problems: A public policy perspective*. Retrieved from <https://www.apsc.gov.au/tackling-wicked-problems-public-policy-perspective>.

Bartunek, J. M., & Moch, M. K. (1987). First-order, second-order, and third-order change and organization development interventions: A cognitive approach. *The Journal of Applied Behavioral Science*, 23(4), 483–500. <https://doi.org/10.1177/002188638702300404>

Beer, M., & Nitin, N. (2011). Cracking the code of change. *Harvard Business Review*. Retrieved from <http://ceewl.ca/12599-PDF-ENG.PDF#page=89>

Brouwer, S., & Huitema, D. (2018). Policy entrepreneurs and strategies for change. *Regional Environmental Change*, 18(5), 1259–1272. <https://doi.org/10.1007/s10113-017-1139-z>

Chu, E., Schenk, T., & Patterson, J. (2018). The Dilemmas of Citizen Inclusion in Urban Planning and Governance to Enable a 1.5 °C Climate Change Scenario. *Urban Planning*, 3(2), 128. <https://doi.org/10.17645/up.v3i2.1292>

Eisenack, K., Moser, S. C., Hoffmann, E., Klein, R. J. T., Oberlack, C., Pechan, A., ...Termeer, C. J A. M. (2014). Explaining and overcoming barriers to climate change adaptation. *Nature Climate Change*, 4(10), 867–872. <https://doi.org/10.1038/nclimate2350>

Duijn, M., & van Buuren, A. (2017). The absence of institutional entrepreneurship in climate adaptation policy – in search of local adaptation strategies for Rotterdam’s unembanked areas. *Policy and Society*, 36(4), 575–594. <https://doi.org/10.1080/14494035.2017.1369615>

Folke, C., Hahn, T., Olsson, P., & Norberg, J (2005). Adaptive governance of social–ecological systems. *Annual Review of Environment and Resources*, 473.

Gray, B. (1989). *Collaborating: finding common ground for multiparty problems*. Jossey-Bass.

Head, B. W., & Alford, J (2015). Wicked problems: Implications for public policy and management. *Administration & Society*, 47(6), 711–739. <https://doi.org/10.1177/0095399713481601>

IPCC. (2012). *Managing the risks of extreme events and disasters to advance climate change adaptation*. Cambridge: Cambridge University Press.

Keskitalo, E. C. H., Juhola, S., Baron, N., Fyhn, H., & Klein, J (2016). Implementing local climate change adaptation and mitigation actions: The role of various policy instruments in a multi-level governance context. *Climate*, 4(1), 7. <https://doi.org/10.3390/cli4010007>

Klijn, E.-H., & Koppenjan, J F. M. (n.d.). *Public management and policy networks: The theoretical foundation of the network approach to governance*, 21.

Klijn, E.-H., & Koppenjan, J F. M. (2016). Governance networks in the public sector. Retrieved from https://www.researchgate.net/publication/284158898_governance_networks_in_the_public_sector

Moser, S. C., & Ekstrom, J A. (2010). A framework to diagnose barriers to climate change adaptation. *Proceedings of the National Academy of Sciences*, 107(51), 22026–22031. <https://doi.org/10.1073/pnas.1007887107>

Olazabal, M., Chiabai, A., Foudi, S., & Neumann, M. B. (2018). Emergence of new knowledge for climate change adaptation. *Environmental Science & Policy*, *83*, 46–53.

<https://doi.org/10.1016/j.envsci.2018.01.017>

Pahl-Wostl, C. (2006). Transitions towards adaptive management of water facing climate and global change. *Water Resources Management*, *21*(1), 49–62.

<https://doi.org/10.1007/s11269-006-9040-4>

Plotnikof, M. (2015). *Challenges of collaborative governance*. University of Copenhagen.

Retrieved from

<http://openarchive.cbs.dk/bitstream/handle/10398/9185/Mie%20Plotnikof.pdf?sequence=1>

Rittel, H., & Webber. (1973). Dilemmas in a General Theory of Planning. *Policy Sciences*, *4*(2), 155–169.

Robbert, B., Judith, K., Catrien, T., & Pavel, K. (2011). Barriers to climate change adaptation in the Netherlands. *Climate Law*, (2), 181–199. <https://doi.org/10.3233/CL-2011-033>

Roberts, N. (2001). Chapter 20. Coping with wicked problems: The case of Afghanistan. In *Research in Public Policy Analysis and Management* (Vol. 11, pp. 353–375). Bingley: Emerald (MCB UP). [https://doi.org/10.1016/S0732-1317\(01\)11006-7](https://doi.org/10.1016/S0732-1317(01)11006-7)

Smith, M.S., L. Horrocks, A. Harvey, and C. Hamilton. (2011). “Rethinking Adaptation for a 4_C World.” *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 369 (1934): 196_216.

Termeer, C., Dewulf, A., & Breeman, G. (2013). Governance of wicked climate adaptation problems. In J Knieling & W. Leal Filho (Eds.), *Climate change governance* (pp. 27–39). Berlin, Heidelberg: Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-29831-8_3

Termeer, C. J A. M., Dewulf, A., & Biesbroek, G. R. (2017). Transformational change: governance interventions for climate change adaptation from a continuous change perspective. *Journal of Environmental Planning and Management*, *60*(4), 558–576.

<https://doi.org/10.1080/09640568.2016.1168288>

Walker, B., Carpenter, S., Anderies, J., Abel, N., Cumming, G., Janssen, M., ...Pritchard, R. (2002). Resilience Management in social-ecological systems: a working hypothesis for a participatory approach. *Conservation Ecology*, 6(1). <https://doi.org/10.5751/ES-00356-060114>

Weick, K. E., & Sutcliffe, K. M. (2001). *Managing the unexpected: Assuring high performance in an age of complexity*. San Francisco, CA, US: Jossey-Bass.

Wise, R. M., Fazey, I., Stafford Smith, M., Park, S. E., Eakin, H. C., Archer Van Garderen, E. R. M., & Campbell, B. (2014). Reconceptualising adaptation to climate change as part of pathways of change and response. *Global Environmental Change*, 28, 325–336. <https://doi.org/10.1016/j.gloenvcha.2013.12.002>