TRACTION

Advancing climate adaptation action

Climate adaptation competences framework

Literature review

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The literature review and framework presented in this report refer to competences. The learning from trialling the approach in Scotland and Malawi was that this term is less relatable to many people and the Traction Framework has subsequently been updated to refer to enablers of adaptation action.

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Executive Summary

This document elaborates competences required for enacting responses to climate change within a national or regional context. It does this by reviewing current and recent scholarly literature on environmental governance, supplemented where appropriate with reference to policy and practice literature. Through this, a framework of competences for climate adaptation is developed, intended for use as a starting point for discussion and peer evaluation of climate adaptation competences in different national or regional contexts.

The framework is intended as a stimulus for discussion and as means of systematically identifying strengths and areas for prioritisation of action that are appropriate to the locale under review. It is not intended as a checklist of the quality of national climate adaptation responses. Nor is it intended to be used to make a comparison between different contexts.

'Competences' are defined as encompassing two broad areas. One is the power to legislate and implement policy, and to make decisions. The second is the presence of knowledges and skills which enable organisations and the people within them to take practical action on environmental issues. Competences for climate change adaptation are thus understood as the presence of a series of sets of powers, knowledges, skills and attitudes within organisations and the inter-institutional systems which are required to inform and influence decision-making on climate change and bring about change. This also includes mandate from a governance and political perspective, as well as financial resources and the ability to draw down and allocate finance from global and national levels for allocation at sub-regional and local levels.

Based on synthesis of existing frameworks for climate adaptation, resilience and sustainability transformations, five broad competence areas are identified as follows:

1. Visioning goals, targets and outcomes, through policy and leadership. This includes the legislation and policy which is in place to facilitate climate adaptation actions, as well as the extent to which this is integrated across different levels of government and across different sectors and areas. It also includes the importance of leadership and 'champions' in driving initiatives forward;

2. Defining and developing pathways from the present towards envisioned outcomes. Included in this competence are ability to foster innovation; opportunities for knowledge sharing; potential for consensual decision-making; and access to financing, resourcing and assets;

3. Synthesis and utilisation of knowledge. This involves the capacity of decision-makers and stakeholders to understand complexity; mechanisms for integrating different knowledge systems including indigenous, local and traditional knowledge; and the availability and accessibility of knowledge to society;

4. Facilitation of cross-sector and cross-organisational collaboration via stakeholder and public engagement. Competence in this area involves public, stakeholder and civil society inclusion in decision-making; the linking of adaptation policy with development and poverty reduction actions; and the capacity of policy- and decision-makers to reflect on how effective societal engagement processes have been.

5. Consideration of ethics and justice via normative competence. This includes ability to build durable rationales for adaptation actions which are able to transcend and endure political attention cycles. It also involves capability to understand issues of equity and fairness in decision-making processes and outcomes, specifically sensitivity to drivers of uneven vulnerability such as gender, ethnicity and social status.

Finally, recent empirical research on climate adaptation governance is reviewed to indicate the kinds of techniques which may be utilised to undertake peer review of this nature – including (but not limited to) meta-analysis; structured policy evaluation; interviewing; collaborative evaluation; participatory action research; and case-study based approaches.

Contents

1. Purpose and context

The purpose of this report is to outline a framework of competences for climate change adaptation at the national or regional level based on a review of the literature. It is intended that the framework be used as a starting point for discussion and peer evaluation of climate adaptation competences in different national or regional contexts.

What this report takes 'competences' to mean in the context of climate change adaptation at the level of the country or region , is the presence of a series of sets of powers, knowledges, skills and attitudes within organisations and the inter-institutional systems which are required to inform and influence decision-making on climate change and bring about change. This also includes mandate from a governance and political perspective, as well as financial resources and the ability to draw down and allocate finance from global and national levels for allocation at sub-regional and local levels.

From synthesis of existing competence/capability frameworks in the climate and environment sphere, five broad competence areas are identified:

1. Visioning goals, targets and outcomes, through policy and leadership;
2. Defining and developing pathways from the present towards envisioned outcomes – governance processes and capacity to respond including financing;
3. Synthesis and utilisation of knowledge – understanding knowledge systems for society and the natural environment;
4. Facilitation of cross-sector and cross-organisational collaboration via stakeholder and public engagement;
5. Consideration of ethics and justice via normative competence. These are then elaborated through review of existing environmental governance scholarship, with particular focus on the broader societal context within which policymaking happens.

The framework is intended as a stimulus for discussion and as means of systematically identifying strengths and areas for prioritisation of action that are appropriate to the locale under review, within the context of what is appropriate and feasible. It is not intended as a checklist of the quality of national climate adaptation responses. Nor is it intended to be used to make a comparison between different contexts or to compare whether one country has undertaken climate change adaptation planning 'better' than another.

2. Competences, climate and the environment

We draw our understanding of 'competences' from two different ways of thinking. The first is the power to legislate and implement policy – essentially, the power to take decisions, and especially the scale/level at which this is held. This is how the term has been used in the European Union (e.g. Vogler, 1999; Yamin and Depledge, 2004). Our second understanding of competences, following Wiek et al (2013), is the broader idea of a linked set of knowledges, skills and attitudes which enable organisations and the individuals within them to address challenges and opportunities relating to 'real-world' environmental issues.

These competences may be held at the level of national, regional or municipal government departments, units within these departments, or even individuals working within units. They may also be held within community groups, businesses and third sector. However, given the importance of long-term strategic action in response to climate change, assessment of the ability of these competences to sustain themselves at a level above and beyond that of individual 'champions' is crucial.

Many of the challenges associated with planning for climate change adaptation are of course well-known in environmental contexts. These include keeping climate and environment agendas moving forwards in the face of socio-economic development pressure (Leck and Roberts, 2015); balancing the need for short-term practical gains with deeper reflection on the structural drivers of inequity and vulnerability (Norgaard, 2010); and the increasingly transdisciplinary nature of environmental governance, which requires decision-makers to synthesise a breadth of knowledges to respond to complex social and environmental issues (Lang et al, 2012). It is therefore not surprising to find numerous frameworks to understand the competences required for climate change adaptation, sustainability and environmental management more widely. A selection of these are summarised in Table 1 to illustrate the breadth of ways in which environmental competences may be evaluated and the range of areas which may be assessed.

Table 1: summary of selected environmental competence frameworks (adapted from Mabon and Shih, 2018a)

Citation	Areas of evaluation	Aim of framework
Luederitz et al (2017)	Inputs; processes; outputs; outcomes.	Evaluative scheme for sustainability transition experiments.
McCormick et al (2013)	Governance and planning; innovation and competitiveness; lifestyle and consumption; resource management and climate mitigation and adaptation; transport and accessibility; buildings; spatial environment and public space.	Facilitating sustainable urban transformation.
Mieg (2012)	Core and growth resources, at micro-, meso- and macro-scales.	Linkage between sustainability and innovation in urban development.
Rosemborg (2015)	Driving investments; social dialogue; skills and training; social protection.	Evaluate sustainability in industrial transformations, with focus on workers.
Tyler and Moench (2012)	Agents; systems; institutions.	Enhancing resilience in the context of urban climate change.
Wiek et al (2013)	Anticipatory; strategic; systems thinking; interpersonal; normative.	Competences for sustainability.
Wolfram (2016)	Inclusive and multiform urban governance; transformative leadership; empowered and autonomous communities of practice; system(s) awareness and memory; urban sustainability foresight; diverse community-based experimentation with disruptive solutions; innovation embedding and coupling; reflexivity and social learning; working across human agency levels; working across political-administrative levels and geographical scales.	Capacity for urban sustainability transitions.

Through comparison of these competence frameworks (see Table 2), five broad categories of competence are identified. These take the five competence areas proposed by Wiek et al (2013) as a starting point, but refine and develop them in light of areas raised in other evaluative frameworks in order to create generic competence areas suitable for the national scale. More specific areas within these competences are identified in Section 2:

1. Visioning goals, targets and outcomes, through policy and leadership;
2. Defining and developing pathways from the present towards envisioned outcomes – governance processes and capacity to respond (including financing);

3. Synthesis and utilisation of knowledge – understanding knowledge systems for society and the natural environment;
4. Facilitation of cross-sector and cross-organisational collaboration via stakeholder and public engagement;
5. Consideration of ethics and justice via normative competence.

Given the breadth of technical, social and political issues which need to be addressed in climate adaptation planning (see references above and further elaboration in Section 3), holistic assessment of the different kinds of competence required across topics and sectors seems appropriate

Table 2: comparison of selected environmental competence frameworks

COMPETENCE AREA	Luederitz et al (2017)	McCormick et al (2013)	Mieg (2012)	Rosemborg (2015)	Tyler and Moench (2012)	Wiek et al (2013)	Wolfram (2016)
Visioning goals, targets and outcomes through policy and leadership	Outcomes Outputs	Governance and planning	Core & growth resources across scales	Driving investments Skills and training	Agents	Anticipatory	Sustainability foresight Working across political levels and scales
Defining and developing pathways from the present towards envisioned outcomes – governance processes and capacity to respond	Processes Outputs	Innovation and competitiveness	Core & growth resources across scales	Driving investments	Agents	Strategic	Transformative leadership Reflexivity and social learning Innovation embeddedness
Synthesis and utilisation of knowledge – understanding knowledge systems for society and the natural environment	Inputs Outputs	Governance and planning	Core & growth resources across scales	Skills and training	Systems	Systems thinking	Systems awareness and memory Working across human agency levels
Facilitation of cross-sector and cross-organisational collaboration via stakeholder and public engagement	Processes	Lifestyles and consumption	/	Social dialogue	Institutions	Interpersonal	Empowered communities of practice
Consideration of ethics and justice via normative competence	Outcomes	Governance and planning	/	Social protection	Institutions	Normative	Inclusive and multiform governance

3.

3. State-of-the-art: competences and challenges

This document does not try to offer an exhaustive review of all the sources of complexity in managing climate change adaptation within a country context. Nonetheless, in order to understand how and why competences of the kind outlined above are required, this section summarises five key areas of complexity or challenge when introducing new concepts, such as climate change adaptation and sustainability, into existing governance systems. Out of these we draw areas of questioning which ought to be addressed during the evaluation process.

3.1. Visioning goals, targets and outcomes through policy and leadership

The first issue concerns the visioning and setting of goals and targets – that is, the role of legislation, policy and leadership in laying out the aims and objectives of climate change adaptation initiatives. Kameyama and Kubota (2010: 1-2) explain that "[t]o effectively deal with any type of environmental problem, it seems quite obvious that certain concrete targets must be set for the implementation of environmental policies." The national level sits at an important juncture for turning international agreements and directives into formal legislation, and for setting the objectives which actors at the regional or local level may put into practice (Schreuers and Tiberghien, 2007; Cowling et al, 2008; Schreuers, 2008). Moreover with citizens, civil society and stakeholders likely to be affected by climate change often expecting 'the government' to take the lead on responding (Simpson and Clifton, 2015), there is a key role for national legislation and policy in creating the conditions for climate change adaptation to take place.

Nevertheless, social and political processes do not operate in isolation, but instead are influenced by processes at both larger and smaller scales (Cox, 1998; Smith, 2004). For instance, the municipal scale is argued to be particularly important in enacting national- or international-level policy, as it is at the urban scale that policy begins to have enough precision to enact practical and tangible changes (Kern and Alber, 2008). International actions such as the Paris Agreement too can inform the extent to which nations need to be able to assess and report their climate adaptation and mitigation actions (Kameyama and Kawamoto, 2016). Competence in imagining goals, targets and outcomes may thus reside not only in government policy-makers, but also in regional and municipal authorities, agencies, third- and private sector actors and civil society members tasked with translating initiatives developed at the national level into practice.

Translating this complex landscape into goals, targets and outcomes requires leadership and potentially 'champions' able to imagine and work towards desired outcomes. Butler et al (2016) argue that providing long-term support to emerging leaders to capitalise on policy windows and lead brokering between stakeholders can help to transcend limited political will. Such 'champions' may be particular departments or sections within government, as opposed to purely individuals (e.g. Leck and Roberts, 2015). Such leadership may also be significant in establishing mandate for action, when climate adaptation is only one of a number of issues on the political agenda (Roberts, 2010). The importance of government actors – whether at the national, regional, or local level – in leading visioning processes which have led to successful adaptation actions has been demonstrated in a range of contexts (e.g. Rabinovitch, 1992; Freund, 2001; Depietri et al, 2016).

The first competence to be evaluated – visioning goals, targets and outcomes – therefore refers to the extent to which climate adaptation policy set at the national level is able to respond to processes at the national, international, community or individual scale. This is significant in terms of how developing countries have had, and now all parties to UNFCCC are expected to, report to the UNFCCC through measures such as Nationally Determined Contributions (NDCs). It is also crucial to reflect on whether these influences across scales are a barrier or an enabler for national climate change

adaptation initiatives, and on the nature of leadership for visioning adaptation outcomes. It is however worth noting that, as will be elaborated further in the following sections, a crucial dimension of this competence is the potential to achieve policy coherence between climate and development goals.

COMPETENCE AREA 1: VISIONING GOALS, TARGETS AND OUTCOMES THROUGH POLICY AND LEADERSHIP

1.1. National policies and legislation

What national policies and legislation are in place to progress and support adaptation actions?

How capable are policy mechanisms of being able to anticipate, monitor and respond to changes?

What indicators are used to assess progress?

1.2. Horizontal integration

How much coherence is there across policies, including adaptation and disaster risk reduction and mitigation but also biodiversity, sustainable development, poverty eradication, environment, agriculture, health, and food and nutrition?

What mechanisms are in place to encourage integration of adaptation into and across policy areas and initiatives?

1.3. Vertical integration

How effective is coordination and collaboration between the national, provincial and municipal administrations/ local implementation? And also with and between other stakeholders (in particular those speaking for communities)?

What are the mechanisms that support national to local policy implementation e.g. devolved planning; place-based partnerships?

1.4. Leadership and champions

What leadership is there to drive visioning of adaptation outcomes forwards – including ability to involve different sections of government and bring in different stakeholders?

Are there particular 'champions' (either individuals or organisations) who are capable of working within and around policy windows and sustaining momentum?

3.2. Defining and developing pathways from the present towards envisioned outcomes – governance processes and capacity to respond

Vital to reaching the goals, targets and outcomes outlined above is competence in developing and implementing pathways which run from the 'present' towards the kinds of outcomes envisioned in

the first competence area. Fazey et al (2015: 4) define adaptation pathways as "approaches for planning and the identification of different adaptation options and how they can be realised." Fazey et al add that a pathways-based approach may be of value in holistically understanding change processes in contexts where power may be distributed and goals may be ambiguous, by working to evaluate context and social influences, and identify key decision and intervention points. Competence in defining and developing pathways could thus be understood as competence in understanding and working within the social context within which actions required to attain climate adaptation outcomes will have to take place. This links also to Section 3.4. on collaboration and Section 3.5. on 'fair' decision-making processes.

Confounding the challenges of policy and legislation outlined above, contemporary environmental issues such as climate change are characterised by a small yet notable degree of scientific uncertainty (Shackley and Wynne, 1996) which may be interpreted differently by different actors (e.g. policymakers, climate contrarians) depending on their viewpoint (e.g. Supran and Oreskes, 2017). The potential for value-driven interpretations of uncertainty, coupled with a decline in trust in 'expert' scientists and policymakers previously entrusted to make decisions on behalf of society (Pellizzoni, 2003), means traditional top-down governance processes may struggle to encompass the range of concerns at play for issues like climate change response (Mabon et al, 2015).

The complexity of social problems themselves (Bryson et al, 2006) serves only to make these limitations even more pronounced. Around policymaking there is hence a need for governance processes, defined by Andrews (1982) as the process of making decisions whilst balancing up a range of competing interests and value positions, and elaborated in the environmental context by Adger et al (2003) as the resolution of conflicts through institutional arrangements that may facilitate or limit the use of natural resources. Fuller evaluation of competences in defining and developing pathways through which climate adaptation actions are undertaken necessitates going beyond a narrow focus on government-led actions to understand the range of actors involved in the issue, and how their interests are balanced through processes of environmental governance (Castan Broto, 2017).

Competence in developing pathways also necessitates ability to assess aspects of capacity to respond. One key area in which the complexity of issues and limitations to top-down decision-making mean collaboration is needed to develop pathways is facilitation of innovation (Mieg, 2012; McCormick et al, 2013; Wolfram, 2016). There is within this a need for competence in being able to learn from adaptation approaches and outcomes to make adjustments, and to understand what works well to increase resilience and reduce vulnerability (Tschakert and Dietrich, 2010). Hilden (2011) argues that greater openness and transparency in policymaking processes, with more openness for independent evaluation and debate, may help to facilitate deeper social and reflexive learning. This can also involve knowledge and experience sharing across contexts (Parnell, 2016). When working towards such learning and evaluation processes – especially in the context of knowledge-sharing and drawing on experiences from elsewhere – It is however also worth bearing in mind Peck et al (2011) on 'truth spots' and the dangers of uncritically looking to mimic 'best practice' case studies without understanding the social context which made them successful in the first instance.

A related competence for assessing pathways is the development of diverse and/or self-sustaining funding mechanisms to translate outcomes into actions (e.g. Bouwer and Aerts, 2006; Persson and Remling, 2014). To do so, however, may necessitate skills in being able to make connections between financing for adaptation and financing for development (Klien, 2010). This also entails being able to work across scales to effectively utilise available finance (e.g. drawing down and allocating resources from the international level to specific locations and/or social groups (Barrett, 2013)), doing so in a way that benefits the most vulnerable (Ayers, 2009). This is discussed further in Section 3.4.

For both innovation and financing, there is also emerging awareness of the need for strong regulation and policy frameworks in order to ensure that necessary collaboration with industry and private sector

actors delivers benefit to society and does not tend towards profiteering or capitalisation (e.g. Spash, 2009; see also Section 3.5.) Facilitating such cross-sectoral collaboration is of course challenging in itself, and is considered as a separate competence under Section 3.4.

The second area of competence to be evaluated is thus the definition and development of pathways towards realising climate adaptation goals at the country level – the decision-making processes which Adger et al (2003) see as crucial. Specific areas to assess include the kind of processes (if any) policymakers tasked with climate change adaptation enact in order to undertake this balancing act during decision-making, looking at both the relationships within government (internal governance) and with other sectors (external governance). This also entails competences relating to finance, resourcing and assets, in terms of the ability to draw down and allocate resources in a way that responds to the range of interests at play.

COMPETENCE AREA 2: DEFINING AND DEVELOPING PATHWAYS FROM THE PRESENT TOWARDS ENVISIONED OUTCOMES – GOVERNANCE PROCESSES AND CAPACITY TO RESPOND

2.1. Fostering innovation and learning

What steps are created – and by whom - to foster innovation (in relation to adaptation), experimentation and the ability to explore solutions to take advantage of new opportunities?

What capacity is there for innovation to be able to understand the impacts of climate change and of proposed responses, so as to reach outcomes that minimise risk, find opportunities and/or deliver multiple benefits?

What means are in place to formalise learning from adaptation approaches and outcomes to make adjustments, and to understand what works well to increase resilience/reduce vulnerability?

2.2. Knowledge and experience sharing

To what extent is there involvement in knowledge- and experience-sharing not only across scales and sectors, but also in terms of cross-border and transnational coordination and cooperation? How much of this is leadership (e.g. establishing/chairing/leading initiatives), versus how much is participation?

What provision is there for knowledge-sharing at the sub-national level, e.g. between regions and cities? (both within-country and participation in international fora).

2.3. Consensual decision-making processes

What approaches exist to identify synergies and support cooperation between stakeholders (ministries, government agencies, community organisations, funders)?

To what extent do the outcomes of these processes feed into climate adaptation policymaking?

How 'democratic' are decision-making processes in terms of allowing involvement of a range of actors and ensuring outcomes reflect the breath of interests involved (see also areas of questioning in Sections 2.4. and 2.5.)

2.4. Financing, resourcing and assets

How available and accessible is long-term and self-sustaining funding, resources and tools to prepare and respond?

What alternative and/or innovative funding sources exist? For instance, financing instruments for nature-/ecosystem-based and other adaptation actions, such as crowd-funding and green bonds?

How much work has been done nationally to understand the availability and interplay of key assets that allow the system to respond to evolving circumstances in a changing climate?

3.3. Synthesis and utilisation of knowledge – understanding knowledge systems for society and the natural environment

A third competence requirement concerns the ability of policy-makers and those tasked with putting adaptation actions into practice to access and understand knowledge pertaining to the likely effects of climate change and the efficacy of potential adaptation strategies, and utilise this knowledge to develop policies grounded in available evidence yet appropriate to the national context. Tyler and Moench (2012) argue that strengthening systems - both infrastructure and ecosystem - is a big part of building resilience to climatic changes. Such competence in systems thinking is defined by Wiek et al (2011: 207) as the "ability to collectively analyse complex systems across different domains […] and across different scales". Systems thinking – especially socio-ecological systems (Anderies et al, 2013) – may thus form part of competence in synthesis and utilisation of knowledge. To do so, however, arguably requires knowledge about effects of climate change and potential response strategies. This 'evidence-based' planning is of course susceptible to social and political pressures (Groves et al, 2002; Svancara et al, 2005), and ability and means to holistically integrate different strands of knowledge available to policy-makers in practice may be limited (Blackwood et al, 2014).

'Knowledge' here refers to indigenous and local knowledge (ILK) as well as what may be considered techno-scientific knowledge. ILK may offer crucial insight into the complexity of social and ecological systems (Horowitz, 2015), and the importance of its integration into climate assessment and planning is gaining traction internationally. For instance, the Convention on Biological Diversity's Article 8(j) is devoted to 'Traditional Knowledge, Innovations and Practices' (CBD, 2018), and the Intergovernmental Panel on Biodiversity and Ecosystem Services' Deliverable 1(c) relates to 'Procedures, approaches and participatory processes for working with indigenous and local knowledge systems' (IPBES, 2018).

Moreover, Cooney (2012) and Casson (2017) also see challenges around 'downscaling' models and knowledge about climate change - often constructed at the global or regional level - in a way that allows distribution of effects across and within localities to be understood. This is especially significant as it may well be actors at the regional or local level who are tasked with enacting adaptation actions, and hence require capacity to access and work with the kinds of knowledge listed above (e.g. Pilgrim et al, 2013). It is also important to register 'knowledge' does not only entail understanding of physical environmental processes, but also integrating knowledge grounded in the humanities and social sciences about societies and how socio-political systems respond to climate change (Corbera et al, 2014).

Assessment of competence in synthesis and utilisation of knowledge for climate adaptation policy hence encompasses a breadth of areas. This involves not only (a) the level of knowledge of policymakers and stakeholders involved in putting decisions into practice, but also (b) what kinds of knowledge decision-makers at the national level have access to, and (c) what types of knowledge and from which scales are perceived as useful (and which are not).

COMPETENCE AREA 3: SYNTHESIS AND UTILISATION OF KNOWLEDGE – UNDERSTANDING KNOWLEDGE SYSTEMS FOR SOCIETY AND THE NATURAL ENVIRONMENT

3.1. Knowledge competences of policymakers and stakeholders involved in reaching/implementing decisions

To what extent is there a comprehensive, multi-hazard risk and vulnerability assessment frameworks that support evidence-based and robust decision-making?

How able are those responsible for national-level adaptation coordination to collect, analyse and share knowledge and information on climate impacts/risks in support of adaptation activities?

What national risk assessments are undertaken, and how do these contribute a broader understanding of risk and give hints on tolerance thresholds?

What mechanisms exist to train and recruit national government staff with specific skills required to undertake complex climate adaptation?

And to what extent does capacity-building extend to regional government staff and other stakeholders, in order to facilitate holistic yet knowledge-driven decision-making?

3.2. Synthesis of knowledge across disciplines and scales

What processes and forums are in place to include non-physical science research expertise (e.g. social science, arts and humanities) in evidence-based decision-making?

Are there processes and guidelines for the inclusion of local and/or embodied environmental knowledges in evidence-based decision-making, both at national level and also at smaller spatial scales?

3.3. Knowledge availability and accessibility

What tools are available to support decision-making on climate risks, e.g. web-based knowledge portals, multi-stakeholder coordination platforms, repositories of case studies of methods for implementing adaptation action? How accessible are these in terms of ease of use, avoidance of technical jargon etc?

How appropriate are these decision-support tools to the country context in terms of e.g. language requirements, internet accessibility and speed, software availability etc?

How and to what extent are end-users' requirements considered at the outset of publicly-funded research programmes? How much of the national approach to research and innovation in the climate adaptation area is based on co-design, co-development and co-evaluation of climate services?

3.4. Facilitation of cross-sector and cross-organisational collaboration via stakeholder and public engagement

A logical extension of more inclusive 'governance' competence is the participation of stakeholders and publics in climate change adaptation decision-making processes. 'Stakeholders' may be understood as any group with an interest in the outcomes of adaptation decisions, e.g. other governmental sectors, private sector, research and development. Given the interest in reducing vulnerability and balancing adaptation and development needs, however, competence to secure involvement of those working 'on the ground' e.g. practitioner-academics, local government, environmental NGOs, community groups may be significant.

Public and stakeholder participation in decision-making processes is argued to be valuable on at least three grounds, summarised as normative, instrumental and substantive (Fiorino, 1990; Stirling, 2008). The 'normative' argument is that as environmental changes brought about by climate change will first and foremost be felt by citizens through their daily living, wider society ought to be consulted for their views as to what is considered an appropriate adaptation action in response. The 'instrumental' argument is that civil society involvement gives decisions greater legitimacy, thereby increasing buy-in and support for potentially challenging, complex or difficult decisions. Finally, the 'substantive' argument runs that the involvement of a broad range of perspectives and knowledges in the decision-making process can lead to technically superior outcomes by, for example, incorporating ideas planners themselves had not thought of.

Of particular importance when it comes to collaboration in the context of climate adaptation is the competence to find means of linking adaptation policy and implementation with poverty reduction and vulnerability reduction measures in different social and economic sectors (e.g. Klein, 2010; Roberts, 2010). More immediate requirements such as poverty reduction, economic development and infrastructure supply may run up against environment- or climate-driven actions (Seto et al, 2012). Following Hurlbert and Gupta (2015), for 'unstructured problems' such as climate change adaptation characterised by these different value positions, the value of collaborative approaches comes through the potential to discuss different perspectives, facilitate dialogue and discourse, and enable learning. More specifically, collaborative approaches to decision-making for climate adaptation can help to understand the immediate pressures and threats to development raised by climate change, thereby helping to build broad-based rationales for actions which balance both adaptation and development imperatives (Mabon and Shih, 2018b). Tschakert and Dietrich (2010) add that cross-sector and cross-organisational collaboration can help to create the conditions for innovation and experimentation required to resolve highly complex adaptation-development dilemmas.

But whilst the value of public participation is broadly acknowledged, questions remain over the extent to which publics actually do participate in decision-making processes, or whether the most marginalised and vulnerable voices are heard in these 'inclusive' processes (Crawford, 2016; Tyler and Moench, 2012; Vanclay, 2012). Moreover, inclusive and deliberative processes underpinned by a drive for consensus have been criticised on the grounds that 'consensus' tends towards the status quo and thus maintaining unequal power relations which may render some more vulnerable to negative climate effects in the first instance (Aylett, 2010). Interpersonal competence of this nature thus means not only providing opportunities for collaboration, but also having the ability to be reflexive and consider whether collaboration is indeed effective in bringing a range of views and knowledges together (Silvia, 2017).

The fourth competence to be assessed is hence the grounds on which national-level policymakers justify the involvement of wider society in the decision-making process. This includes evaluation of extent to which public participation is actually effective in allowing the most marginalised voices to be heard, and also assessment of the extent to which policymakers and stakeholders themselves are able

and willing to undertake this reflexive evaluation by, for example, making materials and data open for comment and scrutiny, committing to learning processes, and participation in cross-disciplinary processes (e.g. Tschakert and Dietrich, 2010; Hilden, 2011; Butler et al, 2016).

COMPETENCE AREA 4: FACILITATION OF CROSS-SECTOR AND CROSS-ORGANISATIONAL COLLABORATION VIA STAKEHOLDER AND PUBLIC ENGAGEMENT

4.1. Public, stakeholder and civil society inclusion

What mechanisms are in place to facilitate participation of stakeholders/society - including at the local level - in adaptation planning and actions?

What channels exist for the outcomes of public and societal consultation to feed into policymaking processes?

At what stages of the policymaking process are citizens and stakeholders consulted? E.g. is it at the policy and planning formation stage (empowerment), in response to draft policies (consultation), or once goals, targets and policies have been set (informing)?

4.2. Linking of adaptation policy with poverty reduction and development policy

To what extent are publics' and stakeholders' development needs considered within adaptation policy, and vice-versa?

Are there processes or initiatives to collaboratively understand potential synergies between adaptation and development?

What processes exist to understand the ways in which adaptation actions may help to maintain development trajectories?

4.3. Reflexivity on collaboration

What processes are in place to systematically evaluate the effectiveness of public, stakeholder and civil society engagement on climate change adaptation?

Is there evidence of a shift over time in the way publics and stakeholders are engaged in climate adaptation policymaking?

3.5. Consideration of ethical and justice issues via normative competence

This broad competence area reflects the ways that legislation can demand or encourage competent adaptation by different stakeholders in terms of public duty, responsibility towards citizens, and working towards equitable outcomes and processes. Even if there is good awareness within government departments of the need for climate change adaptation measures, consistent long-term planning may be at the mercy of political attention, as per Downs' (1972) issue-attention-cycle model. Climate change has shown to be equally vulnerable to issue-attention-cycles (McComas and Shanahan, 1999; UNEP, 2012). There is thus a need to consider how likely politicians' attention is to be held by climate change adaptation issues, or indeed what may make rationales for climate change adaptation planning more likely to withstand issue-attention cycles. Further, in contrast to the more deliberative turn outlined above, informal or behind-the-scenes 'power brokering' still has a role to play in attaining outcomes. This may in cases actually lead to solutions amenable to all being reached (e.g. Hajer and Kesselring (1999) on informal brokering around the Munich transportation system) or in others it can serve to reinforce the status quo in climate change management processes and prevent less empowered voices (who are those most vulnerable and least able to respond to changes in climate) from influencing the planning process (Whitzman and Ryan, 2014).

Related is a broader issue of normative competence – the ability to understand and negotiate the more value-laden questions around the future development of complex systems (Wiek et al, 2011). In a country-level climate adaptation context, competence in considering ethical and justice issues in this way may involve understanding how factors such as gender (Denton, 2002) and race/ethnicity (Klinenberg, 2002) may make some sectors of the population disproportionately vulnerable to climate effects, and in turn the development of mechanisms and processes to ensure the benefits of policies and interventions do accrue to the most vulnerable and to those who need them the most.

Consideration of gender is a significant part of competence in enacting equitable climate change adaptation responses. Women may be under-represented in environmental management processes where decisions over how to respond to climatic changes are taken, and as a result of broader societal inequalities can have less access to land, income, education and health services (Denton, 2002; Demetriades and Esplen, 2008). Disproportionate negative effects for women from climate change in terms of health and workload also been demonstrated in Mali (Djoudi and Brockhaus, 2011) and the USA (Laska and Morrow, 2006), something that takes on additional importance in LMIC contexts where women may rely on ecosystems for agriculture and household management (Denton, 2002).

Consideration of ethical and justice issues within climate change adaptation governance hence entails evaluation of how shorter-term political pressures may be a hindrance to systematic long-term planning. It may also involve consideration of the capability of policymakers charged with climate change adaption to be able to imagine diverse framings and rationales for climate change adaptation actions in order to sustain political traction over time (Shih and Mabon, 2017). When it comes to justice, there is a need to consider how potentially vulnerable groups may be marginalised not only in terms of distributional justice (justice in the distribution of benefits and negatives across space and/or society (Shrader-Frechette, 2002)), but also in with regard to procedural justice (justice in opportunities to participate in and influence decision-making processes (Paavola and Adger, 2006)) and epistemic justice (justice in the kinds of knowledge and identities that are considered appropriate for problem-setting (Mabon et al, 2015). Whilst it is arguably neither appropriate nor desirable to make judgements as to what constitutes 'ethical' or 'just' climate change adaptation, evaluation of competence in this area may nonetheless touch on the extent to which policymakers show awareness of – and are prepared to respond to – questions about who is most negatively affected by climate change and to whom the benefits of adaptation policies primarily ought to accrue.

COMPETENCE AREA 5: CONSIDERATION OF ETHICAL AND JUSTICE ISSUES VIA NORMATIVE COMPETENCE

5.1. Reducing risk from political attention cycles

What different rationales are given in favour of climate change adaptation actions at the national and regional /subnational government level?

Is there evidence of climate change adaptation measures being able to garner buy-in across a range of political positions and viewpoints?

What role is there for 'champions' (either formal or informal) in keeping action moving forwards?

5.2. Awareness of normative issues

To what extent are justice and equity issues explicitly mentioned in national-level climate change adaptation messaging and actions?

What processes are in place to (a) understand differences in vulnerability to climate impacts across sections of society; and (b) put in place measures to reduce these differences and/or ensure the benefits of interventions accrue to the most vulnerable?

How equitable is access and entitlement to key climate change adaptation assets (e.g. 'hard engineering' infrastructure, ecosystem services etc)? Are there measures to ensure these assets are distributed equitably across space and across socio-economic groups?

What consideration is given to gender issues, and in particular ensuring high-level discourses such as 'gender mainstreaming' translate into tangible actions for citizens?

How much recognition is there of the need for systems which encourage justice in decision making (e.g. equality of access), and that offer justice in the outcomes?

What efforts are made to involve different knowledge systems and identities at the problem formation and agenda-setting stage? (see also Section 3.3. on indigenous and local knowledge)

4. How to do it?

This final section offers brief suggestions as to how the kind of evaluation outlined in this document may be undertaken in practice. The aim again is not to provide a complete overview of evaluative techniques, rather it is to use examples from recent scholarly practice to demonstrate the different ways in which competences may be assessed by a group of peers. Note also that methods may be 'mixed' (conducting a mixed method evaluation) to add triangulation of evaluation findings.

4.1. Meta-review

A valuable initial step may be to conduct a 'meta-analysis' of existing evaluations which have been undertaken for countries, in both the academic and 'grey' literature. Whilst this may not cover all of the competences laid out in the framework, it may be a useful means of understanding a national context in the first instance – especially as a way of avoiding 'research fatigue' and/or over-burdening busy policymakers in locales where significant evaluation has already been undertaken.

Vogel B and Henstra D (2015) 'Studying local climate adaptation: A heuristic research framework for comparative policy analysis' Global Environmental Change 31: 110-120.

4.2. Policy and content analysis

Evaluation of publicly-available policy documentation is a commonly-used means of evaluating climate-related policies. This may involve reading and 'coding' for the extent to which themes and competences are mentioned within documentation. Such an approach may be helpful as a means of evaluating competences under situations where resourcing for travel to conduct interviews or appreciative enquiry are limited. What it may miss, however, is the extent to which policy 'rhetoric' translates into practice and is received by stakeholders.

Preston BL, Westaway RM and Yuen EJ (2011) 'Climate adaptation planning in practice: an evaluation of adaptation plans from three developed nations' Mitigation and Adaptation Strategies for Global Change 16(4): 407-438.

4.3. Interview

Competences may also be evaluated through semi-structured or semi-structured interviews with key policymakers and other stakeholders including NGOs, academics, third sector organisations, and even publics. The value of such an approach is that it allows evaluators/researchers to go into more depth on areas arising which appear significant, and hence give a richer narrative base to the evaluation. However, alongside this flexibility there may also be a need for an 'interview guide' (e.g. a 'checklist' of areas to be covered during interviews) to ensure interviews and case studies collect comparable data.

Shih W-Y and Mabon L (2017) 'Land-use planning as a tool for balancing the scientific and the social in biodiversity and ecosystem services mainstreaming? The case of Durban, South Africa' Journal of Environmental Planning and Management DOI: 10.1080/09640568.2017.1394277

4.4. Collaborative evaluation

Processes of this nature bring groups of 'experts' together to collaboratively evaluate issues. Such evaluation may follow a structured (or at least semi-structured) discussion protocol. Similar to interviewing, a strength of this approach is that it allows participants – within the competences and

discussion categories – to raise issues they themselves see as significant. Moreover, bringing a breadth of expertise into the room may engender a more robust evaluation by providing a wider range of perspectives. Challenges include the need for skilled facilitation to steer discussion and ensure continued participation of a range of voices, and also potentially logistical issues around finding locations and time slots at which key participants are all available.

de Franca Doria M, Boyd E, Tompkins EL and Adger WN (2009) 'Using expert elicitation to define successful adaptation to climate change' Environmental Science and Policy 12(7): 810-819.

4.5. Participatory action research

Broadly speaking, participatory action research (PAR) involves academics/evaluators and practitioners working together to develop, implement and evaluate actions collaboratively and in practice. Tschakert and Dietrich (2010) argue the value of PAR-type approaches lies in their ability to evaluate actions in practice and to trial initiatives 'on the ground' in a way that can be implemented. Specific to climate adaptation, Tschakert and Dietrich propose a framework of (a) lessons learned from the past; (b) monitoring and analysis of trends; (c) planning for surprises, perturbations, and discontinuities through scenarios; (d) measures of anticipatory capacity; and (e) design of decision-support tools for adaptation planning.

Tschakert P and Dietrich KA (2010) 'Anticipatory Learning for Climate Change Adaptation and Resilience' Ecology and Society 15(2): 11. [online] URL: http://www.ecologyandsociety.org/vol15/iss2/art11/

4.6. Case study approach

Given the complexity of factors driving responses to climate adaptation challenges, and the number of institutions and organisations involved in governance across levels and spatial scales, in-depth evaluation of the ability of competences to translate into tangible outcomes may be challenging. Nevertheless, particularly in LMIC contexts where the need for responses is more urgent and the challenge of balancing adaptation and development more acute, in-depth evaluation of a smaller number of case studies (i.e. specific locales and/or projects) within a country context may provide a richer and more nuanced account of competences. Caution must however be exercised over the representativeness of selected case studies.

Barrett S (2013) 'Local level climate justice? Adaptation finance and vulnerability reduction' Global Environmental Change 23: 1819-1829.

APPENDIX I: SUMMARY OF COMPETENCE AREAS (SUGGESTED COMPETENCES FRAMEWORKK)

The purpose of this table is to summarise the competence areas and sub-areas listed in the report, as well as to give an indication of the system properties, drivers, inhibitors and determinants associated with each. This provides an overview in tabular form of what the competences may look like, and hence what sorts of areas and aspects evaluators may want to look to when conducting assessments.

COMPETENCE AREA	COMPETENCES	SYSTEM PROPERTIES	DRIVERS (FACTORS SHAPING WHAT IS IN THE SYSTEM)	INHIBITORS (FACTORS THAT SLOW DOWN OR BLOCK SYSTEM FUNCTION)	DETERMINANTS (FACTORS AFFECTING CHANCES OF ACHIEVING SYSTEM PURPOSE)
VISIONING GOALS, TARGETS AND OUTCOMES THROUGH POLICY AND LEADERSHIP	**National policies and legislation** National policies and legislation in place to progress and support adaptation progress Mechanisms that are able to anticipate, monitor and respond to changes. Use of indicators	Adaptation provision included in Climate Change legislation in the duties and responsibilities of policy implementers (in performance contracts or the equivalent)	Civil society, businesses and government support for Climate Policy (national and international)	Ineffective shift of responsibilities from public to third sector Lack of policy coherence. Policy silos that obfuscate need for action	Scale and pace of climate risk escalation. Fiscal space and flexibility. Continuity of political regime.
	Integration across sections of government (horizontal) Coherence across policies including adaptation and disaster risk reduction and also biodiversity, sustainable development, poverty eradication, environment, agriculture, health, and food and nutrition Mechanisms that encourage integration of adaptation into and across policy areas and initiatives	Transparency of public bodies duties reporting and sharing information Scrutiny and assessment of adaptation risks Downward accountability to citizenry	Mechanisms that support national to local policy implementation e.g. devolved planning Scrutiny mechanisms and independent assessments	Lack of inclusion. Elite capture. Resistance to the voice of local people and their participation in decision-making processes.	Interactions with above and below tiers of governance and politics.
	Integration across spatial scales (vertical) Effective coordination and collaboration between the national, provincial and municipal administrations/ local implementation (multi-level governance) Mechanisms that support national to local policy implementation e.g. devolved planning.				

	Leadership and 'champions' from government in driving adaptation processes forwards Ability of government actors to lead processes of visioning, drawing in different actors across levels Champions (either individual or units) able to identify and respond to policy windows to sustain momentum.				
DEFINING AND DEVELOPING PATHWAYS FROM THE PRESENT TOWARDS ENVISIONED OUTCOMES – GOVERNANCE PROCESSES AND CAPACITY TO RESPOND	**Fostering innovation and learning** An enabling environment to foster innovation (in relation to adaptation), experimentation and the ability to explore solutions to take advantage of new opportunities Learning from adaptation approaches and outcomes to make adjustments, and to understand what works well to increase resilience / reduced vulnerability.	Support for research and innovation for academia, research and enterprise sectors.	Culture of experimentation and innovation. Centres of Innovation with academic and private sector)	Private sector dominance / profiteering.	Ability of government / state regulations to foster innovation in a manner that primarily benefits society.
	Knowledge and experience-sharing Sharing of experiences and a collaborative approach including vertical and horizontal, cross-border and transnational coordination and cooperation	Global networks eg Covenant of Mayors Climate and Energy, Rockefeller Resilient Cities.	Political support for showcasing.	Information overload!	Applicability of experiences and lessons being 'showcased' to other contexts. Cautious and judicious evaluation of 'best practices' learned from other locales and contexts.
	Consensual decision-making processes Approaches that identify synergies and support cooperation between stakeholders (ministries, government agencies, community organisations, funders) Pathway from cooperative fora to policymaking processes	Place based partnerships	Government policies supporting collaboration eg City deals, Green Network Partnerships, Resilience partnerships Focus on efficiency savings (financial)	Procurement support (Lack of) for partnerships	Perceived efficacy of participation in affecting policy decisions and outcomes.
	Financing, resourcing and assets Availability and accessibility of long term and self-sustaining funding, resources and tools to prepare and respond. Alternative and Innovative funding sources eg financing instruments for nature-/ecosystem-	Funded capacity building initiatives	National performance frameworks/ strategies (eg Programme for Government)	Short-termism Lack of political appetite for contentious issues (eg funding of managed retreat)	Breadth, depth and sustainability of funding sources.

	based and other adaptation actions, such as crowd-funding and green bonds Availability and interplay of key assets that allow the system to respond to evolving circumstances in a changing climate				
SYNTHESIS AND UTILISATION OF KNOWLEDGE – UNDERSTANDING KNOWLEDGE SYSTEMS FOR SOCIETY AND THE NATURAL ENVIRONMENT	**Knowledge competences of policymakers** Comprehensive, multi-hazard risk and vulnerability assessment frameworks that support evidence-based and robust decision-making Ability to collect, analyse and share knowledge and information on climate impacts / risks in support of adaptation activities National risk assessments contributing a broader understanding of risk and give hints on tolerance thresholds. Mechanisms to train and recruit national government staff with specific skills required to undertake complex climate adaptation?	Place based partnerships – including voice of communities and business sector Opportunities to develop and recruit skilled practitioners	Body of research promoting need for / value of systems approach National performance framework and outcomes Graduate/postgraduate-level programmes to train researchers and practitioners able to address complex and transdisciplinary issues.	Government departments / local authorities working in silos Business working at arm's length to policy implementation Issues-based approach to addressing risk rather than systems and interdependencies	Academic community and research funding
	Synthesis of knowledge across disciplines and scales Processes and forums to include non-physical science research expertise (e.g. social science, arts and humanities) in evidence-based decision-making. Processes and guidelines for the inclusion of local and/or embodied environmental knowledges in evidence-based decision-making, both at national level and also at smaller spatial scales	Government-academia research partnerships and advisory boards.	Mechanisms supporting inter- and transdisciplinary approaches to vulnerability assessment.	Excessive or exclusionary focus on 'hard science'.	Social, cultural and institutional attitudes to what constitutes 'valid' and appropriate knowledge.
	Knowledge availability and accessibility Accessible tools with guidance, to support decision-making on climate risks including web-based knowledge portals and multi-stakeholder coordination platforms including knowledge on methods of how to implement adaptation action	Role of academic community and consultants Knowledge translators and knowledge brokers Knowledge networks	Culture of transparency and knowledge-sharing	Confidentiality, intellectual property and paywall issues inhibiting open access	Scientific knowledge providers Shift of funding landscape to user driven research and co-creation Propriety of decision-support tools to local contexts

	Climate Services that shift away from supply to user-driven and science-informed, underpinned by an approach to research and innovation based on co-design, co-development and co-evaluation of climate services.				
FACILITATION OF CROSS-SECTOR AND CROSS-ORGANISATIONAL COLLABORATION VIA STAKEHOLDER AND PUBLIC ENGAGEMENT	**Public, stakeholder and civil society inclusion** Participation of stakeholders/society including at the local level in adaptation planning and actions, informed by multiple perspectives from both public and private sectors Channels for public / civil society consultation to inform policymaking	Provision for public consultation in government legislation Additional/specific consultation provision in climate adaptation legislation	Cultures of inclusive decision-making Awareness in government bodies (and academia) of need for continual evaluation and assessment of societal consultation and engagement.	Tokenistic engagement 'Informing' rather than 'consulting' or 'collaborating'	Government bodies' cultures and attitudes towards deliberative decision-making.
	Linking adaptation policy with development goals Dialogic and/or discussion-based means of understanding adaptation and development needs Decision-making processes designed to identify adaptation and development synergies				
	Reflexivity on collaboration Processes for systematic evaluation of efficacy of public / stakeholder / civil society engagement				
CONSIDERATION OF ETHICS AND JUSTICE VIA NORMATIVE COMPETENCE	**Reducing risk from political attention cycles** Multiple framings/rationales for climate adaptation actions. Formal and informal champions.	Legislative provision capable of sustaining action over political cycles	Champions able to transcend interest groups and partisan divisions. Broad-based buy-in for climate adaptation actions	Short-term politics Narrow focus on economic growth & emergency response Lack of fiscal space and flexibility	Awareness and interest of political and social leaders.
	Awareness of normative issues Explicit mentioning of equity and justice issues in national climate adaptation messaging and actions. Processes to understand differential vulnerability across socio-economic groups, and	Place based approaches include voice of communities/ third sector	Government Policies (eg Community Empowerment Act) Human Rights Commission	Lack of awareness by those who may be most impacted	Understanding of distributional and procedural justice implications at stage of defining climate adaptation-related issues and problems.

	to redress these differences through targeted actions (distributional justice) A recognition of the need for systems which encourage justice in decision making (e.g. equality of access), and that offer justice in the outcomes (procedural justice) A recognition of the value of different knowledge systems and identities in identifying problems and the range of possible outcomes (epistemic justice) Equitable access and entitlement to key assets by all groups including marginalized (gender, ethnicity, caste)				

APPENDIX II – NATIONAL/REGIONAL/LOCAL VERSUS ORGANISATIONAL COMPETENCES

1. Background

In late 2017 and early 2017, researchers from Sniffer/Adaptation Scotland and Robert Gordon University undertook two separate pieces of work with a common interest in competences required for climate change adaptation. Namely, a literature review on Organisational Adaptation Dimensions led by Sniffer/Adaptation Scotland; and an initial review towards the development of an evaluation framework for competences in climate change adaptation at the national level, undertaken by Robert Gordon University to feed into the TRACTION project led by IIED/Sniffer.

Given the common interest in competences underpinning both pieces of work, the research teams agreed it was sensible to work in parallel to ensure connectivity between their frameworks – or at least to understand why there may be differences in terminology or groupings of competences. The purpose of this Appendix – attached to both the Organisational Adaptation Dimensions and TRACTION outputs – is hence to clarify and explain similarities and differences between the two frameworks.

2. Competence areas

NATIONAL/REGIONAL/SUBNATIONAL	ORGANISATIONAL
Visioning goals, targets and outcomes through policy and leadership	Leadership and vision
Defining and developing pathways from the present towards envisioned outcomes – governance processes and capacity to respond	Planning and implementation
	Organisational culture
Synthesis and utilisation of knowledge – understanding knowledge systems for society and the natural environment	Knowledge, evidence, assessment and data
	Systems thinking
	Learning
Facilitation of cross-sector and cross-organisational collaboration via stakeholder and public engagement	Partnerships and collaboration
Consideration of ethics and justice via normative competence	Governance

2.1. Visioning goals, targets and outcomes through policy and leadership

For both the national and organisational frameworks, the ability to imagine future scenarios and envision the desired outcomes and end-points of actions is key. As such, both frameworks feature a competence dedicated to the role of 'vision'. However, when it comes to climate change policy at the national level, Kameyama and Kubota (2010: 1-2) argue that "(t)o effectively deal with any type of environmental problem, it seems quite obvious that certain concrete targets must be set for the implementation of environmental policies." The language utilised for the country-level competence therefore reflects the necessity of future visions being expressed in terms of goals, targets, and anticipated outcomes.

2.2. Defining and developing pathways from the present towards envisioned outcomes – governance processes and capacity to respond

Both frameworks also contain a cluster of competences relating to the pathways through which envisioned scenarios will be achieved. In the organisational context, this is reflected in competences in planning and implementation, and also in organisational culture towards responding to change. In a national context, however, the complexity of social problems such as climate change adaptation mean that the collaboration of multiple organisations spanning government, civil society, the private sector and others is required to enact a response (Bryson et al, 2006). As such,

at the national level it may be more appropriate to think about competences in balancing up a range of expectations and value positions through processes of environmental governance (Adger et al, 2003). As this governance work involves engagement with different sections of 'government' and also society more broadly, thinking holistically in terms of how pathways are defined and developed drawing in a range of viewpoints seems appropriate.

2.3. Synthesis and utilisation of knowledge – understanding knowledge systems for society and the natural environment

At both the organisational and national level, ability to understand complex social, technological and ecological systems in order to undertake evidence-based action is a key competence. At the organisational level, this was considered to involve competence in knowledge, evidence, assessment and data; in systems thinking; and in learning. Nationally, however, the ability to draw on data coming from a range of spatial scales and to show cognisance to indigenous or 'local' knowledges takes on additional significance given the range of interest groups likely to be involved in the policy formation process. Competence in understanding systems at the national level is therefore framed in terms closer to the systems thinking competence of Wiek et al (2011:207) ("ability to collectively analyse complex systems across different domains […] and across different scales"), with an emphasis on how knowledges are *synthesised* and *utilised* to develop policies amenable to a range of constituencies.

2.4. Facilitation of cross-sector and cross-organisational collaboration via stakeholder and public engagement

Competence in building and sustaining collaboration to tackle complex issues is common to both the organisational and national frameworks. The mere presence of mechanisms for collaboration alone may, however, not be sufficient to ensure effective participation (Silvia, 2017). Hence at both organisational and national level, 'competence' in collaboration also means competence in evaluating the effectiveness of participation as well as initiating it. At the national level, 'cross-sectoral' is used to reinforce the importance of collaboration across sectors as part of governance processes

2.5. Consideration of ethics and justice via normative competence

Lastly, both organisational and national frameworks have a shared concern with how climate change adaptation *ought* to be undertaken. That is, competence in understanding – and responding to - ethical and moral issues relating to who benefits from policies and actions. This is referred to in the organisational framework as 'governance'. In the national framework, however, governance is discussed extensively within the 'Defining and Developing Pathways' cluster given the importance of balancing a range of interest positions in the policymaking process. To avoid confusion, in the national framework, the cluster of competences relating to ability to understand and address normative issues are referred to simply as 'Ethics and justice considerations.'

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