



# Adapting water management to climate change: Institutional involvement, inter-institutional networks and barriers in India



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## ABSTRACT

The capacity of a nation to address the hydrological impacts of climate change depends on the institutions through which water is governed. Inter-institutional networks that enable institutions to adapt and the factors that hinder smooth coordination are poorly understood. Using water governance in India as an example of a complex top-down bureaucratic system that requires effective networks between all key institutions, this research unravels the barriers to adaptation by combining quantitative internet data mining and qualitative analysis of interviews with representatives from twenty-six key institutions operating at the national level.

Institutions' online presence shows a disconnect in the institutional discourse between climate change and water with institutions such as the Ministries of Water Resources, Earth Sciences and Agriculture, indicating a lesser involvement compared to institutions such as the Ministries of Finance, External Affairs, Planning Commission. The online documents also indicate a more centralised inter-institutional network, emanating from or pointing to a few key institutions including the Planning Commission and Ministry of Environment and Forests. However, the interviews suggest more complex relational dynamics between institutions and also demonstrate a gap between the aspirational ideals of the National Water Mission under the National Action Plan on Climate Change and the realities of climate change adaptation. This arises from institutional barriers, including lengthy bureaucratic processes and systemic failures, that hinder effective inter-institutional networks to facilitate adaptation. The study provides new understanding of the involvement and barriers of complex multi-layered institutions in climate change adaptation.

## 1. Introduction

Climate change is likely to affect the spatio-temporal distribution, availability and demand for water (IPCC, 2014) through changing precipitation (Chou et al., 2013) and evapotranspiration patterns, glacier melt rates (Jiménez Cisneros et al., 2014) and saline intrusion of coastal aquifers (IPCC, 2014). Water institutions – government ministries, departments and agencies, non-governmental and developmental agencies, and research and academic institutions – need the ability to anticipate and alleviate these potential threats in order to minimise vulnerability and damages (Bohensky et al., 2010; Matthews and Sydneysmith, 2010), while also taking advantage of the opportunities afforded by adaptation (IPCC, 2007; Vincent, 2007) and from complementing ongoing mitigation efforts (IPCC, 2014; Simonet and Fatorić, 2015). Although informal institutions, such as the ways in which societies interact, also play an important role in climate change adaptation (Berman et al., 2012), formal institutional bodies (particularly government institutions which have their mandate enforced by

legislation) play a major role in the allocation of resources, delineating responsibilities between actors, facilitating actions and mediating trade-offs (Cook et al., 2010). Hence, they are at the very heart of how the challenges of climate change will be addressed (Cook et al., 2010).

In addition to the availability of infrastructure, resources and technology (Arnell and Delaney, 2006; Charlton and Arnell, 2011), the adaptive capacity of water-related institutions (Charlton and Arnell, 2011; Engle, 2011) will depend on how effectively decision makers can gather the required information and knowledge; recognize the need for adaptation; and decide to undertake adaptation (Yohe and Tol, 2002). Adaptation, therefore, involves the exchange of knowledge and experience (Brown et al., 2013a,b; Adger et al., 2005; Lejano and Ingram, 2008; Ziervogel and Downing, 2004) through networks at various scales (Adger et al., 2005; Juhola and Westerhoff, 2011). The role of social networks to enhance the adaptive capacity of individuals (Benson et al., 2015), farmers (Aulong et al., 2012), communities (Brown et al., 2010), non-profit organisations (Steinberg, 2009) and societies (Clarvis

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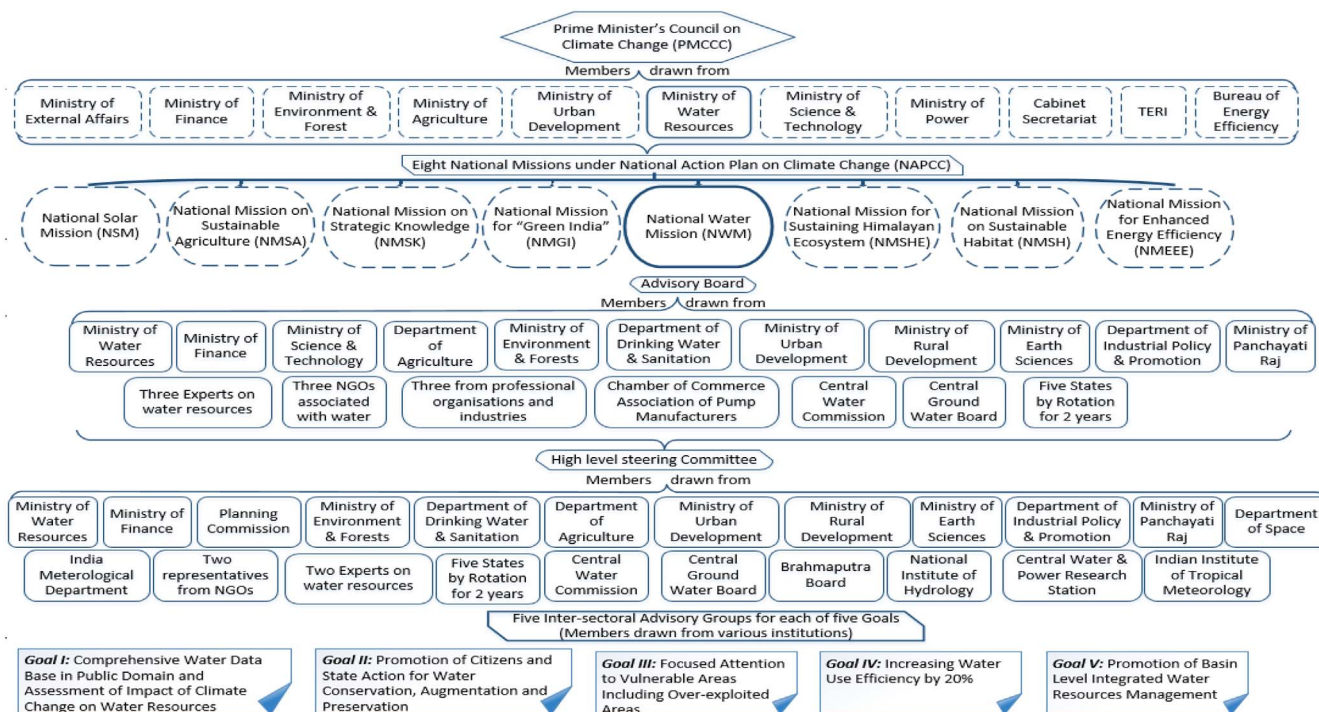


Fig. 1. Institutions involved in the National Water Mission under the National Action Plan on Climate Change in India. (Adapted from (MWR, 2011) and PMCCC, 2008).

and Allan, 2014; Davies, 2005; Dow et al., 2013; Lejano and Ingram, 2008; McAllister et al., 2014; Pasquini et al., 2015; Provan and Milward, 2001) is widely recognised. Social networks between key officials allow institutions to cross or blur formal institutional and sectoral boundaries, building 'relational capital' (Wallis and Ison, 2011) and providing "a constellation of relationships that can be activated when needed" (Lejano and Ingram, 2008; p. 251). Such inter-institutional networks are complex because institutions are made up of individuals (Pahl-Wostl, 2009) with different personalities and motivations. However, knowledge regarding networks among public institutions is very limited (Arnell, 2010). Therefore, there is a need to understand the factors and circumstances that strengthen the ties and cooperation between various institutions and sectors for information diffusion and knowledge exchange (Popp et al., 2013) that ultimately enhance adaptive capacity.

Literature on identifying characteristics and attributes that enable (Wilby and Vaughan, 2011) or hinder (Moser and Ekstrom, 2010; Sciulli, 2013) institutions to adapt to climate change is growing (Biesbroek et al., 2013). However, the circumstances under which such enabling factors are utilised, enhanced, created or shared among institutions or how adaptation barriers emerge (Azhoni et al., 2017), persist and affect the capacity of water institutions to adapt are poorly understood (Eisenack et al., 2014). Achieving the desired adaptation goals is not contingent on adaptive capacity alone, but also upon many factors such as socio-economic and cultural factors (Azhoni et al., 2017) that shape decision makers' perceptions of risks (Liu et al., 2016; Smith et al., 2014), willingness to act (Adger et al., 2009; Gifford et al., 2011; Grothmann et al., 2013) or to prioritise actions. How actors perceive what options and alternatives are under their control, and perceptions of who the key stakeholders are, is particularly pertinent for deliberating and implementing adaptation strategies (Moser and Ekstrom, 2010). Therefore, understanding the traits of the governance system regarding who has control over the processes of policy making and resources allocation will play an important role in determining the adaptation outcome (Berrang-Ford et al., 2014).

Since adaptation usually entails the involvement of key stakeholder institutions, identifying the underlying adaptation barriers to their (lack of) involvement (Azhoni et al., 2017) is pertinent. Even the best top-

down national or regional plans may not necessarily translate into successful adaptation (Preston et al., 2010), as adaptation is context specific (Eisenack et al., 2014) and contingent upon such factors as the aptitude and attitude of implementing agencies towards risks (Berkhout, 2012; Wilby and Vaughan, 2011), political and circumstantial priorities (Haddad, 2005) and the availability of resources and technology. Exposing the factors that stop, divert or delay institutions to effectively adapt are crucial in the adaptation process (Berkhout, 2012). Although adaptation research is transitioning from awareness raising to strategizing adaptation (Mimura et al., 2014), few studies demonstrate that adaptation is occurring (Moser and Boykoff, 2013). The limited reports of actual adaptation (for example, Tompkins et al., 2010) are confined to industrialised countries that afford lesser relevance to developing countries that have competing developmental and economic priorities. Therefore, in this study, while we unpack the complexities of inter-institutional relationships and their individual and joint involvement in climate change adaptation in the context of water management, we aim to identify and expound adaptation and network barriers by looking at the complexities in a large and multi-faceted context exhibited by a developing economy, India.

### 1.1. Context: climate change adaptation in India

Facilitating adaptation is particularly important in the Indian subcontinent, where climate change is likely to impact a billion people (Immerzeel et al., 2010) and magnify the existing water management challenges of growing demand (Bhuiyan et al., 2009; Mukherjee et al., 2010), poor performance and deteriorating infrastructure (Ananda et al., 2006; Basu and Joshi, 2000). India is a welfare state (Narain, 2000) where government institutions both frame laws and policies (Saleth, 2004), meet water demands and manage water related disasters (Ananda et al., 2006). At the Union (national) Government level, multiple ministries have responsibility within the water sphere, supported by many agencies and research institutions. This institutional complexity is evident (Fig. 1) within the current National Water Mission (NWM) (MWR, 2011) that is being implemented under the National Action Plan on Climate Change (NAPCC) (PMCCC, 2008).

This research focusses on Union Government Ministries, govern-

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