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Comparing the local level climate change adaptation strategies in Europe and Canada

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Abstract

The task of adapting cities to the impacts of climate change is of great importance—urban areas are hotspots of high risk given their concentrations of population and infrastructure; their key roles for larger economic, political and social processes; and their inherent instabilities and vulnerabilities. There are significant achievements of adaptation policies and at the same time there are evidences of shortcomings. This paper tries to explore the present local government urban planning approaches whether these include climate change adaptation policies in European and Canadian cities. Several issues are being considered to assess the situation in terms of: a) local knowledge and awareness among the citizens, b) characteristics of existing policies and measures of local government bodies, c) conflicts among different policies in different sectors and d) limits of the adaptation strategies. To compare these situations among different municipalities, secondary sources of data will be collected through researching international journal articles, local municipality plans as well as reports published by international organizations. Finally, the paper will emphasize the major important issues and recommend the strengths of local government initiatives to adapt the possible climate change impacts in studied countries.

Key words: Local government, climate change, adaptation, Europe, Canada.

1. Introduction

Extreme climatic event is a term encompasses the bulk of natural hazard (Blanco, 2006). Climate change is expected to increase the number of strength of these natural hazards in coming years, leading to an incremental rise in the vulnerability of natural and social systems (IPCC, 2001a). Governments seem to be becoming more aware of the negative impacts of climate change. Consequently, policy makers are showing more interest in adaptation discussions at the international and national level (Pielke, 1998). Actions to reduce the human contribution to the changing climate are slowly happening but they so far seem too few and too limited to make significant difference to the climate change scientists predict (Lemons, et.al. 2007). Until the last

couple of years, the European Union with the primary focus on delivering the Kyoto targets and mechanisms has played a rather limited role in adaptation. However, with the publication of the European Commission's Green Paper '*Adapting to climate change in Europe – options for EU action*' June 2007 (CEC, 2007) and the subsequent White Paper '*Adapting to climate change: Towards a European framework for action*' in April 2009 (CEC, 2009b), the European Commission acknowledged the need for comprehensive adaptation strategies in member states. In addition, the Commission stressed the importance of an integrated impacts assessment and comprehensive adaptation strategy at the EU level by 2013 (Biesbroek et.al. 2010). At the same time, public awareness of climate change has increased dramatically in Canada and changing weather trends, extreme weather events, and associated impacts are being blamed – rightly or wrongly – on climate change. Municipalities in Canada are responsible for many affected services and infrastructure: electricity distribution; water supply; storm water management; the state of local roads; bridges, and culverts; public health; social welfare; and more (Penny, J., 2009). As a consequence, a growing number of local governments are considering how to respond to climate change in Canada. The EU organized five workshops to share information for climate change adaptation policies in the ways by involving: (i) the research community, (ii) the EC climate negotiation team and through it the EU Member States representatives, (iii) other commission interests (the stakeholders), (iv) a range of 'outside' stakeholders including industry, finance and commerce, employment, environment, consumer and citizen interests (Hove, 2000). At the same time, Canada has initiated to adapt climate change policies through federal, provincial and municipal government. At the federal level, Natural Resource Canada (NRCan, Primary impacts and adaptation assessment) and Environment Canada (primarily science, including model developments and scenarios) have been involved in adaptation efforts since the late 1990s. At the provincial level, environment ministries have taken the lead on adaptation in most of the cases (Westerhoff, et. al., 2010). This paper explores the present initiatives of climate adaptation policies in some selected countries in European Union and Canada through Federal/EU, provincial/state and local municipalities. The ability to communicate information on impacts, vulnerability and adaptation is considered to be necessary and vital for effective adaptation according to the National Adaptation Strategies (NASs). However, nearly all the NASs emphasise the need to take action at the regional or local level with shared responsibility across administrative scales, reflecting that the effects of climate change will be felt locally and may vary greatly even within national and international border (Swart, et.al., 2009). Canada and most of the EU countries have taken initiatives to prepare NASs emphasising the future adaptation policies to tackle the forthcoming risks of climate change impacts in major cities.

2. Methodology

The main goal of the study is to assess the current adaptation policies of Canada and some selected countries of EU. To compare the efforts of the different countries, four different criteria have been applied as:

- a) Local knowledge and awareness among the citizens,
- b) Characteristics of existing policies and measures of local government bodies,
- c) Conflicts among different policies in different sectors and
- d) Limits of the adaptation strategies

Country selection within the EU was limited to five because of relevant information and sources of data. Canada is being chosen as well to compare the situation in different continents.

Sources of data are mainly based on secondary sources. National Adaptation Plans of EU and Climate Change adaptation policies in provinces (Ontario and Nova Scotia) of Canada have been studied. Relevant published peer reviewed journal articles as well as climate change adaptation reports have been carefully researched to collect up to date information regarding climate change adaptation initiatives through local government in Canada and in EU.

3. Factors driving the development of National Adaptation Strategies in Europe and in Canada

Several supportive or contrasting factors explain why countries decide to develop a National Adaptation Strategy. Basically there were two factors in it: (i) driving factors and (ii) motivating factors. In Canada, the Atlantic Provinces have taken National Adaptation Strategies through their ministries. However, park Canada has also taken initiative to prepare adaptation strategies for the federal government for long – term adaptation planning (Park Canada Webpage, 2010). In the UK, Tompkins et al. (2009) identified a large list of climate and non-climate triggers and drivers that directly or indirectly support the development and implementation of an adaptation strategy. In practice, it is often a culmination of different factors that triggers development – a common hierarchy could not be established in the EU (Biesbroek, et al., 2010). Moreover, the underlying motives to develop adaptation strategies are not always explicitly mentioned. For instance, comparing the motives of the countries becomes difficult since the emphasis of these factors varies by countries: for example, the projected impacts on water resources are emphasized in almost all countries, but recent actual drought events were the prime motivator for action in southern European countries, whereas high profile flooding had a comparable galvanising effect in central and northern Europe (Biesboerk, et al. 2010).

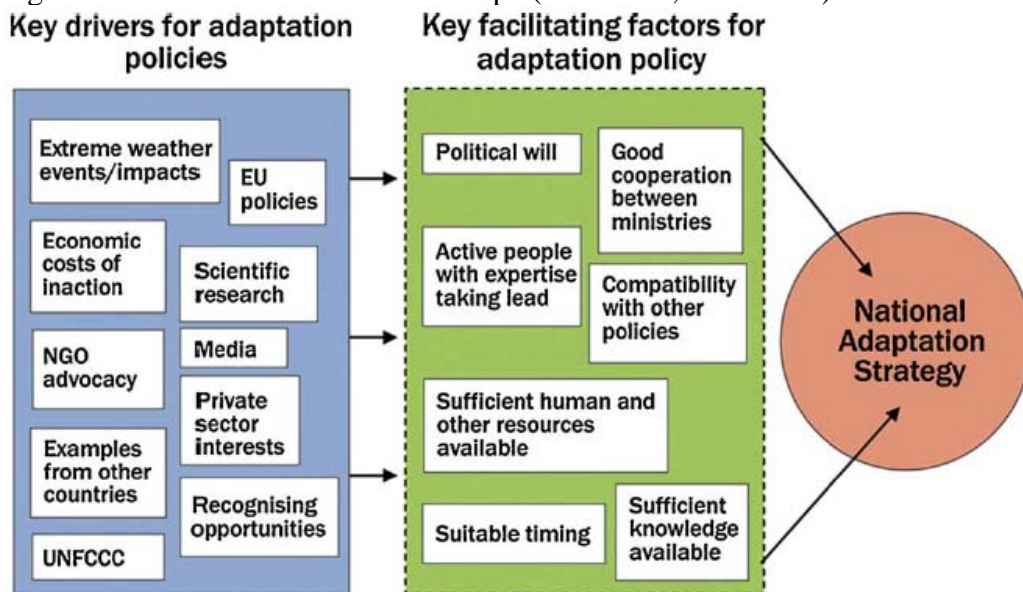


Figure 1, Key drivers and facilitating factors of National Adaptation Strategies in the EU. (Source: Swart et. al., 2009)

Figure 1 shows the driving and facilitating factors of preparing National Adaptation Strategies in the EU countries. Most of the factors are also common in case of Canada and especially in the Atlantic Canadian Provinces where they have already initiated this strategy in 2008 (Ministry of

Environment, NB). Even before activities started at the European level, since the turn of the century, policy makers at national and lower levels of governance have begun to initiate dedicated adaptation practices to counter adverse impacts. Initially the most vulnerable cities, regions and sectors started to include resilience into their planning activities. These adaptation practices are anticipatory and planned (Smit et al., 2000; Smit and Wandel, 2006) and include both national and regional adaptation strategies as well as practical steps at community level or by individuals. At the Council of the Federation (COF) 2008 meeting in Vancouver, Premiers of provinces in Canada agreed that further collaborative work is needed to adapt climate change. Concurrent with the COF discussions, the Council of Atlantic Environment Ministers has identified climate change, and especially climate change adaptation, as a key environmental issue for Atlantic Canada. The following table shows the overview of National Adaptation Strategies in Europe and some provinces in Canada.

Table 1, Overview of the National Adaptation Strategies in Europe (Swart et. al., 2009), Atlantic Canadian Provinces and Canadian initiatives (<http://nrca.gc.ca>).

Country/ Province	National Adaptation Strategies (NAS)	Year	Responsible for the development of the NAS
Denmark	Danish Energy Agency, 2008	2008	Ministry of Environment, shifted in 2008 to Ministry of Climate and Energy
France	Strategie Nationale d'adaptation au changement climatique	2007	Inter-ministerial delegate for sustainable development
Germany	Deutsche Strategie zur Anpassung an den Klimawandel (BMU)	2008	Environmental Ministry supported by the Federal Environmental Agency
Spain	Plan de nacionale de adaptacion al cambino climatico (PNACC)	2006	Environmental Ministry: National office for climate change
United Kingdom	Adapting to climate change in England, A framework for action (DEFRA)	2008	Department of Food, Rural Affairs and the Environment
New Brunswick (NB), Nova Scotia (NS), Prince Edward Island (PEI), Newfoundland and Labrador (NL)	Climate Change Adaptation Strategies for the Atlantic Canada	2008	Ministries of Environment (NB, NS, PEI, NL)
Canada	From Impacts to Adaptation: Canada in a changing climate	2007	Natural Resources Canada

From the table 1, it is clearly seen that most of the European Countries and Canadian Provinces have started to work with national climate change adaptation strategies since 2007.

4. Local knowledge and climate policies in Canada and some EU countries

Climate change impacts affect societies in complex and broad-ranging ways as technological, economic, social and ecological changes take place across regions, groups and sectors. In North America, vulnerability to climate change depends on the effectiveness and timing of adaptation, as well as the distribution of coping capacity. While Canada has considerable adaptive capacity when compared to many less developed nations, vulnerability and adaptive capacity are not uniform across the whole country. Socially and economically disadvantaged populations are likely to have less adaptive capacity than the population as a whole, and climate “surprises” may bring weaknesses in adaptive capacity to light that were not previously recognised (Bizikova, et al., 2008). Community attributes, including social networks, social cohesion, volunteerism, economic and income diversification, contribute to adaptive capacity and resilience. Cross national public perception on climate change and global warming show that people in different countries think that most of the people think that the issue is very serious (Canada: 58%, Denmark: 55%, Germany: 73%, Portugal: 72%, UK: 62%, USA: 47%) in compare to not at all serious (Canada: 9%, Denmark: 13%, Germany: 3%, Portugal: 10%, UK: 8%, USA: 12%) (Brechin, 2003). It also shows that people in the EU countries are more aware about the climate change issues than in North America. Based on the available information and contemporary research works, both Canada and countries in the EU have taken necessary policies and measures to adapt the possible climate change threats in their own territory. Most of the adaptation policies are taken by the federal and provincial governments in Canada and states and EU in Europe. Considering the experiences from the European adaptive policies by PEER and Environment Canada, following are the sectors, the federal/provincial governments and the states in the EU are working on:

- a) Water crisis (In Alberta, Ontario, Portugal, Sweden)
- b) Flood challenges (Germany, Lithuania, Denmark, Finland)
- c) Warm summer and cold winter (Ontario, Norway, Italy, Spain, Portugal)
- d) Forest fire (British Columbia, Portugal, Spain)
- e) Cyclone and water surges (Atlantic Canadian Provinces, the Netherlands)
- f) Storm water management (British Columbia, the Netherlands, Sweden, Finland)

5. Local governments and climate change adaptation initiatives in Canada and EU (Selected countries)

Local governments are the major policy players in the area of climate change policy over the past 20 years (Alber, Kern, 2007). During this period of time many cities around the world (Toronto, Halifax, Stockholm, Colone, Helsinki, Rotterdam, Barcelona, Vancouver, and Copenhagen) have developed their climate action plans and strategies. Global climate change mainly affects to the local governments in three different ways as: a) a high and increasing portion of Green House Gases (GHG) emissions is generated in cities, b) the effects of global climate change have direct impacts on cities and c) linkages and synergies between climate policy and sustainable development become most obvious at local level and motivate cities to generate the social and technological innovations which help in the reduction of GHG emissions and adaptation to the new challenges. However, the actual response of local governments varies considerably due to:

- i) The impact of global climate change at local level (such as precipitation, flooding, rising sea levels, coastal erosion etc.) and the perception of regional vulnerabilities and risks by citizens and policy-makers;
- ii) A city's competences and authority to regulate climate-relevant issue areas, its commitment to fight global climate change and its capacities to do so;
- iii) National programs which support local initiatives, in particular initiatives of local authorities which lack the resources to follow the pioneers;
- iv) The involvement of cities in national and transnational networks, which facilitate the exchange of experience, the transfer of best practice and the joint development of innovative solutions

(Albert and Kern, 2007)

Attempts have been taken both from the EU and Canadian federal government to connect different levels of governance to address adaptive capacity. The following figure shows the situation in detail.

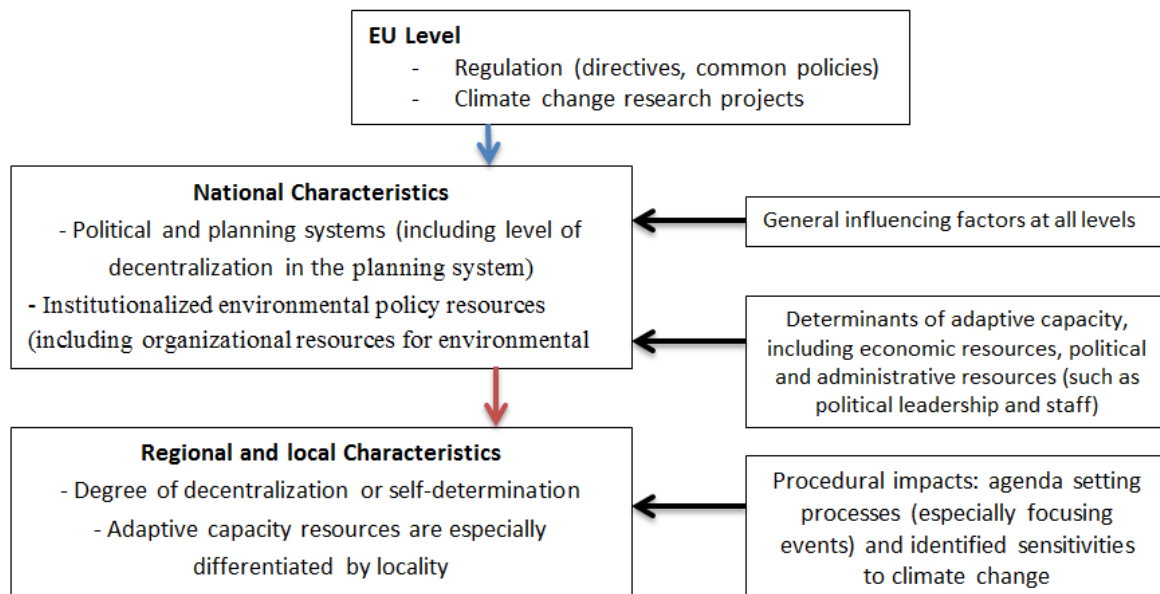


Figure 2, Simplified figure of the impacts on development of adaptation policy practice in a multi-level context in EU.

Figure 2 and figure 3 shows the simplified policy practices followed in Canada and in the EU countries. However, bottom up adaptation policies are also coming up from the grassroots level in both EU and in Canada based on the local experiences of natural disasters as well as climate change impacts (storms in the Atlantic Canadian Provinces and forest fire in Spain and Portugal). From figure 2, it becomes clear that an exploration of adaptation to climate change within a governance context necessarily entails defining a complex network of actors and options in the EU. Despite the absence of a national framework that lays out federal and provincial responsibilities in Canada, formal initiatives on adaptation are underway in selected Canadian provinces. While the federal process that led to the development of the adaptation framework

fostered networking among the provinces to exchange information, adaptation efforts are undertaken within multiple ministries throughout the provinces.

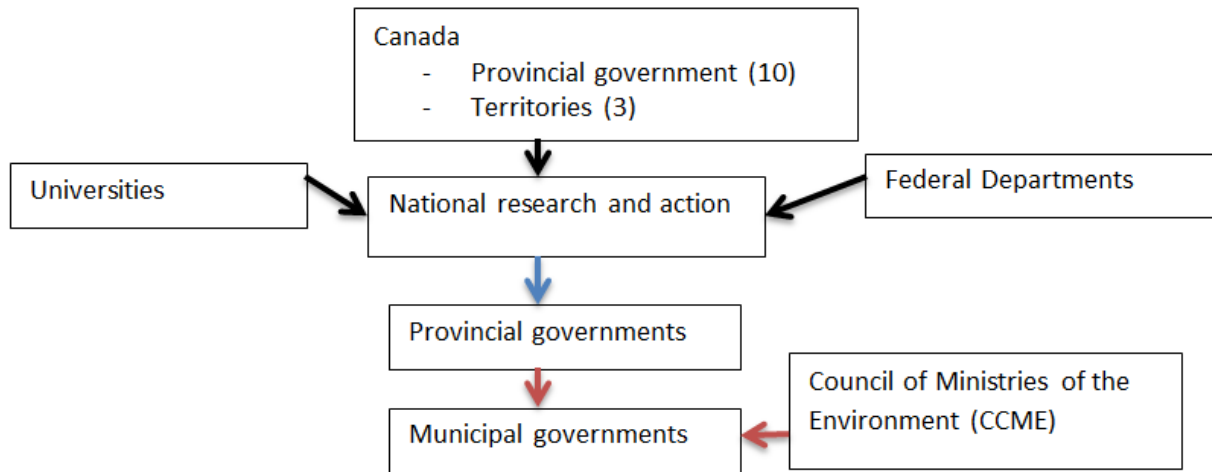


Figure 3, Simplified approach of the Canadian climate change adaptation policy practices.

Climate change adaptation can in these respects be related to the above described dimensions of the governance context that influence adaptive capacity at different levels. An important additional characteristics may be that of the transferability of adaptation options: to what extent can different areas and actors learn from each other – and to what extent may adaptations be too locality or context specific to transfer?

The present urban planning systems both in Canada and in EU have considered climate change adaptation policies in to their planning systems. Local municipalities are initiating their own strategies that suit well with their local plans along with the national climate change adaptation strategies through the NAS. The following table shows different areas whether the local municipalities have considered or not.

Table 2, Comparing the presence of climate change adaptation policies in the local municipalities in EU and Canada

Criteria	Canada	EU
Local people’s involvement in the adaptation planning process	Yes	Yes
Following the NAS	Yes	Yes
Overlapping in implementing policies and strategies	No	Yes
Monitoring projects	Provinces	State

Table 2 shows that in the provincial/state or local municipalities are involving local people to take advantages of sharing information on probable adaptation planning approaches in almost all the countries in EU and in Canada. However, the overlapping of implementing the policies are found in the EU countries because of the differences of legislation and responsible ministries who are taking care of these plans. In Canada, the federal government has given responsibilities to the provinces which ensure less overlapping of implementing the local adaptation plans.

6. Case Studies

i) Annapolis Royal's tidal surge project in Nova Scotia

Annapolis Royal, Nova Scotia, is a small coastal community located on the southern shore of the Bay of Fundy. It is vulnerable to flooding because much of the region is below sea level as a result of Acadian settlers using dykes to reclaim land from the sea during the 17th century, and the fact that land has been naturally sinking for thousands of years.

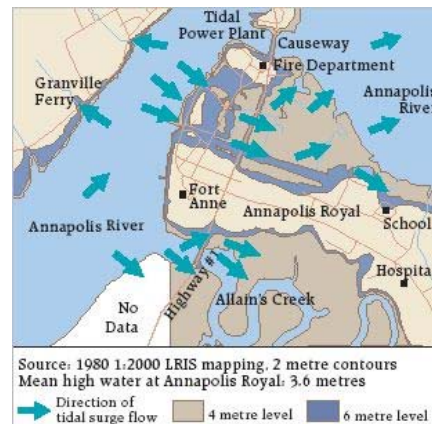


Figure 4, Map of Annapolis royal tidal surge project, (Source: NORDREGIO, 2010)

With minimal resources, a citizens-based group, Clean Annapolis River Project (CARP) conducted an assessment of the town's vulnerability to storm surges (http://www.c-ciarn.ca/primer/page14_e.html). CARP discovered that a tidal surge during a severe storm was a rare but real threat to coastal zones in their region, particularly if it occurred concurrently with an unusually high tide (at least once a year). Using future climate change scenarios and resulting sea level rise predictions, storm surge floods were mapped at four and six meters above mean sea level (in figure 4). With the information gathered, CARP was able to identify wide potential risk zones for tidal surge flooding and some possible implications for people living in the region. In response, adaptive planning measures have been taken. For example, the detailed maps outlining potential flood zones effectively demonstrated the need for proper dyke maintenance, and the need to raise these structures has been acknowledged by the provincial government. CARP's tidal surge project demonstrated that even with limited resources, communities can reduce the uncertainty of climate change effects and find ways to adapt. Because Annapolis Royal is sinking and storm surges have been known to cause floods in the past, the adaptations recommended by the city's vulnerability assessment has benefitted regardless of impacts brought on by climate change (C-CIARN, 2006).

ii) Greve Adaptation Project (Denmark)

Located on the coast in the southern part of the greater Copenhagen area and situated in lowland terrain, Greve can be said one of the most flood-prone areas in Denmark. The municipal council has decided to upgrade the capacity of the existing drainage and sewage system to be able to carry 30% more water especially during flood time. The planned adaptation measures were however costly and Greve had to bear significant additional costs in order to adapt climate

change. Two major flooding events have already occurred this century in 2002 and 2007. Adaptation of the city to climate change is undertaken using a so called ‘strategy model’ developed by Greve municipality. The model is used to help prioritize those areas of the city to undergo adaptation first. The implementation model combines a digital terrain model with a hydraulic model. Using various rain scenarios and basic flows in the streams, the model calculates which areas will be flooded first and this is crucial knowledge to have when seeking to put necessary adaptation measures into place.

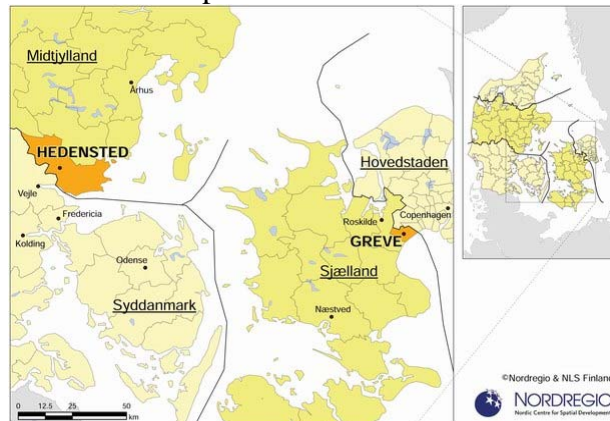


Figure 5, Greve municipality map. (Source: NORDREGIO, 2010)

Implementation of the model is supported by continuous surveying of the streams and the sewer system to calibrate and validate the model’s performance and to raise the alarm in case where high water levels are found. The vision of Greve is to have a model of the total water system. All of these actions are coordinated with the implementation of the EU flood directive in order to predict future flooding and to mitigate the societal impacts of flooding.

iii) Storm water Management Program in Greater Vancouver Regional District, Canada

The Greater Vancouver Regional District (GVRD), a partnership of 21 municipalities and one electoral area, is home to more than two-million people with significant growth expected in the future. As a regional authority, the GVRD is well placed to play a pivotal role in promoting and facilitating the development of climate adaptation measures (Metro Vancouver, 2010). In developing the Integrated Stormwater Management Plan (ISMP) process, the GVRD and its members created an inclusive and comprehensive tool for managing complex risk-management issues that improves the region’s capacity to deal with environmental risk, including the potential risks of climate change and variation.

Some examples of municipal stormwater efforts include:

- bylaws that encourage more natural drainage in new developments
- street sweeping and storm drain cleaning
- creek and watercourse maintenance as well as stream enhancement to improve habitat for aquatic life
- stormwater quality and quantity monitoring
- education programs (e.g. yellow fish storm drain marking to remind residents that materials dumped into storm drains can kill fish and damage habitat)

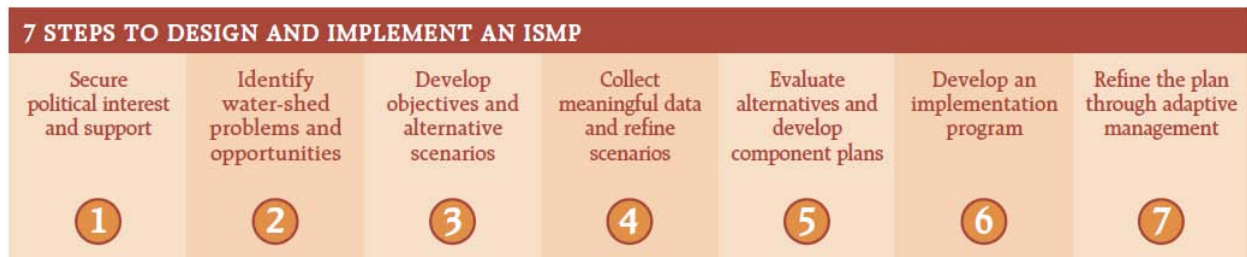


Figure 6, Seven steps to design and implement an ISMP in Vancouver. (Source: C-CIARN, 2006)

Figure 6 shows the steps that have been followed by the GVRD to implement the stormwater management program to adapt the future climate change and water crisis issue.

iv) Flood preparation in Cologne, Germany

In Cologne, the climate change adaptation measures currently in place comprise only those measures used directly to counter the flood hazards. These measures began life as a ‘quick start program’ set up immediately after floods in 1993 and 1995 which resulted in a Flood protection concept (1996). The city has taken structural flood protection projects that include: installing dykes and flood protection barriers, avoid flooding via the drainage system, ensure the operations of the sewage networks and, protect public utilities such as electricity, gas and water. Public awareness building programs to adapt the situation as well as mobile flood protection system have been highly successful to adapt the climate change threats in Cologne with the direct help from municipality and federal government.

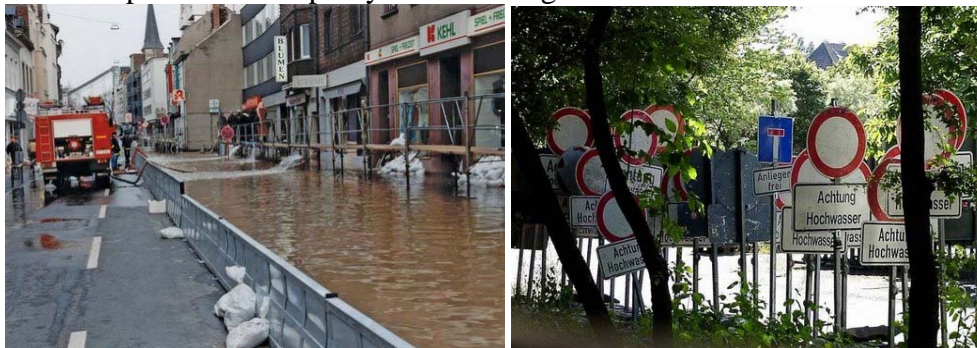


Figure 7, Mobile flood protection system and public awareness billboards in Cologne. (Source: NORDREGIO, 2010)

Mobile flood protection system can be seen in figure 7 where the temporary dykes protect flood water to invade in other part of the city in Cologne. At the same time, public awareness building campaigns can be seen in figure 7 to show probable height of the water during flood time in Cologne, Germany.

7. Conclusion

The present study concludes that the factors driving the development of adaptation policy vary in different countries, but common element is that developments have been fast especially when the municipalities have experienced severe climate change impacts such as: bush fire, flood, extreme heat events, snow storms and cyclones in European countries and in Canada. Case studies in the present work has also emphasised that communication and awareness raising is a very important tool to adapt the future climate change threats. The array of current projects and activities is not yet welded together into a detailed long-term strategy, however, and there are both internal and external barriers to the development and implementation of different strategies considering the governance boundaries. Two key points could be emphasised in this regard as: first, it is very hard to get decision-makers to commit to what could be expensive and far reaching adaptation projects and retrofits where they are not convinced about the extent and the timeline of expected changes. Second, skilled persons in the municipalities are not enough to develop climate change adaptation projects to avoid the probable climate change impacts both in EU and in Canadian municipalities. For example, in the city of Toronto, it has dozens of staff working on projects and programs related to climate change mitigation, it has only one staff person whose primary work is adaptation (Penny, et al., 2009, p. 13). Besides, knowledge of multi-level governance framework is very much important to develop a more effective policy for municipalities on adaptation to climate change. The establishment of institutional capacity at the municipal level is also important to handle the future challenges of climate change adaptations both in EU and in Canada. In this regard, there is a need for more research to increase the understanding of how different levels of governance influence and interact with each other and of the processes leading to efficient networks and interactions between and across governance levels.

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