

A roadmap to effective urban climate change adaptation

R Setiadi

Department of Urban and Regional Planning, Diponegoro University, Jl. Prof. H. Soedarto, Tembalang, Kota Semarang, Central Java 50275 Indonesia

Abstract. This paper outlines a roadmap to effective urban climate change adaptation built from our practical understanding of the evidence and effects of climate change and the preparation of climate change adaptation strategies and plans. This roadmap aims to drive research in achieving fruitful knowledge and solution-based achievable recommendations in adapting to climate change in urban areas with effective and systematic manner. This paper underscores the importance of the interplay between local government initiatives and a national government for effective adaptation to climate change and takes into account the policy process and politics. This paper argues that effective urban climate change adaptation has a contribution to build urban resilience and helps the achievement of national government goals and targets in climate change adaptation.

1. Introduction

A framework is something larger than a theory that serves a particular function at least to describe a particular subject in a systematic manner and ideally to provide key elements that allow thorough analysis to the subject [1]. This indicates that a framework is required because there is complex and unstructured yet past and existing knowledge on the subject of interest. Climate change in general and climate change adaptation in specific may fall to this subject of interest. Hulme [2] states that climate change as ideas has traveled far away from its original root in the atmospheric study since the 1950s and it has crossed various disciplines, from economics to politics and from social to psychology.

The development of a framework will make it easier for a researcher, in particular, to position his or her research in such complex and massive jungle of climate change knowledge. It helps a scientist to shape his or her focus on this contested and rapidly changing terrain. A good framework may assist a group of researchers or scientists to communicate each other, through hopefully constructive debates on each key element of the framework – although sometimes it could end up with heightened unproductive one. However, the proposed framework in this paper is more an invitation to constructive debate and hopefully end up with a collaborative research program to improve or even modify the framework.

2. Literature Review

2.1. *Why effective urban climate change adaptation*

As indicated in the earlier sub-section, climate change adaptation science has developed rapidly. Climate change adaptation as a notion is substantially more diverse and complex than its definitions. Adaptation to climate change has different meaning depending on the framing. Fünfgeld and McEnvoy [3] and Preston et al [4] for example have shown this case and it shapes different adaptation practices in over the globe. Fussel [5] has successfully unpacked complex scope of climate change adaptation in several categorizations, such as in terms of types of adaptation (autonomous vs.



planned), agents (individual vs. collective), adaptation horizon (short vs. long-term), and etc. Although, an empirical survey on adaptation practices [6] shows that most of the adaptation is short-term oriented, small-scale, and follow business as usual rather than reduce the effect of climate uncertainty in the future.

Effective climate change adaptation is a phrase that may put all of these notions in the same basket. Effective climate change adaptation contradicts to ‘mal-adaptation’, adaptation practices that only increase human and natural systems at the same level or higher risk due to climate change and variation, in which Eriksen and Brown [7] and Eriksen et al [8] call as ‘sustainable adaptation’. Effective climate change adaptation drives adaptation practices not only away from mal-adaptation but also achieve their additional goals harmoniously. Effective climate change adaptation has become one of the important themes in climate change research. It has become a focus of interest of many climate change researchers and scientists. A Google searching for phrase “effective climate change adaptation” offers more than 38,000 results, and with careful selection of scholarly sounds result in no less than 1200 documents, which address this phrase is found. Füssel [5] argues that the definitions of adaptation to climate change is not well developed and is open to various scopes and activities. However, the latest report of the fifth working group of the IPCC defines adaptation to climate change as ‘the process of adjustment to actual or expected climate and its effects’ [9].

Without a doubt, cities and urban areas play an important role not only in climate change mitigation but also in adaptation [10]; [11] because cities contribute to major global greenhouse emissions and are home for more than 60% of the global population today and 80% in 2050. Moreover, IPCC [9] also highlights the importance of cities in a single specific chapter of their latest report laying the foundations for strategies for effective urban climate change adaptation.

2.2. About the framework: some criteria

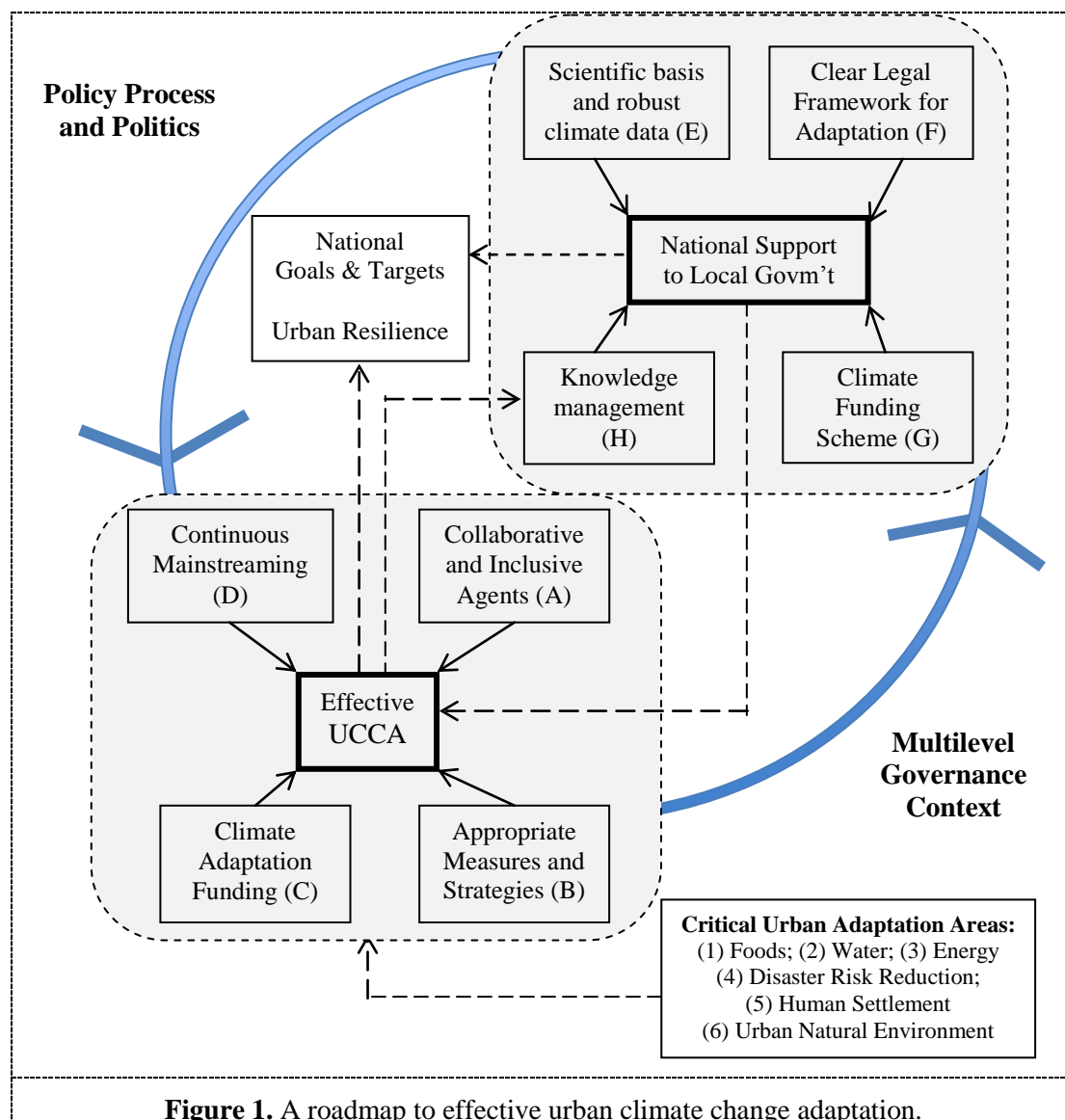
In addition to the literature review, this framework is built from author’s practical experience in the preparation of action plans and urban climate change adaptation strategies and author’s participation in a number of international collaborative programs. To begin with, this section will outline some criteria for the development of this framework.

There are a number of criteria in developing this proposed framework. First of all, this framework should be broad enough and flexible to cover multiple disciplines or subjects. It also capable to explain different dimensions, aspects or themes that are related to urban contexts such as human settlements, foods, energy, mobility, water, disasters (e.g. urban floods and drought), health, and etc. Secondly, the framework should cover various aspects that produce uncertainty in the future. At least, two crucial sources of uncertainty should be involved in the framework, namely: politics and policy-science relationships. Thirdly, the framework should consider various adaptation agents. It means that the framework provides space for analysis of adaptation initiatives delivered by governments, community groups, private sectors and other non-government actors or partnership between these actors including their adaptation performance. The performance of each actor may differ from one another following their organizational characteristics or institutional arrangements across the governance level. Fourthly, the framework should put attention to factors influencing the effectiveness of adaptation programs, projects or actions, such as mainstreaming, funding, cost-effective or affordable adaptation solutions, and etc. Finally, the framework should be able to link all these criteria for both explanatory and evaluative purposes, particularly to understand the ultimate goal of urban climate change adaptation. It is also essential to place the framework in broader and up-dated urban development discourses.

3. Discussion

A framework for research on effective urban climate change adaptation (Effective-UCCA) is illustrated in Figure 1. Besides the importance of local initiatives for effective adaptation to climate change, this research roadmap understands that adaptation to climate change also requires the support of the national government. Moreover, adaptation to climate change should also be framed in the

context of governance or multilevel governance. Multilevel governance is defined as a government that relies on more than one layer of government [12]. Multilevel governance is a model of governance that is inclusive; relying on either the role of government actors and non-governmental organizations [13]. Betsill and Bulkeley [14] categorize that the characteristics of multilevel governance in climate change has become one of the three important issues in the study of cities and climate change. There are two indications that reflect the existence of multilevel governance [15]. First, structures or institutions and actors or agents involved in the development of policy are increasingly more complex. Second, the success in addressing complex problems usually does not only involve a single institution or agency, but also institutions and agencies, which are at different levels of government. Multilevel governance is regarded as a model of governance that makes the management of climate change in cities becomes effective [16].



Therefore, cooperation among stakeholders that is inclusive and collaborative is extremely needed and becomes the first theme (A) in this roadmap. Some emerging research questions from this point of view are:

- A.1. How does collaborative climate change adaptation can achieve effective results? and in what ways?
- A.2. What are benefits generated from and challenges in implementing inclusive and collaborative climate change adaptation?
- A.3. What are effective strategies to encourage private sector participation in climate change adaptation?
- A.4. What sort of models for effective community participation in climate adaptation?

Effective adaptation to climate change is also determined by the management and appropriate adaptation strategies. There are various approaches to adaptation to climate change, which can be broadly divided into physical adaptations or infrastructural adaptation and non-physical adaptations that are more related to e.g. strengthening the capacity of the actors and the strengthening of community's social and economic access to adaptation [5]. Some studies also identified the use of technology for adaptation to climate change, particularly in the food and agriculture sectors. Other studies introduce ecosystem-based adaptation that is promoted by IUCN and a number of other scientists [17]; [18]. Among various adaptation activities, Biagini et al [6] evaluated that most of the adaptation actions are currently focused on social reinforcement and capacity building. Meanwhile, Satterthwaite and Dodman [19] state that physical adaptations are also required by developing and underdeveloped countries because at this time they actually have experienced 'infrastructure deficit'. Therefore climate change is creating new problems in responding to the deficit. Therefore, some research questions that arise from this second theme (B) are:

- B.1. What are efforts or strategies for urban change adaptation in urban areas? And is there any best approach to implement them?
- B.2. How do different approaches to climate change adaptation bring benefits to the city and its inhabitants?

Recent works of Setiadi and Nalau [20] for example addresses B2 question type by assessing whether urban regeneration through public vertical housing development is effective to improve urban health resilience and to deal with the changing climate.

Financing aspects of climate change adaptation become the third essential theme of this roadmap, given the absence of appropriate and adequate financing prevents adaptation actions and implementations. Some studies [21] underline the importance of and encourage the commitment to financing adaptation to climate change, particularly in developing countries. Without any adequate financial support, adaptation to climate change will likely be spontaneous, unplanned, relatively small in scale, and so the impact generated from them is also relatively limited. This pattern of adaptation does not much to change and to provide greater benefits to society. A number of important questions that need to be resolved on this theme (C) include:

- C.1. How much cost required to produce adequate adaptation actions? And what are economic benefits resulting from adaptation activities?
- C.2. How do climate change adaptation activities be implemented at low costs but provide effective results and greater impacts to society?
- C.3. How are the best way to integrate climate change adaptation activities and other activities that have economic or market values?

Mainstreaming adaptation to climate change to be one of research themes that is not less important in climate change adaptation. Adaptation to climate change will not run effectively when climate change is not on the agenda of all development stakeholders. In this mainstreaming, supporting conditions are necessary and required. It is a unique process as it also involves timing and the availability of the key actors and local champions, and political alignments. The theories of the policy process are important to understanding this; they can explain why does climate change policy, including mainstreaming process work very well or does not work at all in the city government. A study conducted by Setiadi [22] for example describes the process of adaptation policies to climate change in urban areas by applying one policy theories known as the advocacy coalition framework

[23]. Yet, many other theories that can be used to explain the development of urban climate change policies, such as the institutional analysis and development, policy diffusion, and multiple streams. Back in the context of mainstreaming for effective adaptation to climate change (D), there are a number of fundamental questions such as:

- D.1. What are key drivers for effective mainstreaming of climate change adaptation? And how to establish that key driver at the municipal level?
- D.2. How to encourage adaptation to climate change at the municipal level?
- D.3. What are capacities required by local actors to get the highest effective mainstreaming of climate change?

This research and practical roadmap can be applied in the areas of climate change adaptation at the local level and in particular in urban areas. In other words, the question type A to D above can be tested to explain and evaluate critical areas of urban studies. These critical areas or fields include (1) food, (2) water, (3) energy, (4) disaster risk reduction, (5) settlements and the built environment, and (6) the urban natural environment.

As described in Figure 1, the support of the national government is another element that makes adaptation to climate change at the city level effective. The national government also needs the support of international community. The elements of central government support consist of four other sub-elements, namely: support to basic scientific and reliable climate data, a clear legal framework for climate actions and adaptation programs, adaptation financing schemes, and knowledge management. Associated with the support for the scientific basis and climate data, there are several underlying research questions (E), such as:

- E.1. What are key drivers, barriers, and challenges in providing scientific evidence and continuous climate data?
- E.2. What are roles played by scientific evidence in urban climate change policy development? Are they really matters?

Some recent works such as Morgan [24] and Tangney [25] has addressed E2 questions. While Morgan [24] examines the case of science-policy relationship in water resource management in Southeast Queensland, Tangney [25] compares complex relationships between climate change adaptation policy and evidence in UK and Australia. Additionally, Setiadi and Lo [26] also explore the role of policy research in local climate change policies in the Indonesian context.

Various existing regulations (ranging from legislation, presidential decree, ministerial regulation, to the local regulations) greatly affect the effectiveness of climate change adaptation. The regulation can encourage or inhibit climate change adaptation. It is associated with a pattern of local government culture, especially in Indonesia, which still puts themselves as the executor rather than as an innovator or creator of policy breakthroughs. These regulations sometimes are unclear and overlapping, which raises doubts and reluctance of local governments to run climate change adaptation programs. Some of the key questions on this theme (F) include:

- F.1. What are regulations that still unclear, potential to generate contradictions, and inhibit adaptation to climate change?
- F.2. What are breakthroughs that should be done to overcome this?

The availability of financing from national schemes has become one of the incentives to city governments to run programs for adaptation to climate change. In 2008 the Indonesian government through BAPPENAS, for example, established the Indonesia Climate Change Trust Fund (ICCTF). Despite attracting international funds to support climate change programs in developing countries, the establishment of the ICCTF represented an attempt to respond to demands for greater coordination and harmonization of climate change funding. Yet, most Indonesian local governments are unaware of the existence of and the funding opportunities provided by the ICCTF. The ICCTF has funded a limited number of climate change projects and all of them were proposed by and went to ministries and institutions at the national level [27], rather than government agencies or non-state actors at the provincial or city level.

- G.1. To what extent of climate change adaptation funding is available?

- G.2. What are roles played by such funding scheme that is publicly opened to climate change adaptation initiatives? and what are effects following this open adaptation funding on the ground?
- G.3. What are barriers and challenges faced by local governments and local community actors in accessing available funding sources?

Efforts in building and maintaining urban resilience to climate change are strongly influenced by the ability of cities to manage knowledge [28], sometimes referred to knowledge management. The knowledge that is built from local actions or practice is important and valuable to be properly managed. The knowledge that can be managed includes methods, solutions, experience, systems, etc. Additionally, providing the media in the form of a forum, or a platform to facilitate the transmission of knowledge so that they can be exchanged to the entire network of the city is also essential.

In essence, the learning process becomes a very important component to accumulate knowledge and experience, as well as to find out what works and does not, including the factors that influence them. The practices of adaptation to climate change that has proven successful in a city or a community need to be lifted and to be disseminated in the other cities and communities involved. Thus, urban climate change adaptation activities are not always departed from the beginning or zero. Under this theme, a number of fundamental research questions include:

- H.1. What are the extent and forms of support made by the national government in encouraging peer-learning among cities in climate change adaptation?
- H.2. What are roles played by the process of peer-learning between cities in the context of urban climate change adaptation?
- H.3. What is the most effective mechanism to improve peer-learning among city governments?

4. Conclusion

This paper has described the rationale, development criteria, and the element of urban climate change adaptation framework. The framework aims to organize various themes of research and then it is expected to result in a roadmap toward research programs and practical actions focusing on urban climate change adaptation. As this framework is at its infancy stage, the framework welcomes further constructive suggestion and means to invite further research collaboration in this field.

References

- [1] Sabatier P A 1999 The Need for Better Theories *Theories of The Policy Process: Theoretical Lenses on Public Policy* ed P. A. Sabatier (Westview Press: Boulder) pp 3-17.
- [2] Hulme M 2009 *Why We Disagree About Climate Change: Understanding, Controversy, Inaction and Opportunity* (New York: Cambridge University Press)
- [3] Funfgeld H and McEvoy D 2014 *Environ & Plann. C: Gov. & Policy*. **32(4)** 603-22.
- [4] Preston B L, Mustelin J and Maloney M C 2013 *Mitigation and Adaptation Strategy for Global Change*. **20(3)** 467-497
- [5] Füssel H M 2007 *Sustainability Sci*. **2** 265–75 doi: DOI 10.1007/s11625-007-0032-y
- [6] Biagini B, Bierbaum R, Stults M, Dobardic S and McNeeley S M 2014 *Global Environ. Change*. **25** 97-108.
- [7] Eriksen S and Brown K 2011 *Climate and Development*. **3** 3-6.
- [8] Eriksen S, Aldunce P, Bahinipati C S, Martin R D, Molefe J I, Nhemachena C and Ulsrud K 2011 *Climate & Dev*. **3** 7-20.
- [9] IPCC 2014 Summary for Policymakers *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of WG II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* eds C. B. Field et al. (Cambridge University Press, Cambridge, UK and New York, NY) pp 1-32
- [10] OECD 2010 Urbanisation, Economic Growth and Climate Change *Cities and Climate Change*. pp 37-79.

- [11] UN-Habitat 2011 *Global Report on Human Settlements 2011: Cities and Climate Change-Policy Directions* (London: Earthscan)
- [12] Bevir M 2008 *Key Concepts in Governance* (London: SAGE)
- [13] Bache I and Flinders M 2004 *Multilevel Governance* (Oxford: Oxford University Press)
- [14] Betsill M M and Bulkeley H 2007 *Local Environ.* **12(5)** 447-56.
- [15] Crespy C, Heraudi J A and Perry B 2007 *Reg. Stud.* **41(8)** 1069-84.
- [16] Corfee-Morlot J, Cochran I, Hallegatte S and Teasdale P J 2011 *Clim. Change.* **104** 169-97.
- [17] Munang R, Thiaw I, Alverson K, Mumba M, Liu J and Rivington M 2013 *Current Opinion in Environmental Sustainability.* **5(1)** 67–71. doi: <http://doi.org/10.1016/j.cosust.2012.12.001>
- [18] Vignola R, Locatelli B, Martinez C and Imbach P 2009 *Mitig Adapt Strateg Glob Change.* **14(691)** doi: 10.1007/s11027-009-9193-6
- [19] Satterthwaite D and Dodman D 2009 The costs of adapting infrastructure to climate change *Assessing the costs of adaptation to climate change: A review of the UNFCCC and other recent estimates* eds M. Parry et al. (London: IIED and Grantham Institute for Climate Change, Imperial College London)
- [20] Setiadi R and Nalau J 2015 *Asian Cities Climate Resilience Working Paper Series* **23** (London: IIED)
- [21] Bouwer L M and Aerts J C J H 2006 *Disaster* **30(1)** 49-63 doi: 10.1111/j.1467-9523.2006.00306.x
- [22] Setiadi R 2015 The Emergence of Local Climate Change Adaptation Policy: An Advocacy Coalition in Indonesian Cities 1993-2013 [Dissertation] (Griffith University: Gold Coast)
- [23] Sabatier P A and Jenkins-Smith H C 1999 The advocacy coalition framework: an assessment *Theories of the Policy Process: Theoretical Lenses on Public Policy* ed P A Sabatier (Boulder: Westview Press) pp 117-166
- [24] Morgan E 2014 *International Journal Sustainability Policy & Practice.* **9(2)** 37-54.
- [25] Tangney P 2017 *Climate Adaptation Policy and Evidence: Understanding the Tensions between Politics and Expertise in Public Policy* (London: Earthscan)
- [26] Setiadi R and Lo A Y 2017 *Urban Policy and Research.* doi: <https://doi.org/10.1080/08111146.2017.1377607>
- [27] Gruning C, Menzel C, Shuford L S and O'Brien V S 2012 National climate finance institutions case study: The Indonesia Climate Change Trust Fund (ICCTF): (Frankfurt: Frankfurt School of Finance & Management). 1-22.
- [28] Kernaghan S and Silva J D 2014 *Urban Clim.* **7** 47-63.