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Title: Which institutional barriers (and opportunities) exist in the climate adaptation planning process and how they interact with each other in the Municipality of Beirut (Lebanon)?

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Which institutional barriers exist (and opportunities) in the climate adaptation planning process and how they interact with each other in the Municipality of Beirut (Lebanon)?

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Summary

The Municipality of Beirut has not up-taken climate adaptation policies nor has a climate adaptation action plan per se, at least there is no clear evidence. It seems that the need to plan for climate adaptation is not understood. The objective of this study is therefore to explain possible institutional barriers (at the Individual level, Organisational level and Enabling environment level) within the Municipality of Beirut that are hindering the adaptation process and in addition explain how they interact leading to '*vicious cycles*' of barriers in the understanding phase (Problem detection, Information gathering and use and Problem redefinition. On the other hand, the study also explains opportunities to overcome barriers.

The research strategy is a *single case study.* The study uses a *mixed method approach*. The main research method is *interviews* together with *expert consultations* and *content analysis.* Experts with a working background in Beirut are consulted to compare information provided by members of the Municipality. Similarly, analysis of existent written information such as a local publication or an official statement, are analysed to compare it with information provided by members of the municipality and the experts. To analyse data, barriers, vicious cycles and opportunities were quantified by the number of times they were suggested by informants.

The main barriers hindering the adaptation process are: *Climate scarcely on the municipality's agenda* (Enabling environment) that affects the Problem detection. The *Lack of interest* (Individual level) that affects the Problem detection and Information gathering and use, and the *Lack of a specialised department* (Organisation level) that affects the Problem detection, Information gathering and use and the Problem redefinition.

There are barriers that form vicious cycles. The main cycle is between *Climate scarcely on the municipality's agenda* and the *Lack of individual interest*. To some extent, most barriers are associated to them. From this cycle, other cycles can appear augmenting the magnitude of the problem. However, the simple existence of an institutional barrier does not necessarily imply the creation of new barriers.

On the other hand, the main opportunities to overcome institutional barriers are: *Central and international support* (Enabling environment level), *Data bank creation* (Organisational level), and in equal importance *Awareness of current climatic threats* (Individual level) and *NGO's and civil society pressure*.

It is concluded that there are crucial issues in the whole setting of the Municipality of Beirut that are hindering the understanding of climate adaptation. Vicious cycles perpetuate some existent barriers hindering the municipality's ability to continue the adaptation process. It is recommended for the Municipality of Beirut to address top barriers that it has relative control of strategically. The *Lack of interest* can be addressed through *Capacity building workshops*. The *Lack of a specialised department* can be tackled through the *Creation of a specialised department*. Further research is recommended on possible *virtuous cycles* of opportunities.

Keywords

Adaptation process, institutional barriers, interconnections, opportunities, Beirut.

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Abbreviations

CNRS	Centre National de la Recherche Scientifique
ESCWA	United Nations Economic and Social Commission for Western Asia
IHS	Institute for Housing and Urban Development
IPCC	Intergovernmental Panel on Climate Change
MoE	Ministry of Environment
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-HABITAT	United Nations Human Settlements Programme

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Chapter 1: Introduction

1.1 Background

Climate change is today a global scale issue that threatens humanity and sustainable development. The Intergovernmental Panel on Climate Change (IPCC), the scientific body of the United Nations dedicated to compile research on climate change globally reuniting tens of researchers and experts, states that "climate change exposes people, societies, economic sectors and ecosystems to risk" (IPCC, 2014a, p. 36). The IPCC defines climate change as "a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer" (IPCC, 2014b, p. 5).

Although natural historic variations in climate exist, it has been reported by researchers and leading organisations that in recent decades, human-caused or - anthropogenic greenhouse gas (GHG) emissions - especially carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) have importantly contributed to a changing climate (Hegerl, Zwiers, et al., 2007, Klein, Midgley, et al., 2014). These GHG emissions are "mainly driven by population size, economic activity, lifestyle, energy use, land use patterns, technology and climate policy" (IPCC, 2014a, p. 8). The IPCC reports that some of these emissions remain in the atmosphere while others are stored on land (in plants and soils) and in the ocean which causes its acidification. In addition, it states that half of the CO_2 emissions between 1750 and 2011 have occurred in the last 40 years (IPCC, 2014a).

More than 54% of the global population (4 billion people) is now urban (UN-Habitat, 2016). Increase in urban population has had adverse impacts for the environment and have contributed to a changing climate (UN-Habitat, 2011). Cities generate as much as 70% of global carbon dioxide emissions through the consumption of fossil fuels for energy supply and transportation (UN-Habitat, 2016). For the agency, urbanization and climate change converge in a way that their effects can have unprecedented negative impacts upon quality of life, and economic and social stability (UN-Habitat, 2011).

At the city level specific risks from climate change have been identified. Climate change increases "risks for people, assets, economies and ecosystems, including risks from heat stress, storms and extreme precipitation, inland and coastal flooding, landslides, air pollution, drought, water scarcity, sea level rise and storm surges" (IPCC, 2014a, p.15). In the context of climate change, risk occur when hazards are combined with societal or infrastructural vulnerabilities plus the level of exposure of people, assets or ecosystems in concern (Wamsler, 2014). With current projections of risks, climate change will have violent impacts for people and ecosystems (Revi, Satterthwaite, et al., 2014).

There are two fundamental pathways to address climate change. Mitigation to reduce GHG emissions and, adaptation to moderate harm from climate change effects (Burkett, Suarez, et al., 2014). Although both pathways are complementary, mitigation has received greater attention in policy perspectives basically due to its certainty (Füssel, 2007). However, it has been documented that there are already inevitable effects from climate change and therefore there is a need to reduce vulnerabilities, the level of exposure and adapt to its consequences (Bulkeley, 2013b, Noble, Huq, et al., 2014, Adger, S. Agrawala, et al., 2007).

Adaptation is defined as "the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects." (IPCC, 2014b, p. 5). An example of adaptation and sea

level rise is to set regulations that discourage and avoid new projects of buildings by the side of flood-prone areas and reinforce existing ones.

Climate change impacts are felt at a local level thus, "adapting to climate change will also require a wide variety of regional and local changes. As with climate mitigation, adaptation may be guided through nationally led mandates, but its implementation will be inevitably local in character" (Teasdale, 2010, p.173). Cities can develop adaptation action plans and strategies alone when there is a lack of support from the central government or the process is too slow. Cities in both developed and developing countries such as Vancouver, Chicago, Mexico City, Quito, London, Rotterdam, Berlin, Durban or Shimla have climate change action plans.

Nonetheless, globally the efforts to develop action plans or strategies at a local level are practically beginning in many cities, especially in developing countries (Bulkeley, 2013b, Carmin, Anguelovski, et al., 2012). The question is: do local government institutions frame climate change as a problem? Understanding the problem of climate adaptation is crucial to be able to make plans and implement them. In developing countries understanding climate change is particularly relevant because many cities have not been able to develop the adaptation plans, perhaps precisely because of a lack of understanding. This study therefore concentrates on the *understanding phase* of climate adaptation.

1.1.1 Brief context of Lebanon

Lebanon is a small Mediterranean country bordered by Syria and the Occupied Palestine with an estimated population of 5.9 million inhabitants of whom 1.5 million are displaced Syrians (Government of Lebanon, 2017). Lebanon's total territory area is 10,452 km2, three times smaller than the Netherlands. The middle eastern country is highly urbanized, 85 per cent of its population lives in urban areas (UNDP, 2008) and it has one of the highest population densities in the world ranking 11th with 391 persons/km2, higher than that of Japan with 336 persons/km2 (MoE, 2005).

Figure 1. Lebanon map with its capital Beirut in the circle. Source: http://www.lib.utexas.edu/maps/middle_east_and_asia/lebanon_pol_2000.jpg

Lebanon has acknowledged the existence of climate change through several official national governmental documents such as the three Lebanon's National Communications to the UNFCCC stating that Lebanon must prepare for the unavoidable consequences of climate change and presented mitigation and adaptation measures at the national level. The most emitted greenhouse gas was carbon dioxide produced mainly from fossil fuels. The energy sector was the main contributor with 74% of GHG emissions followed by the waste sector with 11% and the industry sector with 10%. A recent report (MoE/UNDP/GEF, 2015) stated that although Lebanon's total GHG emissions represented only 0.07% of the global GHG emissions (24,652 Gg CO2eq. in 2011), it will experience many effects from climate change such as higher temperatures, changing precipitation patterns and sea level rise.

According to a recent report (MoE/UNDP/GEF, 2015), effects from climatic changes are imposing costs on Lebanon. Today loses account for USD 800 million per year only in the agricultural and food sector. If current GHG emission trends continue, the total costs will equal 1,900 million in 2020, 16,900 million in 2040 and 138,900 million in 2080. This means that climate change costs will affect the families of people in Lebanon living today.

1.1.2 Beirut, the cosmopolitan capital city is vulnerable to climate change

Beirut, the largest coastal settlement in Lebanon, is the capital city and the most populated one. The Greater Beirut Area comprises adjacent municipalities forming one urban agglomeration that concentrates as much as nearly one third of the entire population of Lebanon with an estimated of 2 million people. Beirut's population density is 21,938 persons/km2 being the highest population density of Lebanon (MoE, 2005, Central Administration for Statistics (CAS), 2004).

Figure 2. Beirut map and districts. Source: https://www.aub.edu.lb/Neighborhood/Pages/analyticalmaps.aspx

Beirut is the central node of Lebanon in economy, politics, culture, art and fashion. It hosts several banks and main government offices and organizations. The Lebanese parliament and the president office, embassies and consulates are seated in Beirut. Several international organizations such as the Union of Arab Banks and many UN agencies such as ESCWA, UNDP, UNEP, among others are headquartered there. Moreover, Beirut is a multicultural and lively city with international shopping brands, diverse selection of restaurants, art galleries and an active nightlife. It is one of the oldest inhabited cities in the world dating back from the year 3000 BC and recently was voted as one of the new seven wonders cities (New 7 wonders, 2017).

However, Beirut is vulnerable to climate change. Several factors are contributing. The current conditions of Beirut as a coastal and highly densified city that concentrates a large amount of people makes it easily susceptible. The garbage collection crisis which started after the civil war in the 1990's and intensified a couple of years ago makes for a dirty city, threatens the coast and ocean life, and continues to be a huge problem addressed with temporary solutions (Strobl, J., 2016, Wood, J., 2017, Al Jazeera news, 2016). Traffic jams take place daily contributing to high levels of pollution (Duncan, 2010). In addition, Beirut has limited green areas which contributes to create urban heat island. Artificial dense urban fabric areas such as Mazraa, Bachoura or Achrafieh are 6°C hotter during summer than vegetated areas such as the park 'Horsh Beirut' (Kaloustian, Bitar, et al., 2016).

Some of the effects from climate change are: by the end of this century, Beirut will have 50 more days with temperatures exceeding 35°C and 34 more nights with temperatures exceeding 25°C (MoE/GEF/UNDP, 2011); Beirut is projected to have 126 hot days per year, the second city in the Arab States after Riyadh that are expected to witness more hot days per year (Alkantar, B., 2014). At a national level increases in temperatures will cause 2,483 to 5,254 additional deaths from from heat stresses, malnutrition, diarrhea, malaria and cardiovascular diseases per year between 2010 and 2030 (MoE/UNDP/GEF, 2015).

Rainfall and precipitation are declining (Navarra and Tubiana, 2013). Relative to the present, rainfall will decrease by 10-20% by 2040 and by 25-45% by 2090. Water resources will decrease 6-8% with an increase of 1°C and 12-16% with an increase of 2°C; droughts will occur 15 days to 1 month earlier and will extend 9 days longer by 2040 and 18 by 2090; storm surges are stronger and are more frequently hitting Beirut's coastline; sea level will rise 30-60 cm in 30 years with the current rise rate leading to seawater intrusion into aquafers, increase coastal flooding risk, coastal erosion and coastal ecosystems alteration; among others (MoE/GEF/UNDP, 2011).

Beirut cannot avoid these climate effects, but it can reduce its vulnerability by adapting to climate change. Beirut can facilitate the movement of existing structures and activities out of climate-risk prone areas, for instance along the coastline; discourage new structures in such areas; update design norms for households which are appropriate to anticipate climate risks or; strengthen institutions that are responsible for preparing to the climate effects on public health (MoE/GEF/UNDP, 2011). To this regard, the local government - the Municipality of Beirut - must start to understand adaptation to climate and follow an adaptation process.

However, political and institutional issues in Lebanon have lasting impacts. Lebanon national's life is highly influenced on hand by regional countries such as Syria, Iran and Saudi Arabia, and on the other hand by religious coalitions. This has acted against the political stability of Lebanon whose situation has been in a standstill with minimum legislative activity by the main public institutions. "The political and institutional paralysis has exacerbated the population's traditional problems, including those related to the management of basic services" (Goenaga, 2016, p. 224).

Moreover, Fawaz (2017) documented the widespread practice of issuing 'exceptions' in Beirut. Exceptions are the many different manners, forms or justifications in which building permits are issued by authorities to planning agencies and particular social groups, and materialise as either temporarily legal or extra-legally. It is suggested that this practice has become the norm contributing to current spatial and invisible structures of Beirut.

Furthermore, apart from the Ministry of Environment (MoE) which is a national level institution, in Beirut it is not clear whether any institution is responsible for climate change. According to Kaloustian, Bitar, et al., (2016) there is an absence of appropriate planning,

environmental and management acts in Beirut. Although there are urban planning codes and decrees, they do not consider urban climatology and associated health and environmental risks and impacts. On the other hand, considerations in the building law introduced in 2004 tackling issues of environmental sustainability in the construction sector were not based on scientific endeavours and without a strategic planning.

Recently the Resilience Master Plan for the City of Beirut was initiated by the Municipality of Beirut and the World Bank in collaboration with the consultancy firm BuroHappold. However, since resilience is viewed as comprehensive comprising several issues, adaptation measures may remain very general. In addition, the plan was halted at the moment of this study.

1.2 Problem statement

Although the Resilience Master Plan for Beirut was started, it is not clear how it would address climate adaptation. On the other hand, different official documents seem to place more emphasis on mitigation over adaptation measures. However, as it is stated above, Beirut is vulnerable to many climate change impacts and thus it must adapt to them. Though, no adaptation planning is taking place.

It is to highlight that only a few official government documents such as the National Communications to the UNFCCC briefly outline climate adaptation activities. These documents however usually keep suggestions at the national level and no specific actions for cities, nor for its capital Beirut which concentrates one third of the people in Lebanon, are stated.

Nevertheless, Beirut can develop its own climate adaptation action or strategy plan, as it has been done by other cities in the world. Though, the problem is that the Municipality of Beirut has not up-taken any climate adaptation policies or activities nor has a climate adaptation action plan, at least there is no clear evidence. It seems that this need to adapt to climate change and plan for adaptation is not understood or perhaps ignored by the Municipality.

1.3 Research objective

Since the Municipality of Beirut seems to lack adaptation activities and policies, the objective of this study is therefore to explain possible institutional barriers such as Lack of individual interest on climate change by members of the Municipality or Lack of climatic information which is the base to develop plans, that are hindering the adaptation process and how they may be interconnected in the understanding phase. This builds upon previous research agendas on the field of barriers in the climate adaptation process (Ekstrom and Moser, 2014, Biesbroek, Klostermann, et al., 2013, Eisenack, Moser, et al., 2014). On the other hand, the research also aims to explain which opportunities exist to overcome barriers. By explaining these barriers and interconnections, a better understanding of the issue can be gained in an attempt to avoid this kind of issues in the adaptation process.

1.4 Research questions

1.4.1 Main research question

- How do current institutional barriers influence the understanding phase of the climate adaptation process in Beirut, Lebanon?

1.4.2 Research sub-questions

1. What is the status of the adaptation process in Beirut?
2. What are the institutional barriers and to what extent they affect the understanding phase of climate change in Beirut in terms of problem detection, gathering of information and problem definition?
3. How do barriers interact in vicious cycles to influence the understanding of the effects of climate change in Beirut?
4. Which opportunities exist to overcome the barriers to climate change adaptation?

1.5 Significance of the study

Recent literature has suggested to move forward from only listing institutional barriers towards a more in-depth analysis of the interactions among them. It is necessary to explain what are the relations between them. Also, there is a need to establish how barriers influence the climate adaptation process, especially in developing contexts.

Therefore, this study contributes to the scientific and practical knowledge by explaining institutional barriers and their interconnections or interactions. In addition, it outlines possible ways to overcome them which could help the adaptation policy-making for Beirut. Finally, there is also a societal relevance since a better understanding of the nature of barriers can help avoid them which would be ultimately beneficial for people, communities and the city of Beirut.

1.6 Scope and limitations

The scope of the study is examining only institutional barriers and opportunities to overcome them at the phase of understanding of climate adaptation planning process in the Municipality of Beirut, Lebanon.

Though there are limitations. First, the time-frame given for this master thesis was a constraint. Six months research roughly and one month for fieldwork. Another limitation was the difficulty to find sufficient relevant interviewees such as Municipality members and sources of information such as relevant local climate adaptation related research during the fieldwork in Beirut. On the other hand, given that this is a ‘case study’ research, findings are context-specific. Thus, they are difficult to generalize outside the Beirut context, even to other Lebanese cities.

Following this introduction, chapter 2 makes a literature review of adaptation planning frameworks, barriers and opportunities. Chapter 3 shows the methodology. Chapter 4 presents findings and chapter 5 concludes.

Chapter 2: Literature Review on adaptation planning frameworks, barriers and opportunities

Since approximately the beginning of this century, research on different types of barriers to adaptation encountered by actors and accompanying opportunities to overcome them has considerably increased in number. This number has risen even more from 2010 (Biesbroek, Klostermann, et al., 2013). The bedrock motivating research on this realm is that human-driven climate change is already irreversible and adaptation of people, places, sectors and systems to its effects is an imperative task. To this matter, government institutions play an important role as entities that can provide a solid framework for planned adaptation. Though, if these institutions lack certain characteristics such as understanding or lack of acknowledgment of climate change, adaptation might fail.

Many city governments are noticing changes in patterns of temperature, precipitations and some of sea level rise that are attributed to climate change (Carmin, Nadkarni, et al., 2012). It has been widely documented that these changes affect the urban fabric in a considerable way (Bulkeley, 2013a, McGranahan and Satterthwaite, 2014). Literature also states that there are already inevitable effects from climate change and therefore it is necessary to adapt to them.

Climate adaptation can indicate different things as it is further unbundled depending on the focus. Adaptation can mean building adaptive capacity, mobilising adaptive capacity, implementation of adaptation measures and actions, the uptake of adaptation in policies, adaptation policy failure, individual engagement or action to adapt, or the uptake of new tools to support adaptation (Biesbroek, Klostermann, et al., 2013). Adaptation in this research refers to the acceptance of adaptation in policies done by government institutions.

Institutional barriers hinder the planning development and therefore need alternatives or opportunities to address them. The interaction of these factors, namely barriers and opportunities, and their influence on the initial phase of the adaptation planning process, the climate change problem understanding phase, is the focus of this study.

This chapter reviews the state of the art of theories and concepts of the most relevant and recent available literature on climate adaptation planning and institutional barriers and opportunities enabling to identify gaps in this realm. Based on this, the conceptual framework was developed.

2.1 Climate adaptation planning frameworks

Authors reviewed in this section suggest in different ways that adaptation planning refers to the process of making adaptation plans from the conceptualization until the implementation and evaluation of adaptation actions and activities. It is also continuously suggested that given the nature of climate adaptation, adaptation planning is meant for changes that will take place in the future and therefore must be based on climate projections and not on current conditions (Füssel, 2007, Carmin, Dodman, et al., 2013). This section presents different frameworks to plan for climate adaptation encountered in the literature.

Moser and Ekstrom (2010) presented an easy-to-understand circular adaptation framework called the *adaptation process* which consists of nine stages:

1. Problem detection
2. Information gathering
3. Problem redefinition

4. Adaptation options development
5. Options assessment
6. Options selection
7. Options implementation
8. Monitoring
9. Evaluation

These nine stages are grouped in three main phases, each containing three stages: the first phase, *understanding* (the issue) includes the detection of problem; the information gathering and; the definition of problem. The second phase, *planning* (adaptation actions) includes the development of adaptation options; the assessment of options and; the selection of options. The third phase, *managing* (the selected options) involves the implementation of those selected options; the monitoring and, the evaluation.

According to the authors, the problem detection constitutes the very first step to realize that climate is changing. In other words, detecting the problem can lead to understand what the issue is and raise awareness. For instance, higher in temperatures than usual can trigger the detection that something has changed. It is important to highlight that this is an idealized model whose phases in real life might be iterative. In an ideal process, if any of these phases and sub-phases is skipped, problems would likely happen later on (Ekstrom, Moser, et al., 2011). This framework provides a baseline to analyse barriers for climate adaptation, as stated by the authors.

Kaloustian, Bitar, et al., (2016) proposed an evidence-based planning approach tool to mitigate Urban Heat Island (UHI) impacts in Beirut and to inform decision-makers about possible environmental, social, economic and health impacts. It consists of the following 5 steps:

1. Establish the need for UHI mitigation. Based on existing conditions.
2. Develop goals and objectives. Evidence from previous success cases supporting the intervention.
3. Develop UHI mitigating design and planning strategies
4. Implement policies and programmes. Showing achievement of results.
5. Monitor and evaluate outcome and impact. Evidence shows achievement of desired outcomes and impact.

The tool which is actually circular, similar to Moser and Ekstrom's framework, puts in the middle of the circle the use of evidence from collected data and results for quality improvement.

Likewise, Carmin, Nadkarni et al., (2012), stated that there are six steps in the adaptation planning process. The preparatory stage, the initial planning stage; risk and vulnerability assessments; plan development; plan acceptation and; plan implementation. In this case, the risk and vulnerability assessments can constitute a first effort to understand the city hazards. Carmin et al (2012) suggest that adaptation planning is motivated by endogenous (city internal goals, civil society) and exogenous forces (external pressures).

Carmin, Dodman, et al (2013, p. 4) state that "understanding risks and vulnerabilities is integral to adaptation planning". According to this paper, there are four main motivations that lead to initiate adaptation activities. First, the experience of a natural disaster and natural hazards. Second, concern about decreased availability of natural resources such as water. Third, a desire by a certain city to demonstrate climate change leadership, for instance when international reunions take place in the city. And fourth, international support for adaptation by organizations or donors that allocate resources to adaptation related issues.

The authors agree that the awareness that some disasters and hazards are caused by climate change is a prerequisite to adaptation planning. Without this awareness, which is detected by individuals, it is unlikely that adaptation activities will start by city governments. It can be therefore implied that awareness constitutes an important part to start to understand climate change. To increase planning effectiveness, awareness of the evidence and knowing-how to respond are an important factor (Dodman and Carmin, 2011).

Mukheibir and Ziervogel (2007) insisted that a framework for adaptation at a municipal level is necessary to prioritize urgent adaptation activities and identify the required human and financial resources. They provided the following 10 step process to guide the development of a Municipal Adaptation Strategy:

1. Assess current climate trends and future projections at the city-level
2. Undertake a climate vulnerability assessment of the municipal area identifying current cross-sectoral vulnerabilities and capturing this information on local vulnerability maps using GIS and other tools
3. Review current development plans and priorities
4. Overlay general development priorities with current and expected climate vulnerability using tools such as GIS to identify hotspots where adaptation activities should be focused
5. Develop adaptation options integrating climate-sensitive responses with development priorities
6. Prioritize adaptation actions using multi-criteria analysis (MCA), cost-benefit analysis (CBA) and others.
7. Develop a programme and project. This document will be the Municipal Adaptation Plan (MAP) (Figure 1)
8. Implement prioritized interventions
9. Monitor and evaluate
10. Review and modify the plans if necessary

The authors invite to understand the climate impacts on different urban sectors to prioritize and intervene them knowing that they would reduce their vulnerability. This understanding would help to ‘adapt rather than react’. In this process a ‘understanding step’ is not literally mentioned, however it is implied that to start an assessment of climatic trends and projections and a vulnerability assessment it is first required to understand that this is necessary. This will also allocate resources to that end.

Dodman and Satterthwaite (2008) synthesized the Mukheibir and Ziervogel 10 step process in 6 steps to city-level adaptation planning as follows:

1. Identify current climate trends and future projections and make local vulnerability maps
2. Assess the local climate vulnerabilities per sector
3. Review current development plans and priorities in relation to climate variability and climate change
4. Develop and prioritise adaptation options using consultative tools
5. Develop programmes and projects to form a Municipal Adaptation Plan
6. Implement, monitor, and review the plan

The authors also suggest that understanding the impacts of disasters such as floods, landslides is of particular importance in order to collect further information about these events and advance adaptation planning at a city-level. In addition, it is suggested that to ensure adaptation in urban areas, building the capacity of local urban institutions is appropriate.

Various adaptation planning frameworks reviewed by Füssel (2008) were developed by different authors to provide guidance for adaptation policy assessments in the human health sector. One of them was developed by Willows, Connell, et al., (2003) aiming to provide guidance to decision-makers about risk and uncertainty to facilitate adaptation. The framework consists of the following 8 stages: identify problem and objectives; establish decision-making criteria; assess risk; identify options; appraise options; make decision; implement decision; monitor results. This framework was circular and iterative, very similar to the Moser and Ekstrom's one. Another reviewed framework by Connell, Richenda, et al., (2005) presented an adaptation policy framework assessment approach that consists of five consecutive components: scoping and designing an adaptation project; assessing current vulnerability; assessing future climate risks; formulating an adaptation strategy; continuing the adaptation process.

Based on these and other pertinent assessment frameworks Füssel provides an integrated one, although lengthened, which is tailor-made for climate adaptation assessments:

1. Scoping the project
2. Screening of current and future risks
3. Examination of the adaptation baseline
4. Review of projected climate impacts in other sectors
5. Identification of key information needs for policy decisions
6. Analysis of future risk changes
7. Evaluation of future risk changes
8. Identification of additional adaptation options
9. Evaluation and prioritization of adaptation options
10. Decision about adaptation strategy
11. Implementation of decision
12. Monitoring and evaluation of e□ectiveness

It seems that instead of simplifying steps the new framework made it more complex. Moreover, although there are more steps than in other frameworks, this one skips an understanding phase and goes directly to 'scoping the project'. Nevertheless, Füssel, as other authors, indicates that the integrated framework typically resembles a theoretical order however in practical terms the process can be multi-tiered and iterative. In addition to this process, resources such as data, money or expertise, need to be made available to conduct an adaptation process

As it is seen in the literature, adaptation frameworks have been widely developed. They roughly coincide about the process. Most revised frameworks suggest that for city governments a first step to initiate an adaptation process is to understand the city's climatic vulnerabilities and risks. This initial phase of understanding would help to allocate human, technical and financial resources to act accordingly to plan for adaptation.

Given that Beirut does not yet have adaptation measures in place and is trying to develop an understanding of how to adapt, this study therefore focuses on the understanding phase and takes the Moser and Ekstrom (2010) *adaptation process* framework as guide. This circular framework is convenient since it was especially devised as a prototype to orient the climate adaptation process and to analyse institutional barriers which is the purpose of this research.

2.2 The Moser and Ekstrom understanding phase of climate change adaptation planning

Understanding climate change is crucial to initiate the process of adaptation planning. This study focuses on the understanding phase of the climate adaptation process making a distinction of what the components of the planning process are itself separating them from the barriers that seem to be jammed in these components.

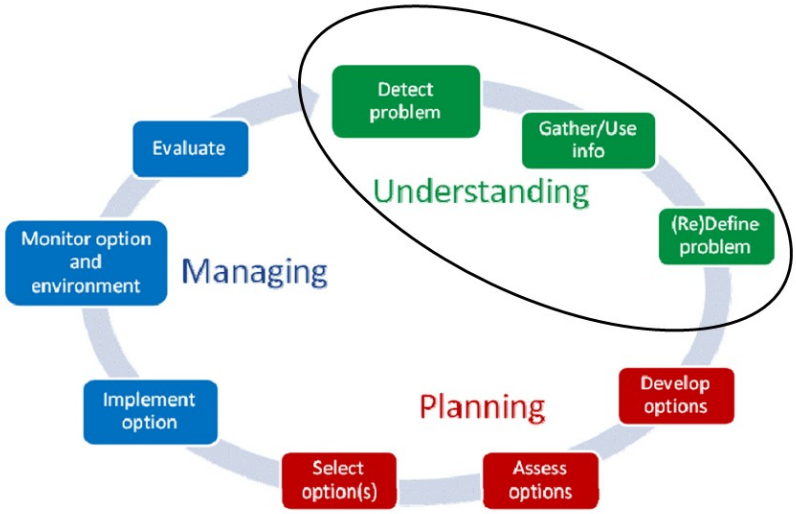

Figure 3. The understanding phase in the adaptation process. Source: Ekstrom, Moser, et al., 2011

As it was briefly explained the framework is circular allowing to come back to the beginning and check the process. The understanding is the first phase (green in figure 3). Understanding in this context refers to how climate change is perceived or interpreted by institutions and what actions they undertake (or not) in relation to it. This initial phase involves the three following sub-phases or stages.

2.2.1 Problem detection

Problem detection refers to how actors within an institution initially frame or conceptualize a climatic problem or hazard (e.g. perceived changes in temperature) and how awareness is raised (or not) within the institution. The result of this is an initial framing of the problem that can or cannot be accurate to reality.

2.2.2 Information gathering and use

When an initial framing of the problem is done, the next step is to gather data and information (e.g. data on means and extremes of temperature) by an institution of that potential climatic problem affecting the place and using it to deepen the problem understanding in a more detailed manner. The information collected can be a study of atlas of risks, vulnerability assessments, local development plans, land use plans, scientific research, maps of climatic hazardous locations, meteorological records (rainfall, dry season, temperature pattern, air quality, pollution), newspapers reporting disasters, climate change impacts and effects, etc.

2.2.3 Problem redefinition

At this last stage of understanding, the adaptation problem is reframed or redefined by the institution more accurately based on science (the reality of local temperature variability) since a process of collecting, using and analysing climatic information and science was done. Here, the problem is understood in a more detailed and strategic manner. The analysis can conclude

that the problem e.g. a potential flood, can have bigger or lesser, larger or smaller impacts than initially expected.

2.3 Institutional barriers for adaptation

Recent research has shown that many commonly reported barriers relate to institutional issues. Institutions play an important role for adaptation to climate change (Ekstrom and Moser, 2014, Oberlack, 2017, Berkhout, 2012). Biesbroek et al., (2013) in a metadata analysis of 81 peer-reviewed papers, state that among institutional, social, informational, financial and cognitive categories of barriers, the most often reported barriers relate to the institutional dimension.

In a theoretical perspective, institutions are "humanly devised constraints that structure human interaction" (North, 2016, p. 74) which are composed of formal rules (laws, regulations, policies) and informal constraints (values, traditions, conventions, norms of behaviour, and self-imposed rules of behaviour). For Johnson, institutions "reduce uncertainty, coordinate the use of knowledge, mediate conflicts, and provide incentive systems" (2010, p. 27). For Hodgson, an organisation is a type of institution with additional features that involve "(a) criteria to establish their boundaries and to distinguish their members from non-members, (b) principles of sovereignty concerning who is in charge, and (c) chains of command delineating responsibilities within the organization" (2006, p. 8).

Adaptation planning follows both formal and informal elements (Carmin, Anguelovski, et al., 2012). Institutions shape adaptation action, they affect and influence the decisions. Local government institutions such as municipalities have the power to facilitate adaptation planning but conversely can also hinder it. In the literature, impediments that hinder adaptation planning have been called barriers, obstacles, traps, constraints or hurdles. For practical reasons, in this study they are going to be often referred as barriers.

Barriers are also referred to as factors that hinder the ability to proactively adapt to forthcoming environmental changes (Biesbroek, Klostermann, et al., 2013). Oberlack, who in a meta-analysis of 52 European cities identified 31 archetypical patterns of institutional barriers, defines institutional barriers or traps as "adverse manifestations of adaptation parameters which are attributed to particular properties of institutions" (2017, p.4?). Eisenack, Moser, et al, provide a compiling definition to barriers to adaptation as "an impediment to specified adaptations for specified actors in their given context that arise from a condition or set of conditions" (2014, p. 868). Biesbroek mentions that more than 200 context dependent barriers have been identified in 81 peer-review papers.

Moser and Ekstrom (2010) define barriers as obstacles that make adaptation less efficient or effective. According to the authors, barriers differ from limits which are practically impossible to overthrown. (e.g. an economic structure or social beliefs). Similarly, Füssel (2007), refers that there are fundamental and practical 'limits to adaptation'. A mountain chain can be considered as fundamental limit because it cannot migrate to a suitable new place in case is threatened. A practical limit to adaptation has to do with insufficient economic resources, technical skills or political will. For this study, it is more appropriate to use the term 'barrier' because they can be surpassed.

Klein, Midgley, et al., define constraints (used as synonym to barriers) as "factors that make it harder to plan and implement adaptation actions" (2014, p. 907), and add that barriers can arise from the 'governance system' including institutions and policies: laws and regulations, procedural requirements, governance scope or institutional arrangements.

2.3.1 Categories of institutional barriers

Many of the reviewed literature suggesting that institutional barriers are among the most frequent, does not provide further categorization of the barriers that can facilitate their analysis. However, a paper on mainstreaming adaptation in Mozambique, Sietz, Boschütz, et al., (2011) suggested to make three categories of institutional barriers: the individual level, the organisational level and, the enabling environment. Based of this categorization, frequently reported barriers at the understanding phase in different papers are synthesised here:

2.3.1.1 Individual level

In the context of adaptation planning, the individual level refers to the individual experience and knowledge of actors who deal with climate change issues at an institution. Possible barriers that may appear in this level are:

- **Lack of or insufficient interest.** Actors in institutions do not have interest in the causes and effects of climate change (Ekstrom and Moser, 2014), for instance due to scepticism about the science of climate change (Ioris, Irigaray, et al., 2014). Moser and Ekstrom (2010) call this 'Threshold of concern', meaning that there can be a lack of concern about climate change even if the presence of hazards is known.
- **Poor individual knowledge and capacity.** It relates to little knowledge about what is climate change, what causes it, what are the effects or how to start to address climate adaptation (Ekstrom and Moser, 2014, Oberlack, 2017). For instance, due to the paucity of personal skills and technical capacity or ignoring how to identify the climatic hazards from the vulnerability assessment. This level involves personal attitudes, abilities and beliefs.
- **Low awareness.** Actors are simply not aware of the existence of climate change and its effects. To act for adaptation relevant actors in institutions must be aware of the risks from climate change. The vulnerability assessment can help to raise awareness. Raised awareness is a continuously mentioned factor to help the planning process (Ekstrom and Moser, 2014, Füssel and Klein, 2004). Moser and Ekstrom (2010) call this barrier 'detection of a signal'.
- **Leadership issues.** This barrier relates to a lack of people that can guide the planning process, 'champions' that can bring adaptation to the city government agenda and prioritize it Ekstrom and Moser (2014). Leadership is needed to guide the adaptation planning process. When leadership is missing this may lead to not achieve appointed goals and to inappropriate decision-making. On the other hand, a very dominant leadership may lead to unilateral perspectives (Burch, 2010, Garrelts and Lange, 2011, Galaz, 2005).

2.3.1.2 Organisational level

The organisational level refers to the inherent attributes of an institution where individuals apply their adaptation planning knowledge and skills. Barriers encountered in this category are:

- **Data and information issues.** It has to do with insufficient data and information availability, data records, figures or scientific information, vulnerability assessment; weak or poor data, information inaccessibility; inadequate data and information dissemination (Ekstrom and Moser, 2014, Moser and Ekstrom, 2010, Oberlack, 2017). For instance, In Mozambique different meteorology forecasting systems are

not integrated into one single forecasting system to ensure adequate conclusions. Therefore, a timely information dissemination for planning to respond to extreme events cannot be fulfil (Sietz, Boschütz, et al., 2011). Information is required to properly frame and implement adaptation actions (Füssel and Klein, 2004). In some adaptation planning frameworks such as in the Moser ad Ekstrom's (2010), information is an integral part of the framework.

- **Lack of stable institutions.** A well-funded institution, with a clear legal framework and goals contributes to facilitate adaptation planning and decisions over time. This formality would provide a sense of recognition and trust to the institutions among the society (National Research Council, 2009).
- **Institutional fragmentation**. It relates to dispersed decision-making authority among various sectors, such as water management, spatial planning, etc. or among administrative departments, leading to a paused urban adaptation planning (Ekstrom and Moser, 2014, Burch, 2010, Krellenberg, 2011).
- **Scale of institutions mismatch (temporal/spatial).** Temporal scale refers to whether an institution was set up to deal specifically with climate change issues or whether it was invested with the responsibility to do so, e.g. if an institution was not originally established to deal with climate change issues but for others not specifically climate change related matters. The spatial scale refers to jurisdictional boundaries of institutions e.g. if the local institution cannot intervene in other municipalities (Oberlack, 2017). In this case, the result can be that the institution is not well prepared to work climate change
- **Lack of personnel with expertise.** It relates to the lack of a specialised area that can deal with climate change issues (Ekstrom and Moser, 2014). Füssel and Klein (2004) call this barrier 'availability of resources to implement adaptation measures', which includes technical and human resources.

2.3.1.3 Enabling environment level

The third level is the enabling environment which refers to the means and interactions of actors at the local, regional and perhaps national and international level that enable or hamper the adaptation process. It shapes how institutions function and reflects the societal context where adaptation planning takes place (Sietz, Boschütz, et al., 2011). The enabling environment can host several barriers:

- **Laws and regulations incompatibility**. This constitutes a barrier when there are regulations subject to contradictory interpretations or if they represent incompatibilities for the planning process (Oberlack, 2017).
- **Communication or coordination issues.** It refers to communication and coordination issues both internally among members of the same institution or externally among different institutions leading the adaptation planning process (Sietz, Boschütz, et al., 2011).
- **Mandate and/or responsibility issues.** It relates to unclear, fragmented or overlapping responsibilities and mandates on 'who do what' among institutions. This may lead to standstills and setbacks, e.g. when there are double functions in authorities commissioned to carry out the planning process (Oberlack, 2017, Sietz, Boschütz, et al., 2011, Mukheibir, Kuruppu, et al., 2013).
- **Scepticism.** Ioris, Irigaray, et al, (2014) in an analysis of institutional responses in the Pantanal shared by Brazil, Bolivia and Paraguay, encountered that in Brazil there is a dominant climate change scepticism in the government sector which hinders planning efforts. Scepticism sometimes is not only due to lack of understanding or knowledge

of climate change but also related to personal interests from particular sectors that see adaptation plans as detrimental for their own economic activity and therefore they tend to oppose to any climate change activity. This is certainly related to the *detection of a signal* barrier stated by Moser and Ekstrom (2010) as it is suggested that a signal that climate is affecting certain sector can be detected but perhaps not acknowledged.

- **Scarce sources of adaptation funding**. This might be due to the lack of capacity to secure budgets for adaptation planning, e.g. mismanagement of funds, financial constraint or inappropriate decision-making routines (Ekstrom and Moser, 2014, Sietz, Boschütz, et al., 2011, Vine, 2012).
- **Lack of technological resources**. It refers to unavailable technologies and tools, e.g. innovative systems for prioritization or data analysis (Klein, Midgley, et al., 2014).
- **Conflicting municipal agendas for prioritization.** It may take place when different policies and programs attract higher priority, e.g. when adaptation is seen as not urgent because other short-term tangible issues are prioritized or there are power or political ideologies different to that of focusing on climate adaptation (Sietz, Boschütz, et al., 2011).
- **Lack of incentives to implement adaptation measures.** Institutions necessitate incentives to implement adaptation activities. There are some adaptation activities that have immediate benefits for the institutions implementing them. An allocated budget from an international donor to be used for a given project is an example of an incentive (Füssel and Klein, 2004).

There are consequences of these different set of barriers in the adaptation process. One is that understanding the adaptation need may stay unknown or very limited. The process of planning itself may importantly slow down resulting for the city to not have the proposed adaptation plan. Actions to address adaptation would be absent and therefore implementation is not possible. According to Moser and Ekstrom (2010), barriers can lead to missed opportunities or higher costs. Ultimately, the lack of adaptation actions hinders bridging the adaptation deficit of cities and keep the limited adaptive capacity of communities in the same status.

Authors suggest that no matter their specific context, the numerous barriers to adaptation planning encountered across high or low-income countries have similar patterns but different levels of severity (pasquini, 2013, oberlack and eisenack 2014)

Although there are commonly reported barriers in the literature such as information related issues, their effects on the planning process can vary according to specific case-studies (Eisenack, Moser, et al., 2014). Barriers are context and actor specific, difficult to generalize and cannot be understood in isolation, therefore, in some cases the same barrier exists in several cases but can be explained differently (Idem). Table 1 provides a list of examples of barriers found in different case studies worldwide and their attributed affected phase.

Table 1. Examples of barriers, effects on adaptation planning and attributed affected phase in different case-studies

Location	Barrier	Attributed effects on adaptation	Attributed adaptation phase affected	Reference
Santiago	Institutional fragmentation	Hinders urban adaptation and decision making	Understanding	(Krellenberg, 2011)
California	High costs	Delayed adaptation	Understanding	(Vine, 2012)
Lima,	Low awareness	Low priority for	Understanding	(Lehmann, Brenck, et al., 2013)

Santiago		adaptation in policy agendas		
Australia	Low awareness	Unclear role and responsibilities	Understanding	(Mukheibir, Kuruppu, et al., 2013)
Germany, Sweden	Missing/dominant leadership	Absence of appropriate decision-making routines	Understanding / Planning	(Garrelts and Lange, 2011, Galaz, 2005)

***Source: Author based on* Eisenack, Moser, et al., 2014**

In the case of Santiago fragmentated institutions made fragmented adaptation plans since they derive from the interaction of different sectors and ministries. In most reviewed cases, financial issues are not present. However, in the state of California, Vine (2012) found that the costs to intervene identified sectors represent a constraint. In other cases, such as Lima, Santiago and Australia there was a lack of or low awareness about climate change by individuals and therefore by their institutions which derives in not giving the proper priority to climatic threats and hence the adaptation process slows down. In the case of German cities Garrelts and Lange (2011) and Swedish cities Galaz (2005), missing or dominant leadership can affect the decision-making by authorities. Missing of leadership or guidance can constitute an obvious barrier but excessive leadership can also create issues for the planning process as it might impose unilateral views.

In addition to the appearance of barriers, Eisenack et al (2014) suggest that there are interconnections of barriers arguing that barriers can be interdependent and dynamic. This can lead to a never-ending issue of barriers. The authors make an example of dynamically interlinked barriers: limited climate change awareness may lead to little public support for adaptation. Little support from relevant actors can hamper the process of learning about climate change impacts. Halted learning in turn can lead back to limited awareness.

On top of that, interconnections can evolve over time and therefore, by the time of intervention, interconnections may have already changed into more complex ones. It is claimed in the paper of Eisenack et al., that to effectively intervene interconnections, it is necessary that actors understand their dynamics. In the case of this study, investigating these relations of institutional barriers would be appropriate.

Links between barriers are also suggested by Ekstrom and Moser (2014). Sometimes a barrier was originated far in the past but continue in the present. For instance, many institutions that now deal with climate change issues were not originally created to that purpose. This may explain for example, the staff's lack of technical expertise or the lack of understanding and knowledge. Mimura, Pulwarty, et al., (2014) state that barriers in general are seen as dynamic and context dependent across sectoral, spatial and temporal scales. The dynamics of barriers can relate to the interactions with other constraints and their changing or evolving nature.

Fussel (2007) also suggests interconnections of barriers. For example, little awareness among policy-makers and other stakeholders can lead to a lack of knowledge about the risks from climate change. A lack of awareness can also lead to have little climatic information about these risks and a lack of climatic assessments. On the other side, if there is awareness and knowledge it is more feasible to continue to the development of options and implementation stages.

Figure 4 graphically represents a hypothesized interconnection of barriers.

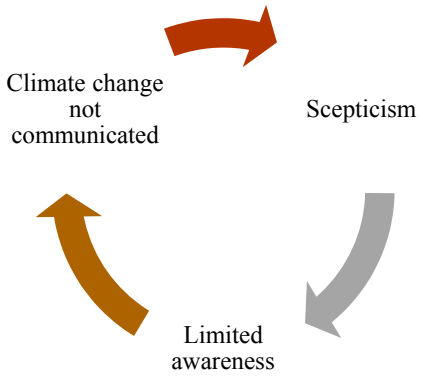

Figure 4. Example of a hypothesized interconnection of barriers

In an early stage, scepticism, as suggested by Ioris, Irigaray, et al., (2014) within institutions on climate change can lead to have limited awareness on its impacts. In turn, low awareness might lead to not communicate the possible impacts of climate change and thus the lack of communication can lead to deny that the science behind climate change is unequivocal.

As mentioned above, recent literature has suggested to further investigate the interconnections of barriers. This kind of interconnections are called *vicious cycles* in this study.

2.4 Institutional opportunities for adaptation

Although the aim of this study is to analyse institutional barriers, it is also convenient to briefly review which are the institutional opportunities to overcome them. This section presents so. This allows to compare existent literature to the actual findings of this research.

It is often suggested in the literature that institutional barriers constitute precisely the opportunity rooms to overcome them if the opposite action is undertaken, as a mirror effect (Ekstrom and Moser, 2014, Oberlack, 2017, Lehmann, Brenck, et al., 2013, Mimura, Pulwarty, et al., 2014). For instance, lack of individual awareness constitutes a barrier but awareness raising among individuals and the community constitutes the opportunity to overcome it; the lack of institutionalized climatic information at a city-level would constitute a barrier but departments and government bodies dedicated to information provision would be the opportunity.

Lehmann, Brenck, et al., (2013) suggest a dual interrelationship between barriers and opportunities in a study carried out in the Latin American cities of Lima and Santiago and the German cities Berlin and Sangerhausen. These opportunities can also be considered as strategies or enablers to plan for adaptation. Oberlack defines opportunities as "conditions and strategies that enable actors to prevent, alleviate or overcome a specific institutional trap or trade-off." (2017, p.814). Likewise, the definition of the IPCC for opportunities is the opposite to that of barriers: "factors that make it easier to plan and implement adaptation actions (Klein, Midgley, et al., 2014, p. 907)

Ekstrom and Moser (2014) similarly suggest that to overcome barriers, setoffs are an opportunity. For example, when there is a lack of awareness among actors or the community itself, risk assessments can build a notion that certain area in prone to disasters; when there is a lack of understanding of climate change, conferences, expert's lectures and information constitute a way to build it; when staff lacks capacity, capacity development through

workshops can help to overcome this issue and so on. In addition, they suggest that cities might have innate assets that can help to prevent barriers. For example, local leaders and experts that guide the planning process articulating different institutions and bringing people's efforts together, convenient political stability, good momentum for the city and good timing. Therefore, these potential assets should be used to seize opportunities.

In their case study of San Francisco, different strategies to overcome barriers were identified. They emphasize that barriers are context dependant and therefore they might importantly vary in other case studies. Among the most common strategies are: policy and management changes, involving for instance appropriate institutions and governance for climate change or having adequate policies and plans that build upon adaptation; strategic communication, involving more people. For example, to build awareness among staff about climate change or ways to frame climate change to make it a more attractive issue; cooperation and partnerships, that has to do with formal agreements and informal talks among, and; education and learning, meaning knowledge-sharing and boosting research.

To overcome barriers, Moser and Ekstrom (2010, p. 2) suggest locating a barrier according to its spatial/jurisdictional and temporal origins. In this sense, an opportunity to address barriers would be to address those ones that are located 'here and now' e.g. understanding of climate change and communication are the 'easiest' ones to address, rather than those in a remote and older origin, 'not here and not now' such as institutional fragmentation which typically dates back to old discontinuities among different institutions that have prevailed in the present.

It is worth to mention that different studies allude that a higher-level cooperation such as international cooperation, is needed to overcome or alleviate barriers and address adaptation planning (Eisenack, Moser, et al., 2014, Oberlack, 2017, Reckien, Flacke, et al., 2015). Fusel (2007) adapt planning states that in developing countries international assistance may help to overcome local institutional barriers. It is also suggested that local governments are not capable to address all barriers alone (pasquini, 2013). Hence, higher-level interventions can be fruitful for city governments. However, Carmin, Anguelovski, et al., (2012) argue that in the case of Durban and Quito, adaptation was driven by internal local factors such as local actors, called 'champions' who could creatively mainstream adaptation into existing city plans.

As it can be seen, several are the opportunities that have been identified to overcome barriers. It is then needed to identify local opportunities for local barriers in this case study.

2.5 Literature review summary

After the review of several 'adaptation frameworks', it is concluded that the *adaptation process* framework developed by Moser and Ekstrom (2010) to analyse barriers is easy and useful to structure the analysis of this research. Also, given that a large number of barriers have been encountered in the 'understanding', this research focuses on this phase.

On the other hand, institutions are found to play a key role when it comes to plan for adaptation. They can considerably boost or hinder the adaptation process. After reviewing literature on institutional barriers, it is found that several authors have found similar barriers that are common to how institutions understand climate adaptation. For instance, knowledge and information related issues have been listed constantly.

It is therefore concluded that providing one more list of barriers would not be academically relevant beyond the location of this case study research. Nonetheless, explaining the importance of certain barriers and how they relate to each other – the interconnections – is

relevant as it has been suggested by several researchers (Biesbroek, Klostermann, et al., 2013, Eisenack, Moser, et al., 2014, Moser and Ekstrom, 2010). However, to analyse interactions of barriers, first it is necessary to find out which are the actual barriers specific for the case study that are taking place and thereafter try to explain how they are interlinked, if so. The research gap addressed in this study is therefore the interactions between institutional barriers, meaning how they combine or connect with each other.

This study uses the three levels of institutional analysis proposed by Sietz, Boschütz, et al., (2011): the individual level, the organisational level and, the enabling environment level to categorize institutional barriers. It is worth to note that many of the encountered literature on barriers has been done in a developed country. Thus, it would be interesting to find out what kind of barriers appear in a developing country. In addition, there is a need to analyse which opportunities exist to overcome barriers which is also addressed, though the focus is on the barriers.

2.5.1 Conceptual framework

Figure 5 shows the graphic conceptual framework. *Institutional barriers*, the independent variable, might influence the *understanding phase of climate adaptation planning process* in Beirut, the dependent variable. The three levels of institutional barriers that might affect the planning process are the individual level, the organisational level and the enabling environment level. The three sub-phases of the understanding phase where barriers might arise are the problem detection, the information gathering and use, and the problem redefinition. The conceptual framework is based on the literature review.

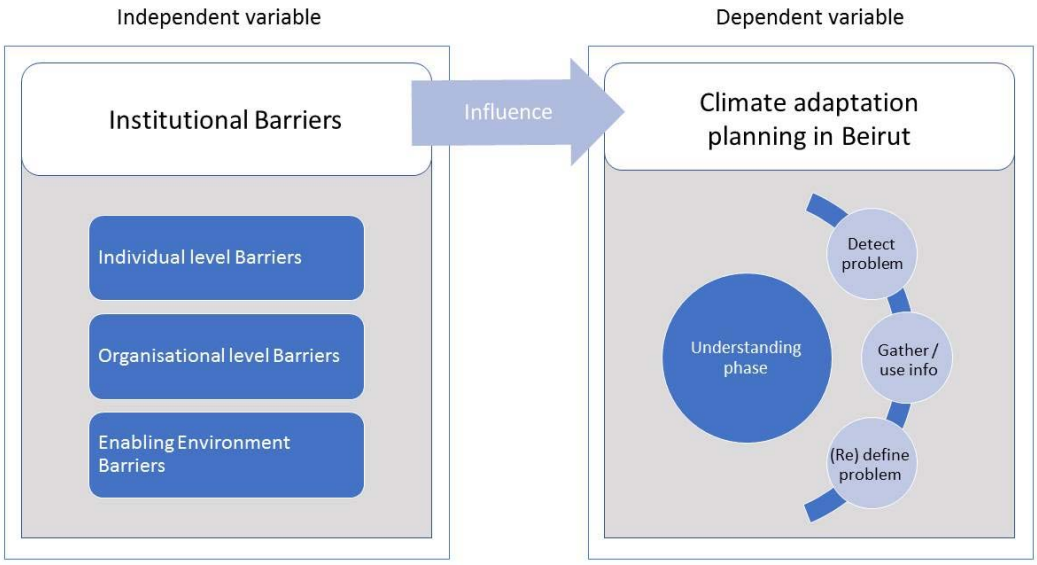

Figure 5. Conceptual framework

To find out whether interconnections between barriers actually exist, there were questions related to that end and analyses of interviewees' responses. This is further explained in the methodology (chapter 3).

Chapter 3: Research Design and Methods

3.1 Research strategy

The research strategy for this study is a *single case study*. Case studies allow to investigate the context and factors in a deep and rich manner and find the relations between them, not only looking at the most important ones but at the whole. In this case, factors can be barriers, opportunities, etc., that influence the adaptation planning process in Beirut.

Case studies aim at describing, explaining and exploring a certain real-life phenomenon within its context. A 'case' can be almost anything: a city, neighbourhood, an organization, a group, an event, a relationship, a project, etc. (Van Thiel, 2014, p. 86)In this research the 'case' to study is the Municipality of Beirut.

Case studies have a small number of units and large number of variables, possibly unknown (Studying cities: social science methods for urban research. Research strategies, case study, 2017). The unit is the Municipality of Beirut. The variables are the barriers. E.g. lack of individual knowledge and capacity or coordination issues, etc. Based on the conceptual framework the type of case study for this research is *co-variation* in order to know how barriers influence the adaptation process and what explains so.

As other research strategies such as desk research or survey strategies, a case study has disadvantages. According to Van Thiel (2014), although a case study can bring vast explanations on a situation since a large body of data is analysed in-depth - in this case about the adaptation planning process in the Municipality of Beirut - the findings cannot be generalized to other cases because they are embedded in their specific context (Beirut).

3.2 Research methodology

This study uses a *mixed method approach*. The main research method is *interviews* together with *expert consultations* and *content analysis*. Experts with a working background in Beirut were consulted to compare information provided by members of the Municipality. Similarly, analysis of unpublished documents, statements, magazines and webpages found during the fieldwork were analysed to compare it with information provided by members of the municipality and the experts.

In this way, it was possible to check whether information pointed at the same direction which relates to the reliability of the research (see section 3.7). The above-mentioned led to acquire qualitative data in an accumulation of primary data.

3.3 Operationalization: variables and indicators

Concepts in the conceptual framework are defined for this study as follows:

- *Adaptation planning process:* the process of initiating an adaptation process specifically in the understanding phase: problem detection, information gathering and use, and problem redefinition. This definition is based on Moser and Ekstrom (2010).
- *Institutional barrier:* an obstacle for actors during the adaptation process which can arise from the individual level, the organisational level or the enabling environment of institutions that make adaptation less efficient or effective. The definition is based on Eisenack, Moser, et al., (2014), Moser and Ekstrom (2010), and Sietz, Boschütz, et al., (2011)

Table 2 shows the operationalisation of concepts with its variables and indicators. A list of potential barriers is presented as "indicators", though what they really are is entry points to do the characterization of the possible barriers in the understanding phase.

Table 2. Operationalisation.

Concept	Variable	Indicator	Data Type
Adaptation planning process	Problem detection and awareness raising (initial problem framing)	Detection (and perception) of a signal Initial framing of problem (Concern) Initial framing of response	Qualitative data: Semi structured interviews with open-ended questions
	Information gathering and use (detailed)	Information collection (all possible) Information selection (most relevant) Use and analysis of selected information	
	Problem (re)definition (accurately)	Reframing of the problem after analysis Strategic response need Level of agreement or consensus	
Institutional barriers	Individual level barrier	Lack of Interest Lack of individual knowledge or capacity Low awareness Leadership issues	Qualitative data: Semi structured interviews with open-ended questions
	Organisational level barrier	Data and information issues (availability, relevance, accessibility) Lack of formality/stability in the institution Institutional fragmentation Scale of institutions mismatch (temporal/spatial) Lack of personnel with expertise	
	Enabling environment barrier	Laws and regulations incompatibility Communication and/or coordination Mandate issues Responsibilities issues Scepticism Scarce sources of adaptation funding Lack of technological resources Conflicting municipal agendas for prioritization Lack of incentives to implement adaptation measures	

3.4 Sample size

A sample is a selection from the total population of possible units of study (Van Thiel, 2014). In other words, a sample size is a selection of relevant people that can provide valuable information and are subject of an interview.

As shown in Table 3, the sample size or 'list of interviews' for this research was composed by members of the City Council of Beirut and external experts working on climate change or environment and sustainable development related issues in Beirut. City counsellours are individuals who can give first-hand information about the municipality efforts on climate change adaptation. Experts can confirm or refute opinions of the municipality members.

Table 3. List of interviews.

Category	No.	Position	Role & Responsibilities	Institution
Municipality members (main source)	1	Municipal Counselor	Sustainable Urban Development and Cultural Heritage portfolios	Municipality of Beirut
	2	Former Municipal Counselor	Finance & Budget Committee, Comprehensive Resilience Master Plan	Municipality of Beirut
	3	Municipal Counselor	N/A	Municipality of Beirut
External experts (triangulation)	4	Team Leader and Project Manager	Supervise team, Advice to the Ministry	Ministry of Environment - Climate Change Unit / UNDP
	5	Professor	Full-time professor, Urban Planning and Architecture Departments	Lebanese University
	6	Director of Research on Water Resources	Researcher	National Council for Scientific Research, Centre for Remote Sensing
	7	Former Director of Research	Current Project Manager	National Council for Scientific Research, Centre for Remote Sensing
	8	Previous Municipal Elections Candidate	Public Space Monitoring	Beirut Madinati
	9	Head and Founder	Project Coordination	Organisation De Developpement Durable NGO
	10	Economic Team	Stakeholder Management, Comprehensive Resilience Master Plan team	BuroHappold Engineering Consultancy

An equal number of interviewees between municipality members and experts is ideal. In real life however, this was difficult to accomplish since experts who work independently were more easily 'reachable' and seemed to be freer to express their opinions than the members of the municipality.

To make initial contact with potential interviewees two types of sampling were used. First, a *purposive sample* helped to select the interviewees according to their position or responsibilities, etc. For example, heads of departments, project officials or project managers. Purposive sample avoids 'randomness' in the selection of informants. Second, "s*now-ball*" helped to reach out new potential interviewees through the already contacted ones. (Van Thiel, 2014).

3.4.1 Description of interviewees

After the fieldwork in Beirut, more information about the interviewees and their institutions was available (Table 4). Three members of the Municipal Council and seven experts were interviewed. It is worth to note that current elected members of the municipality have been approximately one year in office. In addition, the municipality seems to be very hermetic in general. In fact, one of the limitations during the fieldwork was to get in contact with municipality members.

Informants were asked to say, based on their own experience and knowledge, how the municipality frames and works on climate change issues. External informants in general were more open and expressive in terms of sharing information, commenting on the municipality and talking about current conditions of Beirut, time allocated for the interviews, etc.

Table 4. Description of interviewees and institutions.

Institution and position	Description
(1) Municipality of Beirut,	Responsible of the sustainable urban development portfolio within the

Municipal Counsellor	municipality. This counsellor is specialised in environmental and energy studies with 20 years' experience in climate change issues. This informant is the focal point on climate change within the municipality and is personally working on the cultural heritage of Beirut. This informant didn't allow to record the interview and answers were sometimes very brief for instance about political aspects.
(2) Municipality of Beirut, former Municipal Counsellor	Counsellor of the previous administration who left office in 2016 specialised in business administration and disaster risk management. The informant oversaw the Comprehensive Resilience Master Plan for Beirut project within the municipality in different aspects. Among them was to be a member of the steering committee representing Beirut city at UN conferences and was part of the preparatory meetings to advocate the role of the municipalities in city resilience. In addition, the informant was part of the finance and budget committee within the municipality. This interviewee, counsellor for 6 years, from 2010 to 2016, was very open to talk and allocated plenty of time for the interview.
(3) Municipality of Beirut, Municipal Counsellor	This counsellor was very hermetic and didn't share much information. Informant suggested to be part of the civil protection steering committee. The informant expressed negatively about "environmentalists" because "they are against whatever the government proposes". The informant mentioned that doing a research on climate change in Beirut is not a good idea because is "too complicated" and because there is no information. Informant suggested to do this research somewhere else. This informant did not know that the municipality had started the Resilience Master Plan project.
(4) Ministry of Environment, Climate Change Unit / UNDP, Team Leader	Team leader and project manager of the climate change unit which is a UNDP project supporting the Ministry of Environment to meet Lebanon's obligations under the climate change agreements of the UN. This body is recognized as the main official agency in Lebanon working specifically on climate change issues at the national level. The informant has had contact with the municipality to discuss issues such as air pollution monitoring systems.
(5) Lebanese University, Professor Urban Planning and Architecture Departments	Full time professor with a PhD in urban planning at the Lebanese University. The informant has had contact with the municipality through the university and student projects to work on urban projects at neighbourhood level. The Lebanese University is one of the main universities in Lebanon
(6) Centre for Remote Sensing, CNRS, Director of Research on Water Resources (including climate change)	Researcher with a PhD in applied geology. This informant has been a researcher for 20 years at the Centre for Remote Sensing which is part of the National Council for Scientific Research, CNRS (acronym in French). This council is the main scientific research body in Lebanon.
(7) Centre for Remote Sensing, CNRS, Consultant and Project Manager	Former director of research currently working on land degradation. This informant has a PhD in soil science and a master in irrigation. The CNRS has had contact with the municipality in relation to reforestation projects in Beirut.
(8) Beirut Madinati, previous municipal elections candidate	The interviewee ran as candidate for the Beirut municipal elections last year from the civil organisation "Beirut Madinati". The organisation which is nonpartisan lost the elections and is currently constituting itself as the "municipality shadow" monitoring what the current municipality is doing. The informant, an architect and urban planner and professor at the Lebanese University, is monitoring the public space related matters. Informant is also a consultant for the EU, UN-ESCWA, UN-HABITAT on local sustainable development, strategic planning and urban issues.
(9) Organisation de Developpement Durable	Informant coordinates the NGO activities and projects which aim at ttransmitting the idea of sustainable development through workshops and

NGO, Head and Founder	mainstream it into architecture and the urban level. The NGO works with municipalities in Lebanon, Beirut among them, and around the world and its partner with UNESCO. The NGO is implementing a workshop on the sustainable development goals for the Arab world.
(10) Burohappold Consultancy, Economic Team	Informant was part of the consulting team commissioned by the Word Bank to develop the Comprehensive Urban Resilience Master Plan for the City of Beirut. Interviewee assisted with the stakeholder management and communication work with the Beirut municipal council and other stakeholders. Informant has a Master in urban economics from UCL London.

3.5 Data collection methods

As it is indicated above, individuals were *interviewed* to collect qualitative data. The interviews were *semi-structured* to guide the conversation on the path of adaptation planning and barriers (Van Thiel, 2014). Since this research focuses only one specific phase of the adaptation process, the understanding and issues along it, questions asked to informants were akin so that answers could be compared, though slightly adjusted to each person (see Annex 1 for a full copy of the interview guidelines). Some follow-up (FUP) questions were also included after the main questions depending to elaborate more on specific topics of interest.

As for research ethics, interviewees were briefed that information was going to be used for academic purposes only and their names were not going to appear in the document. Most interviewees were very open and allocated plenty of time to answer questions with the exemption of one related to the influence of the private sector on the Municipality's decisions. Some informants answered very shortly or cautious this question. One informant didn't allow to record the audio of the interview and another one was reluctant when answering and didn't allow to ask the full interview guideline.

Interviews lasted 40 minutes on average although the estimated time was 1 hour. The shortest interview lasted 18 minutes while the longest 1 hour. The language used was English, so there was no need to use translators or third parties.

In addition to interviews, *content analysis* was used for triangulation. The following were the consulted documents: Publication "Atlas du Liban. Les nouveaux défis (Verdeil, Faour, et al., 2016b); an unpublished official Statement by the Municipal Council of Beirut City on reducing the disaster risk and increasing city resilience (2011?); a youtube video on Making Cities Resilient and Disaster Risk Reduction in Beirut (United Nations Office for Disaster Risk Reduction, 2011); a brochure on the national economic, environment and development study for climate change projects (Republic of Lebanon, et al., 2009?); and an online source on politics in Beirut (Winters, J., 2016).

3.6 Data analysis methods

To analyse the data collected several steps were undertaken:

1. A full transcription of the interview audio was captured in a Word document. Only in one case, an informant didn't allow to record the interview, so a manual report of key messages was written down during the interview.
2. Once in the Word document, sentences or paragraphs that related to the same topic were coded. The coding was done, using the software for qualitative data analysis *Atlas.ti*, according to what key words or sentences represented or suggested to be e.g. a barrier, an opportunity, the status of adaptation planning, etc. Codes serve to

summarize the content of a certain concept (Van Thiel, 2014). In this way all transcripts had the same code names. This is also called data management.

3. Based on the coding, different sentences under the same codename could be compared to revise whether information provided by different informants somehow coincided or not. This resulted in preliminary findings.
4. In order to be able to analyse the occurrence of barriers, the number of times a barrier was mentioned was quantified (Atlas.ti does this automatically when coding). An Excel table illustrates this frequency.
5. Based on their occurrence and on the code-related sentences, further analysis of data was possible which is presented in the findings section. Data analysis requires personal interpretation from the researcher.
6. Based on the data analysis, conclusions were drawn linking back findings to literature.

3.7 Validity and reliability

3.7.1 Reliability

A high level of reliability means that the explanation of findings is most likely the correct one. Basically, reliability consists of accuracy and consistency (Van Thiel, 2014). Accuracy refers to how interview questions are framed. The questions derive from each of the variables which in turn come from the concepts developed in the operationalisation process. The questions attempted to be neutral in nature and as precise as possible to increase the reliability of the research.

Consistency has to do with repeatability meaning that under similar circumstances, similar results must be found even if the research is made by a different researcher or group of researchers. Results must draw the same or very similar conclusions.

3.7.2 Internal validity

Theoretically, internal validity of findings in case studies is high due to the fact that a large amount of information on a specific situation is collected from different (Van Thiel, 2014). However, the internal validity of this case study on the Municipality of Beirut cannot be considered very high. This is due to various factors. Although, several sectors such as the local and national government, academia, research institutes and NGOs were interviewed, only ten people could be reached for an interview. Also, the local private sector is not included due to difficulties to reach informants in general. Although the international consultancy firm BuroHappold can be considered as a private sector company, they were only commissioned by the Municipality and the World Bank to work on the Resilience Master Plan for Beirut.

In addition, in the structure of the municipality there are no ‘departments’ focusing on specific topics. Rather there are two main areas in the municipality that seem to work separately, one is completely administrative and the other one is the decision-making body who oversees all kind of topics and projects, including environment / climate change.

3.7.3 External validity

External validity of case studies is low because the information collected is context-specific and cannot be generalized (Van Thiel, 2014). This study focuses only on the barriers in Municipality of Beirut to plan for adaptation, thus all data and information is related to it. Barriers can differ within the municipality of Beirut about a different topic.

In addition, there are three sources of interference that threat validity (Van Thiel, 2014). First, *the researcher* who has their own mental model and personality - way of thinking - which

may influence the interview and the data analysis. Second, there can be mistakes in the interview guideline either in their development or in their application. For instance, wrong formulated questions. Third, interviewees' answers might not hold full truth, for instance, by omitting information they think can affect their work.

To increase reliability and reduce threats to validity it is convenient triangulate information collected during the fieldwork (Studying cities: social science methods for urban research. Research strategies, case study, 2017). Figure 6 depicts such triangulation for this research.

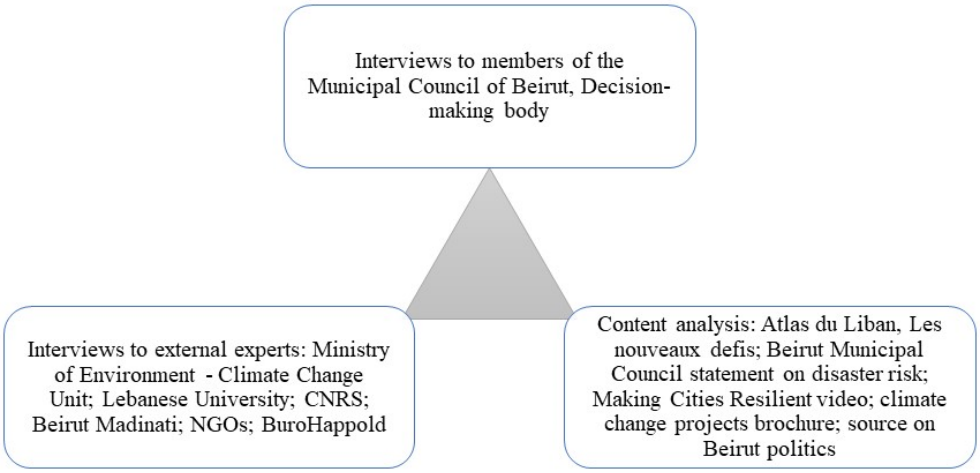

Figure 6. Triangulation of information.

Chapter 4: Research Findings: commonly reported barriers, interconnections and opportunities in the adaptation process in Beirut

In order to answer the research question: How do current institutional barriers influence the understanding phase of the climate adaptation process in Beirut, Lebanon? fieldwork was carried out in the city of Beirut during July 2017. During this month, 10 individuals were interviewed providing valuable data which was subsequently analysed. This is presented in this section as findings. 'Interviewees' also called 'informants' are referenced by number (see table 3 in section 3.4)

As a result of interviews, a context of the Municipality of Beirut and climate adaptation is provided before the actual findings. Informant 2 gave some key facts remarking that the Municipality of Beirut has a unique structure in Lebanon. It is composed of two governing bodies. One is the elected body which has a president and the other one is the administration of the municipality. The former body is the city council, decision-making and controlling body while staff of the latter one is basically administrative. Municipal counsellors, part of the first body, are the decision-makers and elected every 6 years. They do voluntary work as members of the municipality and are dependent of other sources of income.

The municipality has engaged in some level of cooperation with the World Bank to develop the Comprehensive Resilience Master Plan for the City of Beirut. This project was commissioned by the World Bank to the international consultancy firm BuroHappold and according to interviewees it would be probably finalized by the end of this year 2017.

The only available documents about this project at the moment of this research were two online presentations. The first one, dated from 16 March 2016, is an introduction to the project which aims "to make the city of Beirut a resilient capital city, providing a safe and liveable environment to its population and a prosperous economic and development future" (Burohappold Engineering, , p. 2). It shows the 4 main pillars of the project: society & community, environment & infrastructure, adaptive capacity & response, and governance & economy

The second presentation 'stage B', 25 August 2016, (Burohappold Engineering). provides preliminary conclusions: the top resilience gap is in earthquake preparedness and the top initial risk is from armed conflict. The most deficient sectors were governance, societal & community resilience, business & trade and infrastructure. However last year in 2016, informant 2 remarks, municipal elections took place in Beirut and the administration which had started the Resilience Plan was replaced and the project apparently stayed stalled.

The approach towards climate change has not been straightforward. In fact, there was a shift from disaster risk reduction that was up taken in the latter part of 2010 to resilience around 2013, as stated by informant 2. The change was seen as moving from a reactive approach to a more proactive one. From then on, environment and climate change issues started to be considered institutionally.

Apart from the Resilience Plan, it was suggested that there has been scattered studies on environment, on waste collection, plans to increase green areas, and a plan for the coastal area including floods and tsunami impacts with no further information. However, Beirut still does not have a climate change action plan per se.

4.1 Presentation of data and analysis

4.1.1 Institutional barriers and their influence on the understanding phase of the adaptation process in Beirut

Based on the 10 interviews, commonly reported barriers aroused hindering climate adaptation within the Municipality of Beirut. Numbers in figures refer to the number of times reported barriers were mentioned by informants during the interviews e.g. the Lack of interest was repeated 24 times by different informants. To refer to informants, their corresponding number is presented in brackets (see list of interviews)

4.1.1.1 Individual level barriers

Four barriers at the individual level were found and are explained below (figure 7). The individual level or dimension refers to the personal idiosyncrasy, character or personality of persons that constraint action on climate change forming a barrier per se.

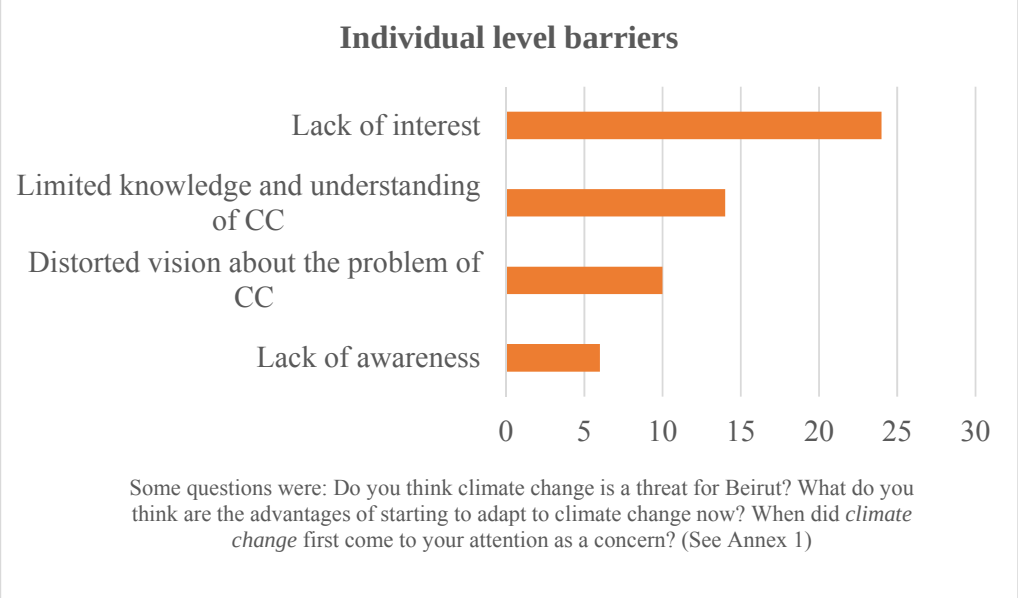

Figure 7. Institutional barriers at the individual level

Lack of interest on climate change

The lack of interest on climate change issues was the most frequently encountered barrier at the individual dimension and the second most frequently encountered in overall. Reasons behind this are several. One of them is that usually individuals are simply not interested on this issue. They are interested on different topics other than climate change and therefore they don't take it into consideration. In other words, climate change is not an interesting topic for them and hence it's not on their agenda nor is promoted as something that the municipality would have to be working on. This doesn't necessarily mean that none of them are interested or concerned about the issue of climate change, its causes and possible effects in Beirut but rather that few municipal members are. As one informant said, climate change is a matter of being concerned.

Another reason is that municipal members work on issues that citizens highly demand and these demands are usually to solve immediate problems, as suggested by informant 1. This has a close relation to matters that the municipality prioritizes. Members would prioritize

matters that require high attention and pay off quickly –political salience– (see section 4.2.2.1 on vicious cycles). Climate change is usually not part of this prioritization because in part there is no interest on it.

On the other hand, members respond to political parties which main concern is to stay in power and to achieve this they get interested in tangible and short-term projects that can be beneficial for that purpose. Climate change projects are neither as tangible for the society as other type of projects and the benefits cannot be immediate and therefore it's not a paradigm for them.

Many interviewees (3, 4, 6, 7, 8 and 9) suggested that the lack of interest affects the problem detection and the collection and use of climatic information . According to them when there is no interest on climate change it is difficult for individuals to realize the importance of the issue, hence they won't act to collect further information about it.

When individuals firstly respond to political interests they would likely tend to gather information about those interests. Even in cases when individuals get interested they wouldn't have the support from others and no efforts to collect information would take place.

As suggested by informants 4, 8 and 9, another reason which closely relates to the previous one is that the private sector seems to have an important influence on the main political party that is currently in power. This sector usually promotes business-oriented projects that don't take climate change issues into consideration and members of the municipality follow those interests. A strong factor behind this type of projects is that they are more profitable in monetary terms and they can get a benefit from that. Therefore, it seems that the interests that individuals within the municipality might have are responding to bigger reasons.

Limited knowledge and understanding of climate change

Similar to the lack of interest barrier, some members of the municipality understand the problem of climate change and have knowledge about it but others don't. It is mentioned by interviewees that within the municipality there is a lack of knowledge and understanding of the exact negative impacts of climate change that can take place in Beirut and what are their effects even though members do acknowledge the existence of the issue. It can be said that climate change risks are sub-estimated by individuals and therefore by the municipality. This lack of knowledge and understanding of climate change can derive in not being concerned about the issue. Informant 6 stated that climate change "*is a matter of understanding and believe that this is a serious issue we have to deal with*" and further explained:

> *"…you can't make any adaptation or any action before understanding, if I want to make any adaptation measure or instrument for the climate change in Lebanon I should understand before if we have a decrease in the rainfall or if there is an increase in temperature or whatever. So, when you understand exactly the issue itself, you can build your plans and build your vision, you see? this is the problem".*

This reflects that whenever a proper understanding of climate change is lacking this would directly interfere on its detection and further steps towards addressing it would be obviously jeopardized. In other words, when individuals are not familiar with the issue of climate change they won't concern about what might happen and the issue would not be taken seriously. However, as its documented, impacts of climate change can come sooner than expected. No evidence was found pointing that the information collection is hindered when there is knowledge and understanding issues.

Distorted vision about the problem of climate change

Sometimes how informants see the issue of climate change and how it should be approached is misconstrued. Their vision seems to be distorted in a number of ways. Informants 1 and 3, suggested that working on climate change issues is more a national task rather than local. However, Beirut can look at many cities and local governments around the world that have taken the initiative to develop and implement local adaptation action plans without the support from the national government or it can ask for international support.

Another factor is the lack of vision that can be connected to leadership issues within the Municipality to make the projects of the municipality sustainable rather than just quick solutions that solve challenges in a rudimentary manner. In this regard informant 5 stated:

> "*…when you get to the real projects they are rarely dealt with from this entry point, from example if you take the issues of flooding for them is an issue of canalization, so it's just public works, it doesn't integrate a lager framework of sustainability of risk management, "just let's have canalization along the roads", it doesn't go beyond that.*"

It can be said based on this quotation that the way decision-makers conceptualize climate change related issues might not be accurate. Furthermore, when the municipality addresses issues such as extreme rain patterns, floods, lack of green spaces, waste collection, quality of water, quality of air, etc. they tend to treat these events as isolated and not as part of a trend related to climate change. Thus, even though they work on some of these issues, they don't realize that they can at the same time make projects that help start to adapt to climate change in a sustainable manner. Interviewee 5 emphasised that:

> "*…even when they work on green spaces the idea of having green spaces have nothing to do with adaptation, potential floods, etc. its only to do with making it more attractive*".

The informant was talking in relation to the municipality's focus on economic growth and on territorial marketing being attractive merely for investment leaving out sustainability matters. Interviewees suggested that a distorted vision or lack of leadership affects mainly the climate change detection and the problem redefinition. In the first case, it can obstruct identifying the consequences from climate change in Beirut such as increased temperatures. In the second case, a distorted vision can make them have an inaccurate idea of what climate change really is. For instance, when it is thought that canalizations along roads, as mentioned in the first quotation, is sufficient to cope with augmented rains and floods.

Yet another factor that goes beyond institutional matters and is possibly putting a vail on municipal members is that whenever there are hot temperatures, they and citizens in general can travel to colder places avoiding them quickly. A lot of Lebanese families have a house on the mountains. Lebanon has different climates given its uneven topography, high mountains inland and the sea coastline. While in the coastal city of Beirut during summer temperatures are reaching 40+ degrees, on the mountains the weather is much more benevolent.

Lack of awareness

The lack of awareness was the least often mentioned barrier within the individual dimension. Lack of awareness in this case means that some municipality's decision-makers are not informed nor conscious of the existence and complexity of climate change and thus decisions made don't take it into account.

However, an encountered document from the Municipal Council of Beirut City (2011?), states that the council was aware of the importance of reducing the disaster risk and increasing city resilience especially because Beirut is vulnerable to earthquake and flood risks. Though this document was released a few years ago and belongs to the previous administration.

On the other hand, it was suggested that, an evident example of a lack of awareness of current members is the waste collection mismanagement problem that Beirut has suffered for years. Sometimes garbage dumps are incinerated using fuels. Municipal members might not be aware that incinerating garbage without reducing the total amount by recycling contributes to deteriorate the air quality, the environment and the climate of the city.

To worsen things, since one of the garbage dumbs is located immediately next to the sea in the northern part of Beirut, when it rains this garbage flows directly into the seawater contaminating it and threatening the ecosystems (see Annex 2). This shows that the lack of awareness by individuals results in not taking environmental aspects into consideration.

Lack of awareness is present in individuals both in relation to climate change issues in general and in relation to the work of the municipality. When asked about any climate adaptation efforts carried out by the municipality, informant 3 said that there was nothing developed in this regard by the municipality. However, to make sure, the informant made a phone call to another Municipality member and came to realize that the Resilience Master Plan for the City of Beirut had been started by the Municipality. This reflects that even when there is a certain amount of work done on the topic, not all members are aware of it.

The Lack of awareness directly impacts the problem detection. If municipal members are not aware of climate change, its impacts, its magnitude, etc. they won't perceive it as a problem.

4.1.1.2 Organisational level barriers

At the organisational level six barriers relapse (figure 8). The organisational level refers to structural and administrative matters - the anatomical setting - so to say of the municipality as an institutional body itself.

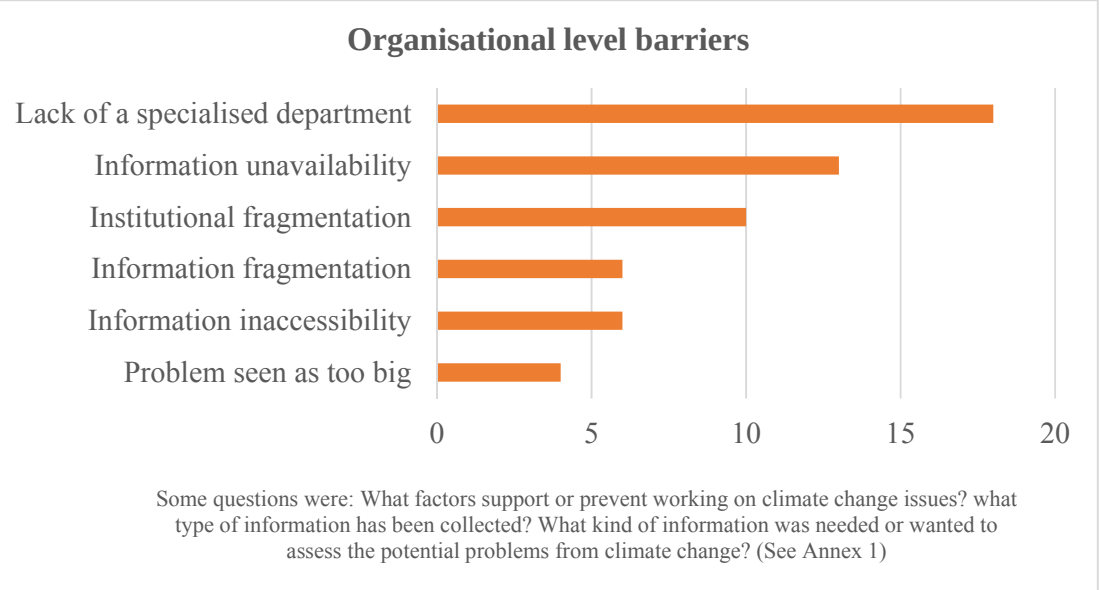

Figure 8. Institutional barriers at the organisational level

Lack of a specialised department

This barrier refers to the lack of a specially designed department at the Beirut local level permanently working on climate change. This barrier is the third most mentioned one among all type of barriers. The municipality of Beirut lacks personnel with expertise on the topic although there are members that specialise on climate change and environment they are also working on other issues thus climate change is something they look at occasionally and that they propose to work on to other members that are not necessarily connected to it.

In a statement, the Municipal Council of Beirut (2011?) proposed to establish an urban planning committee within the municipality to strengthen the urban governance and promote adequate urban planning. Informants also suggest that not having a specialised department within the structure of the municipality obviously constraints any work on climate change. Informant 2, a former member, mentioned that the previous administration was willing to constitute a specialised department as part of the Resilience Master Plan for Beirut:

> *"the administration should have the capacity and this is what we were working out of the plan to have part to build the capacity of the municipality to handle this project because you still need the resources, the people skills and this is something new, you have to build a new department (...) So one of the deliverable of this plan was to build a new department in the municipality which would handle this on a continuous basis, to renovate the data, to set data base for loses of shocks and stresses of the city, so we have to build a job description for it (…) this was our plan, we need to put structure for this in the municipality with a dedicated department with an office".*

This matches what it was proposed by the previously cited document in 2011 confirming the lack of a specialised group of people working on urban planning issues including climate change.

The lack of a specialised department looking into climate change affects the 3 sub-phases of *understanding,* the problem detection, the information gathering and the problem redefinition. First, since a formal specialised body is missing the proper detection of climate change is in risk. Second, not having the adequate people with the skills and knowledge on how to deal with climate change may hinder the collection of appropriate information of climate change. Similarly, the absence of this department with expertise may jeopardize the analysis of information thus a more accurate definition of the climatic risks and impacts in Beirut would also be at risk. The know-how ability is crucial for the development of the 3 stages.

Information unavailability

The unavailability of information which could provide knowledge about what are the current patterns of precipitations and projections, what are the means and extremes temperatures, what is the sea level and whether it is rising disturbing the coastline of Beirut and in general information about climate change at the city level was the barrier most frequently found among those related to information and data issues.

An unpublished document by the Municipality of Beirut (Municipal Council of Beirut City, 2011?) on reducing disaster risk proposes to "initiate a database on risks and hazards that Beirut city has /will encounter." Since the word "initiate" is used, this suggests that data on this real is missing. Having this information in reports, publications, etc could highly benefit the understanding of climate change issues in Beirut but currently this specialize information

scarce. Regarding information issues for the Resilience Master Plan for Beirut, informant 10 states:

> *"for us data collection was a very big challenge because in order to do anything you need data and it was very challenging to get it and we had a very limited time frame so that was another challenge but in general data is very limited."*

The lack of studies, assessments, figures, numbers, statistics, forecasts, etc. of climatic information naturally affects the information gathering and use. As the informant clearly states, "in order to do anything you need data" but this kind of information in Beirut is very limited. With this climatic information, a vulnerability assessment for example based on scientific data could be done.

When asked what exactly is needed to know about climate change impacts, informant 6 stated:

> *"What we need now is to have the data, the measured climate variables, like temperatures and rainfall, these are the major parameters, we need data about it, we need complete data sets, not just some patches of data, we need complete data sets for long time period so we can make a manipulation, how the trend is, and after that we can make projections and scenarios, it's not a matter of just to have the model, no, we need the data before to apply the model."*

Again, this shows that data and information are the bedrock to be able to understand the current situation of climate change in Beirut. Data and information related issues are part of the organizational level because they allow individuals to operationalize their expertise within the municipality and act accordingly.

Institutional fragmentation

Institutional fragmentation refers to gaps, discontinuities or disjunctions that restraint the municipality's efforts on climate adaptation. To start, informants suggested that the way the municipality is structured doesn't help since there are two bodies, the executive body and the decision-making body which usually act separately from each other. Talking about the Resilience Master Plan, informant 2 stated:

> *"(…) the very specific issue about the municipality of Beirut as I told you, we have two bodies, the executive body and the decision-making body, these 2 bodies should really have the same knowledge and the same appetite regarding this project, if these 2 bodies don't have the same attitude toward this project it will be a big difficulty and this is the big challenge (…) this is the setup of the municipality (…) this is how its formulated, so they need to have the same appetite and the same priorities."*

Likewise talking about constraints in the municipality informant 9 states:

> *"…the structure, the infrastructure of the whole municipality because it's not an efficient way to work, if you go to the municipality you may be lost between what to do and where to do (…) you see it's a very complicated thing..."*

This exemplifies the institutional disjunctions of the municipality's structure that are hindering the work on climate adaptation. The fact that the municipality doesn't have a supportive structure is detrimental. However, it is worth to note that not only the municipality

has gaps but also other institutions in Beirut and in Lebanon. For instance, informant 6 remarks that "*every institute does its own part of work and they are all separated*". Thus, it can be implied that there is fragmentation both *within* institutions and *among* institutions.

When questions related to each of the stages of understanding were asked to different informants, they referred that the institutional fragmentation was present in the three stages. Firstly, it affects the problem detection because having a generalized fragmented situation in institutions in Beirut hinders the way climate change is framed by the municipality. Second, the information gathering is affected because different institutions have different types of information which many times don't match to each other (see also information fragmentation). For example, informant 6 suggested that among research centres there are different air quality and pollution data due to different ways to collect it which makes different findings. This fragmentation doesn't allow to share the information but rather each institution does its own work and therefore there is no necessarily a common agreement. Lastly, with a fragmented situation, the problem redefinition is more difficult to accomplish because of the lack of sharing of information itself and lack of agreement.

Information fragmentation

Information fragmentation refers to dissimilar information that is unevenly dispersed across different institutions which makes it difficult for the municipality of Beirut to collect it. As mentioned by informant 6 working at the National Council for Scientific Research, CNRS, the centre has climate related data, but other institutes have different data on the same topic and there are no attempts to try to join them together to come to a unified one that can make the findings more accurate and reliable.

It is to point out that the municipality doesn't generate climatic information by itself but rather it compiles it from other institutions. Informant 6 made an example stating that for some researchers there is *climate change* but for others there is a *climate variability* which to some extent is normal, while for others it is an *abrupt climate change*. These interpretations were based on findings from other researchers that differ to those found by the informant. As it is illustrated in the following quotation, the informant further suggests that the reason behind this is the different data and time frames that researchers through their institutes use to investigate climate and its variables:

> *"...the methodologies, the data available, I mean the data set available between different sources are not the same. Let´s say I have 20 years data, the other have 10 years data, so it's also not the same. In addition, the use of the method is different. You see, for example, I am using satellite sometimes satellite images, maybe they depend on the gas stations or ground stations, so that is why we have different results and we don´t accord on one finding."*

The informant also suggests that among institutions, different research methodologies are being used, but also there are different findings, opinions and even different solutions. Ground stations are devices used to receive and transmit signals from satellites. The research centre where the informant belongs, uses this type of remote sensing devices.

Informant 10 who was part of the team working on the Resilience Master Plan for Beirut stated:

> *"…even those who were wanting to have the data, it was too scattered, so challenging to talk to this guy and then from this guy to this guy (…) it's so scattered that even if people are helpful it's still so much effort (to collect)."*

It can be inferred from this quotations that having fragmented information slowed down at least the Resilience Master Plan project and can also halts other projects affecting the information gathering and use stage by the municipality.

Information inaccessibility

Information inaccessibility refers to cases where even if information is available it is not necessarily easily accesible for everyone in this case by relevant members of the municipality. In other words, information can exist somewhere but it cannot be found. When asked about data and information informant 6 stated:

> *"(It is) not accessible, they are available but not accessible. Available I mean they exist with different institutes but it´s almost a matter of debate to have some data from another institute in order to make pure research. This is one of the problems that we are facing."*

The informant refers as 'a matter of debate' as to how difficult can be to get information needed that belongs to different institutes. In occasions when data and information are not accessible this might be due to controversies whether that information can be shared. Informant 7 said:

> *"…the climate change information, if you want to collect, the problem is the access to information, although the parliament issued a law about the free access to information, not everybody here is fully sharing information, there is always a restriction of information due to political dispute and corruption."*

It is evident that there are several factors that make the information inaccessible. As it is mentioned, political disputes and corruption play a role. In cases when information is available political parties can make it unattainable for other parties. All these factors slow down the process affecting the information gathering and use.

Problem seen as too big

For some interviewees climate change its a national task rather than local. Informant 1 feels that for people in the municipality climate change it is not their problem but rather the state's problem because it is out of their control and scope. Similarly, informant 3 suggested to do this research somewhere else because in Beirut the current conditions are not the adequate and it is "too complicated".

This vision of the problem of climate change as too big is constraining action at the local level and is relegating any action to the central government. In a way, it can be said that by doing such a relegation of responsibilities, the municipality detaches itself from any climate change consequence. Based on what informants stated in this regard suggesting that the problem of climate change is too big to be dealt with at the local level, it is implied that this affects its detection.

4.1.1.3 Enabling environment level barriers

The enabling environment level refers to the context, conditions or circumstances that facilitate or not acting on climate change. It is a more intangible atmosphere so to say that can relate to networks, relations between people, external aspects, etc. Five barriers were identified at this dimension, as shown in figure 9.

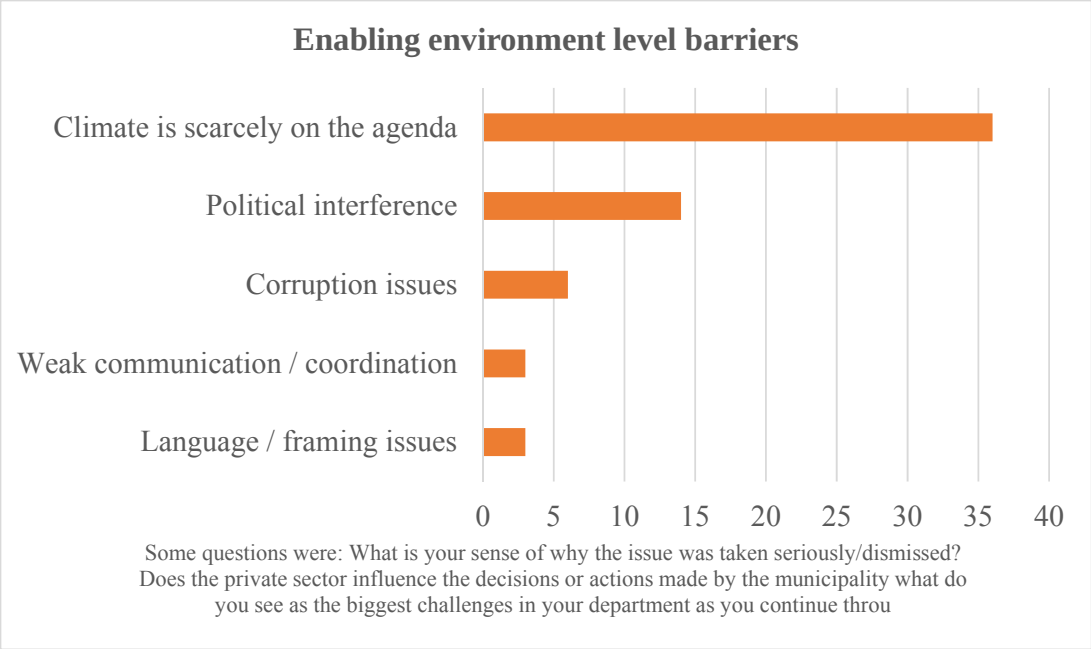

Figure 9. Institutional barriers at the enabling environment level

Climate is scarcely on the agenda

Climate change scarcely present on the municipality's agenda is the most often mentioned barrier overall. The context, meaning the conditions, in which Beirut is currently situated have not allowed for climate change to get sufficient attention by the municipality. Reasons behind this are war conflicts, social, political and economic issues. As mentioned in the previous barrier *problem seen as to big*, displaced Syrians have moved to Lebanon and Beirut, creating an issue for the municipality. Moreover, this region where Lebanon is located, next to Syria on one side and the occupied Palestine on the other, has been in tension for years which have put Lebanon's focus on security matters protecting its borders from possible invasions. Talking about priorities for the municipality informant 9 shares:

> *"…I think for the municipally is now how to deal with refugees, some security issues and how to transmit the agenda of the big political party behind the municipality."*

As shown in this quotation, in addition to the Syrian refugee crisis this and other informants add that political issues have also hampered the up-taken of actions to tackle climate change by the municipality. The same informant states:

> *"I think the biggest challenge is to define the priority, and I don't think climate change is a priority (for the municipality) to be honest. It's something already that it looks for the upcoming 20 years and at the same time they might not be here after 4 years so all what they care is to be re-elected, all what they care is to have certain persistence…"*

Climate change adaptation sometimes takes many years to be implemented until it is finally seen by the public as a tangible outcome, though political cycles are usually shorter, thus political activities privilege those actions that can provide an immediate result. Furthermore, political parties tend to have agendas that respond more to their own interests as a party than

the public or civil society ones. In the case of the Municipality of Beirut, parties respond to private sector interests and usually those interests do not consider climate change. In other words, generally party members' biggest priority is to stay in power and to strive based on that.

Furthermore, there is an uneven interest on economic growth that has affected the sustainable development of Beirut. As it can be inferred from the next quotation from interviewee 5, there has been a focus on exchanging attractive areas to private and real estate interests for money that doesn't necessarily guarantee the adequate protection of such areas.

> *"… its different priorities leading to not getting interested on the issue of climate change. When you focus only on growth, on territorial marketing being attractive for investment, this is not exactly climate change as a priority at all, it's another discourse, another paradigm, other tools, other operational approaches…".*

In Beirut, orders to issue building licenses often come from high levels of the Municipality – the major of Beirut –. This is the case of many of the issued licenses to build on banned areas along the coastline either because it is a natural protected area or because it is a public area. When high-level orders like these are given, municipal members and officers that want to put adaptation on the agenda can do little about it.

There are also short term pressing issues such as water scarcity, clean water, electricity provision for households. Beirut Madinati, a civil organization that lost in the last elections, issued for its campaign a 10-point list of key promises in which, although topics such as green areas, waterfront care, upgrading informal settlements or the integration of principles of environmental sustainability are touched upon, climate change is not straightforwardly mentioned. When asked about this to informant 8, a member of Beirut Madinati, it was said that they are not working on climate change issues nor they are experts but rather they firstly worry about ending the water and electricity shortages or about having a cleaner air with less pollution and that it is because of this that climate issues go to a second layer. However, these issues are intimately related to climate change. Hence, it can be implied that there is a generalized unfamiliarity on what climate change entails.

Apart from launching the Resilience Master Plan in an event with the media invited, no evidence was found pointing at attempts from the Municipality to overcome issues related to climate change familiarization that could help to put climate adaptation on the municipality's agenda.

In addition, when asked about priorities for the municipality a current member stated that these are mainly socio-economic ones without further specifying. Similar to the unfamiliarity with climate change just mentioned, it seems that it is neither understood that it will cost millions of dollars to repair damages provoked by climate change if nothing is done. Climate change would ultimately affect the socio-economic structure of Beirut anyway but they can be reduced.

Informants 4, 7 and 9 suggest that it can also be seen that climate change has not been a priority for previous municipality administrations by looking at the current state of the city. For instance, informant 4 mentions that an unproportioned area of Beirut's public space is covered with asphalt which doesn't allow the infiltration of rain water. Also, green areas such as public parks in Beirut have been decreasing (7, 9). The few areas left are being handed over such as the Harsh Beirut park. It can be seen that trees scatter. These factors contribute to climate change and to be more prone to risks from it.

Moreover, a recent publication by the CNRS (Abdallah, Cartier, et al., 2016) suggested that in Beirut, locally observed phenomena, such as urban heat islands enhancement, are not integrated into action programs. Based on all these factors, it can be said that the scarce presence of climate on the municipality's agenda primarily affects its detection.

Political interference

Political interference refers to political actions that directly or indirectly obstruct the planning of climate change. This barrier is linked to the lack of interest shown by members of the municipality. Individuals are members of political parties and follow certain agendas. Political parties naturally act according to the interests they might have even if they are detrimental for the city. Informant 4 remarks:

> *"…there's so much political interference in the decisions, I mean they give a decision of building a resort on the last public beach of Beirut and the law says that whatever you want to build on the shore (it) has to be 20 meters away from the water. The structure that is built now is 3 or 5 meters away from the water and the 'ok' was given by the municipality and the governor… (because of private sector) of course, god knows what happened but when you see such things, you're talking about climate vulnerability and they are building resorts or a building at the end 5 or 6 meters away from the sea water, if you see about climate vulnerability, how can you allow that, already we are seeing some weather extremes during the winter with big waves hitting…"*

As it is seen in this quotation, politics play a major role in the decisions of the municipality but they at the same time act following private sector interests. It can be therefore implied that the private sector controls to some extent the decisions that the municipality takes. They are in the position to authorize what can be done and where. Informant 9 adds:

> *"I think the private sector is the mayor generator of all the idea in Lebanon, wherever (it) is in Beirut or any other part of this country, and they are the one who do big things and they spoke (speak) with the municipality to have their support, like they do with the government (…) so in this country the central government or the system what is called the political part is not an efficient system, however the private sector are highly successful, (they) are among the best and they are the one who promote and push the municipality to follow that…"*

The private company 'Solidere' was often alluded regarding their polemic role and influence in the political life of Beirut and over the municipality. Informants referred to this company as one of the main private sector companies in Beirut. However, it can be noticed from this quotation that the influence of the private sector on the decisions of the municipality is not a unique phenomenon happening in Beirut, but it also happens in other Lebanese cities. Informant 7 states:

> *"…politics here play a major role in the decisions. Politics, disputes... the situation is not clear for the national unity of the country, there is a division in the public opinion and in the political approach (...) if you are a leader of the green project but you belong to another party, I will go against you because your party is doing well."*

The informant refers that projects face opposition when they are being carried out by a different political party no matter what type of projects they are. This is common in many cities.

As it is stated by an online source, sectarian divisions in the Beirut's politics have had consequences in the general management of many basic aspects such as the garbage, water or electricity that have led to street protests (Winters, J., 2016). This kind of issues hinder the ability to work on climatic aspects. However, Beirut continues to have the same politicians and the same basic problems. Thus, it can be inferred that the political interference affects the climate change detection because the municipality won't even consider it as a real problem that it has to be given more attention.

Corruption issues

Corruption is a common issue that is present in diverse forms in many places. In the case of Beirut, it takes place when public spaces, green areas, common goods, beaches, etc that could abate climatic impacts are exchanged for economic profits. Informant 8 explains:

> *"…they (the municipality) are commodifying all the public amenities, the common good is being co-modified, its being exchanged into money this is the biggest (challenge) and the main challenge is the corruption and this mercantile approach for everything."*

The informant suggests, as informants 1 and 4 did, that the Municipality sell licenses for private companies to use the land where it was not allowed before. Prices for these licences are then inflated to get a bigger economic gain. In this way both parties are benefited in economic terms. However, in the end this exchange of land and public goods for money threatens the quality of life of citizens.

The publication 'Atlas du Liban, Les nouveaux defis' (Verdeil, Faour, et al., 2016a), pairs what is suggested by these informants. It remarks that along the Beirut coastline, land and public spaces are being occupied by private companies tolerated and facilitated by the government which is causing environmental degradation and financial speculation. The Beirut coastline has now become largely private. It further adds, that in Lebanon several decrees have allowed more than 2,5 million sq.m. of the public maritime domain to be exploited for touristic or other purposes.

Corruption can also be linked to the influence of private sector in the municipality's decisions as mentioned in the previous barrier. The municipality issues licenses to build where it is neither adequate nor allowed increasing risks derived from climate change and making it more difficult for locals to adapt.

It can be implied that corruption mainly affects the problem detection given that the focus on pure economic gains, as suggested by informants, harms the sustainable vision that would facilitate to initiate a climate adaptation planning process.

Weak communication and coordination

Weak communication and/or coordination issues refers to shortcomings in the way climate adaptation is communicated and/or coordinated, although not necessarily within the Municipality of Beirut but between institutions such as ministries, municipalities and others. This barrier is among the least often mentioned ones by informants. This type of issues however come from different reasons such as political and not precisely because of

communication deficiencies itself but in the end communication and coordination are affected. To this regard informant 4 comments:

> *"…we* (the climate change unit of the Ministry of Environment) *were trying to open channels with the Ministry of Interior and the Municipality (of Beirut) because that's where you can directly talk to municipalities but you know there's a certain hesitation from the Ministry of Interior and the municipalities to go into climate / environmental action because there will be political sensitivities for the elections, in a way you may a have political party within the Ministry of Interior assisting only their municipalities and the other municipalities may not benefit as much…"*

It can be seen in this quotation that 'political sensitivities' play an important role in the way climate adaptation and climate change in general are communicated from national level ministries to the local governments. Consequences of this for climate adaptation can range from not fully share what is the status of climate change in cities in Lebanon or several misunderstandings and confusion. It can be therefore implied that communication and coordination issues affect the problem detection of the understanding phase.

Language and framing issues

Language and framing issues refers to the complicated way of expressing about climate change by professionals, the scientific community, academicians, experts, etc., in Lebanon. They have been unsuccessful to transmit a clear and concise idea of climate change, without technicalities to municipalities and the society in general. This barrier is also one of the least mentioned by informants. Informant 8 alleges that:

"…climate change is a new paradigm which is not yet in the conscious now yet, it's more less a terminology used by the elite, by the experts but not within the conscious of people… (it's a) very sophisticated language."

This suggests that the lexicon of climate change is not easy to understand for people that are not within the field and should be more sympathetic to the general public. This doesn't imply that it should change but rather that the way is shared to others should be more pragmatic. When it comes to the municipalities a complex vocabulary may hinder a proper understanding of climate change and thus it may be difficult to make an initial framing of the problem. Therefore, it is inferred that language and framing issues affect the problem detection stage. This may create confusion or construct a misleading idea of what climate change is.

4.1.1.4 Entire list of institutional barriers

Figure 10 shows all institutions barriers with their corresponding institutional category (abbreviated in brackets) and the number of times it was mentioned. In total, fifteen institutional barriers were found at the individual, organisational and enabling environment levels.

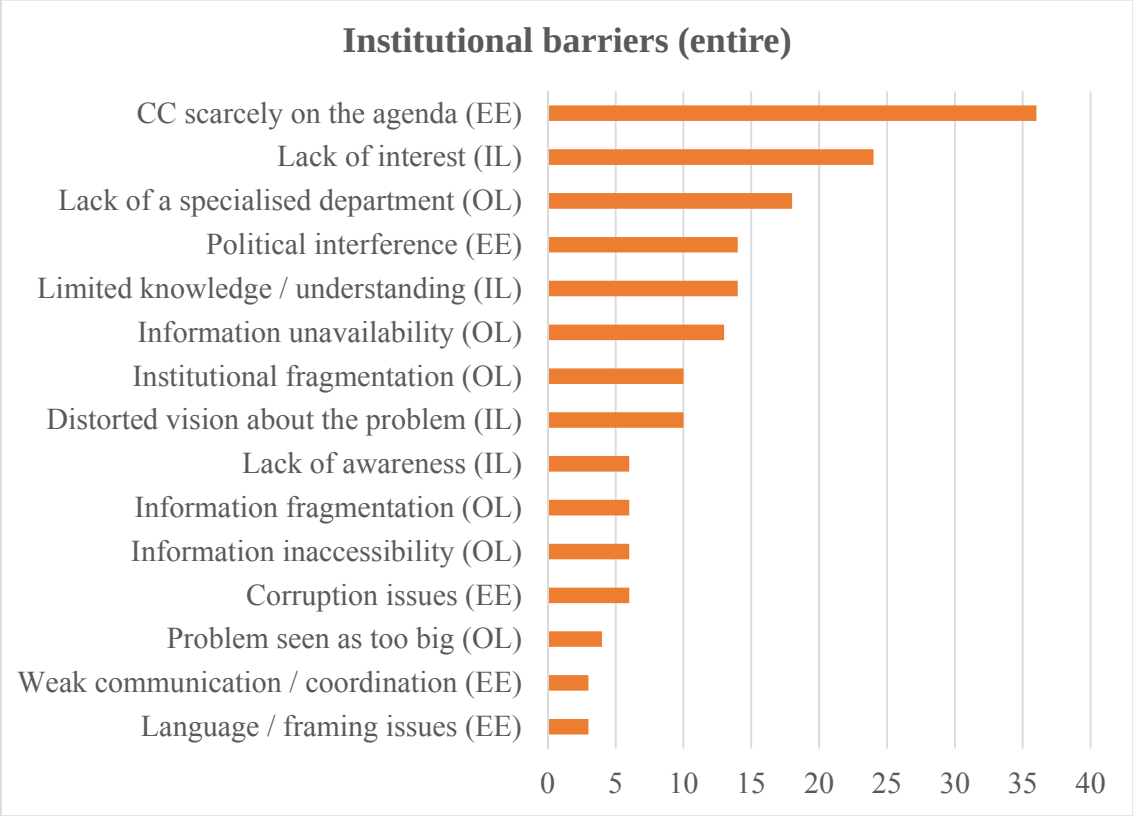

Figure 10. All institutional barriers. Note: IL stands for individual level, OL organisational level, EE enabling environment.

Climate change scarcely present on the municipality's agenda was by far the most often mentioned barrier, followed by Lack of interest and Lack of a specialised department. These are the most important barriers. Interestingly these three top barriers correspond to the three different categories of institutional barriers, the enabling environment, the individual level and the organisational level respectively. It can be therefore inferred that the three institutional levels play a role with important issues hindering the adaptation process.

Table 5 shows the barriers under their corresponding institutional level and the stage of the adaptation process they affect.

Table 5. Influence of institutional barriers on the understanding phase

Barrier	Influence	Stage affected
Individual level		
Lack of interest		Problem Detection, Information Gathering and Use
Limited knowledge / understanding		Problem Detection
Distorted vision about the problem		Problem Detection, Problem Redefinition
Lack of awareness		Problem Detection
Organisational level		
Lack of a specialised department		Problem Detection, Information Gathering and Use, Problem Redefinition

Information unavailability	Information Gathering and Use
Institutional fragmentation	Problem Detection, Information Gathering and Use, Problem Redefinition
Information fragmentation	Information Gathering and Use
Information inaccessibility	Information Gathering and Use
Problem seen as too big	Problem Detection
Enabling environment level	
CC scarcely on the agenda	Problem Detection
Political interference	Problem Detection
Corruption issues	Problem Detection
Weak communication / coordination	Problem Detection
Language / framing issues	Problem Detection

It is interesting to notice that as much as twelve barriers affect the problem detection stage while six barriers affect the information gathering and use and, three affect the problem redefinition. Figure 11 illustrates these proportions better. At the information gathering the number of barriers declines by half and at the problem redefinition the number drops even more, again by half.

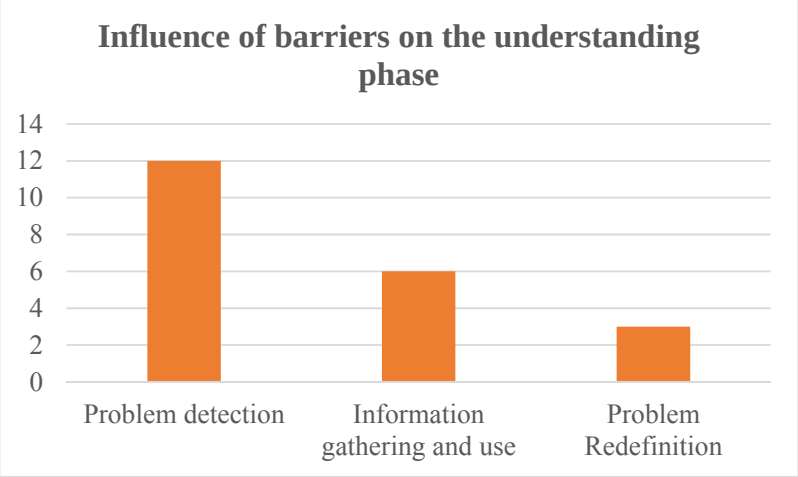

Figure 11. influence of institutional barriers on the understanding phase.

4.1.2 Vicious cycles of barriers take shape

It was identified based on interviews that there are barriers that lead to further barriers. These interconnections are called *vicious cycles* of institutional barriers. However, only 6 out of the 15 barriers form vicious cycles and the rest of barriers are just consequences of these cycles and/or they do not create further cycles themselves. It can be said that these 6 barriers are associated to many of the other 9 barriers.

Vicious cycles perpetuate difficulties to plan for adaptation to climate change. Vicious cycles can start at one institutional category of barriers and 'jump' onto others. For instance, a cycle can start at the enabling environment level and jump onto the individual level and come back and so on and so forth. This section presents only the correlations of interconnected barriers. Figure 12 shows the frequency with which each barrier was mentioned to lead to another one.

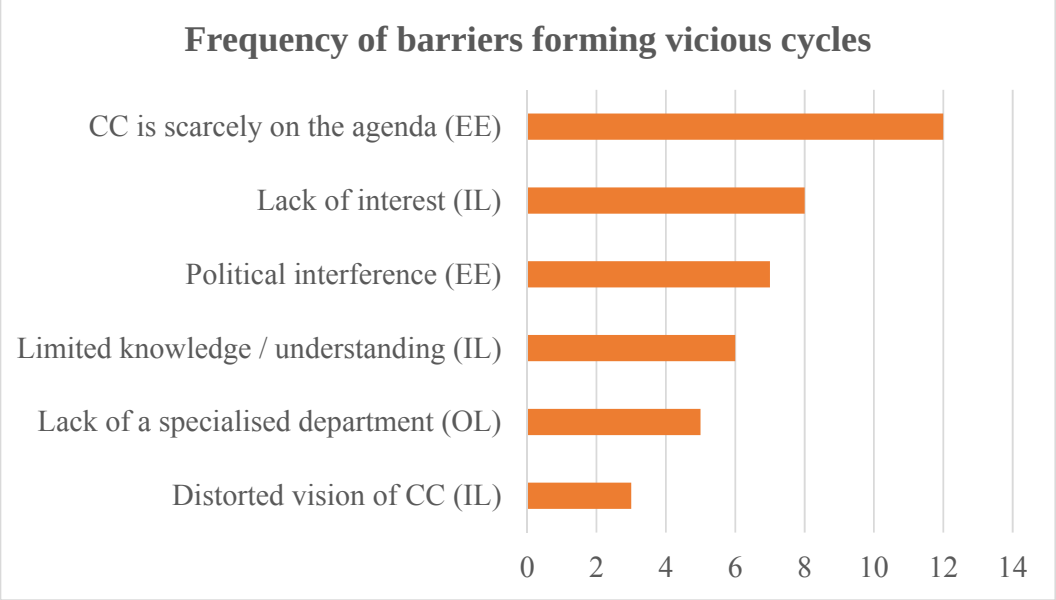

Figure 12. Frequency of barriers forming vicious cycles. Note: quantification was done based on the number of times a barrier forming vicious cycles is mentioned at least three times

The cycles here presented are the most frequently mentioned ones only. Vicious cycles interact differently. Thus, it is not possible to depict one big single cycle that is perfectly circular with all barriers included.

4.1.2.1 Climate change being scarcely on the agenda together with a Lack of interest creates further vicious cycles

The most frequent barrier that creates vicious cycles is having *Climate change scarcely present on the agenda* of the municipality. The second one is the *Lack of interest*. These 2 barriers are strongly corelated within the Municipality of Beirut and many times informants identified them as one leading to the other directly (figure 13). Having Climate change scarcely present on the municipality's agenda doesn't allow individuals to be fully interested in climate change, and vice versa, the lack of interest by individuals is then reflected in the scarce presence climate adaptation as a priority.

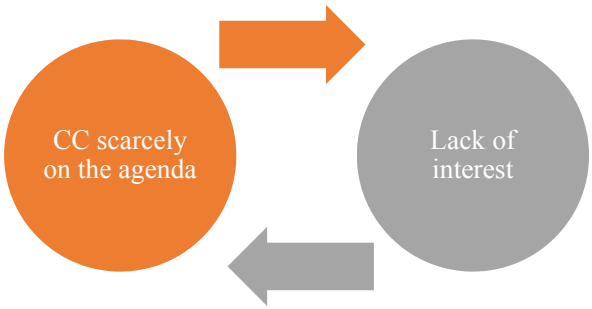

Figure 13. Vicious cycle of Lack of interest and Climate scarcely on the agenda.

> *"the biggest challenge is to define the priority, and I don't think climate change is a priority to be honest. (…) not having this people educated in terms of climate change, or sustainability, makes people who are behind the political wheel are not also (sic) they don't use it as interest, so the whole area is in a non-settled situation (…) for the municipally is now how to deal with refugees, some security issues (…) maybe is not the moment…"*

As it can be seen in this quotation, informant 9 relates the Lack of interest and prioritization or Climate change scarcely on the agenda but also suggesting further barriers such as *Limited knowledge* and a *Political interference* as we can see in consecutive cycles. Climate scarcely on the agenda plus the Lack of interest affect the Problem detection and Information gathering. It was also suggested that Climate scarcely on the agenda and the Lack of interest relate to a *Distorted vision about climate change* (figure 14). As it explained above Distorted vision refers to climate change being interpreted in divergent ways. Informant 5 explains:

> "(Barriers) *are creating vicious cycles. It's different priorities leading to not getting interested on the issue of CC, when you focus only on growth, on territorial marketing being attractive for investment, this is not exactly CC as a priority at all (…), the idea of having green spaces have nothing to do with adaptation (…) its only to do with making it more attractive".*

The causes, risks and impacts of climate change are not clear for the municipality. Selling land exclusively for investment is detrimental for adaptation. Climate change scarcely on the agenda, plus the Lack of interest plus Distorted vision affect the Problem detection and Information gathering and Problem redefinition.

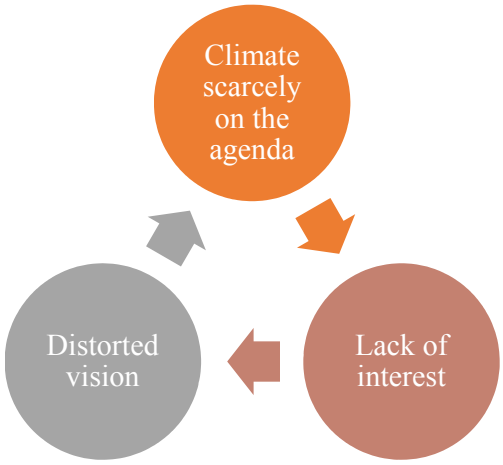

Figure 14. Climate scarcely on the agenda + Lack of interest + Distorted vision

Although no directly connected to the lack of interest, *Limited knowledge and understanding* of climate change is related to a Climate scarcely on the agenda and a Distorted vision. Another cycle can be therefore depicted as follow:

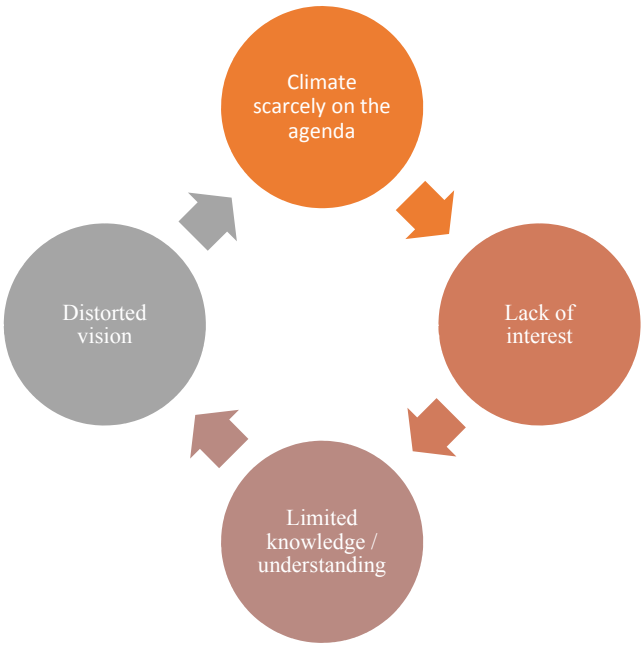

Figure 15. Climate scarcely on the agenda + Lack of interest + Limited knowledge and understanding + Distorted vision

Many external informants suggest that within the Municipality of Beirut there is Limited knowledge about climate change adaptation which is then linked to a Distorted vision (figure 15). A quotation from informant 5 serves to exemplify:

> *"…for them is something in the long term that it will come one day (…) the Mediterranean area specifically is an area that is very vulnerable to climate change, risks are huge in this area but to get these actors to consider a different approach regarding climate change is very difficult".*

Having an idea that climate change will come in the long-term is a clear example that it is misunderstood. Climate impacts are happening now.

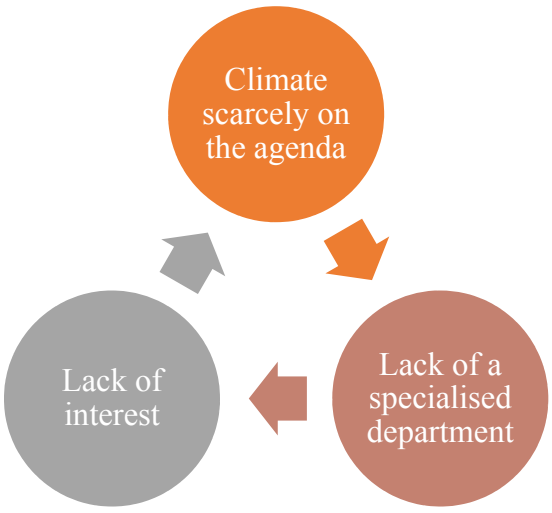

Figure 16. Climate scarcely on the agenda + Lack of a specialised department + Lack of interest

Informants 2, 3, 4 and 9 suggested that the Lack of interest and Climate scarcely on the agenda can explain the Municipality's Lack of a specialized department (figure 16). Informant 2 remarks:

> *"the very specific issue about the Municipality of Beirut, we have 2 bodies, the executive body and the decision-making body, these 2 bodies should really have the same knowledge and the same appetite regarding this project, if these two bodies don't have the same attitude toward this project it will be a big difficulty, and this is the big challenge (…) this is how its formulated, so they need to have the same appetite and the same priorities. The administration should have the capacity, and this is what we were working out of the plan, to have part to build the capacity of the municipality to handle this project because you still need the resources, the people skills and this is something new, you have to build a new department for disaster risk or something. So, one of the deliverable of this plan was to build a new department in the municipality which would handle this on a continuous basis, to renovate the data, to set data base for loses of shocks and stresses of the city (…) this was our plan, we need to put structure for this in the municipality with a dedicated department with an office."*

The project the informant is talking about is the Resilience Master Plan which includes adaptation activities for Beirut. This cycle affects the three stages of the Understanding.

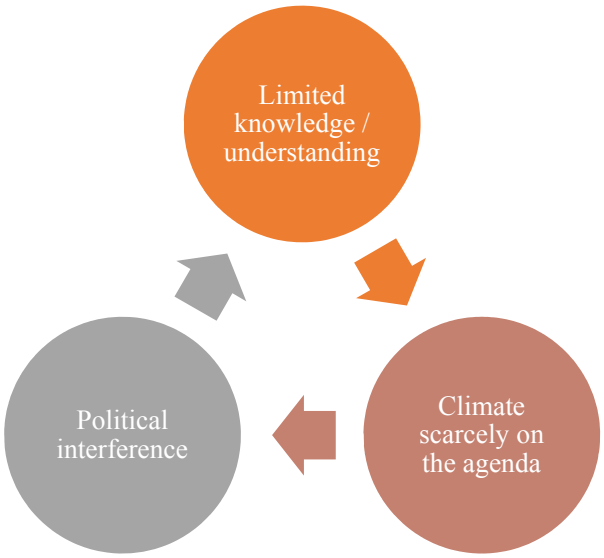

Figure 17. Limited knowledge and understanding + Climate scarcely on the agenda + Political interference

Limited knowledge and understanding and Climate scarcely on the agenda are also related to Political interference (figure 17). This cycle affects only the Problem Redefinition. Though, there are further vicious cycles that relate to the Political interference.

4.1.2.2 Political interference + lack of interest + climate scarcely on the agenda + successive cycles

It was continuously suggested that political interference affects the interest on climate change adaptation which hampers having a specialised department focusing on climate change within the local government (figure 18).

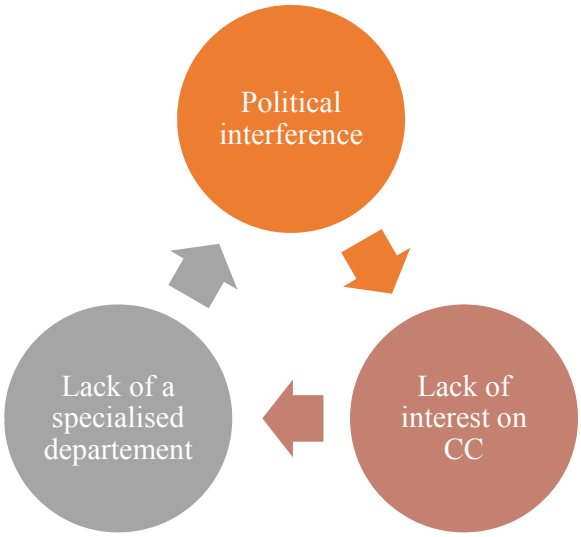

Figure 18. Political interference + Lack of interest + Lack of a specialised department

The Lack of a specialised department makes this cycle to affect the Problem detection, the Information gathering and the Problem redefinition automatically.

Likewise, it was also suggested that the Political interference does not allow to have a Specialised department which also hinders a proper Knowledge and understanding (figure 19).

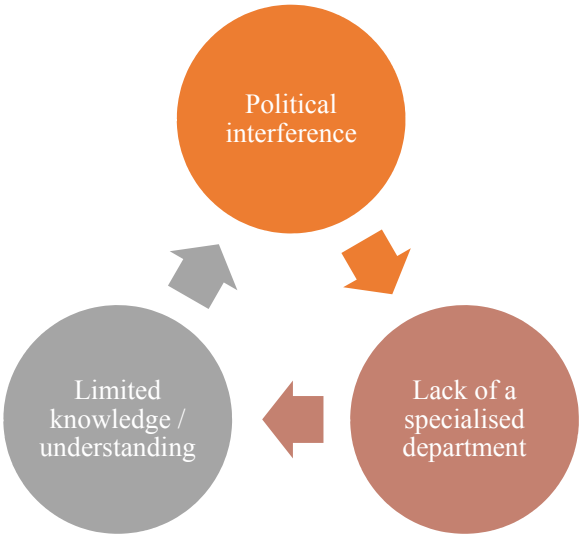

Figure 19. Political interference + Lack of a specialised department + Limited knowledge and understanding

Related to this type of vicious cycles, informant 9 remarks:

> *"…people that got elected they are maybe like related to the political parties and doesn't mean… it's not an obligation to have people with good competences* (within the Municipality) *in this thing. So, you need people inside to have the enough understanding and enough scientific background or whatever it is, in order to allow them to create the strategy."*

Again, the absence of a Specialised department makes this cycle to automatically affect the three stages of the adaptation process.

Based on the mutual relations of these barriers, it can be therefore said that Political interference, Climate scarcely on the agenda, Lack of interest, Lack of a specialised department, Limited knowledge and Distorted vision can all at some point be connected at least indirectly in vicious cycles. In order to visualize this, figure 20 shows the accumulation of all vicious cycles together.

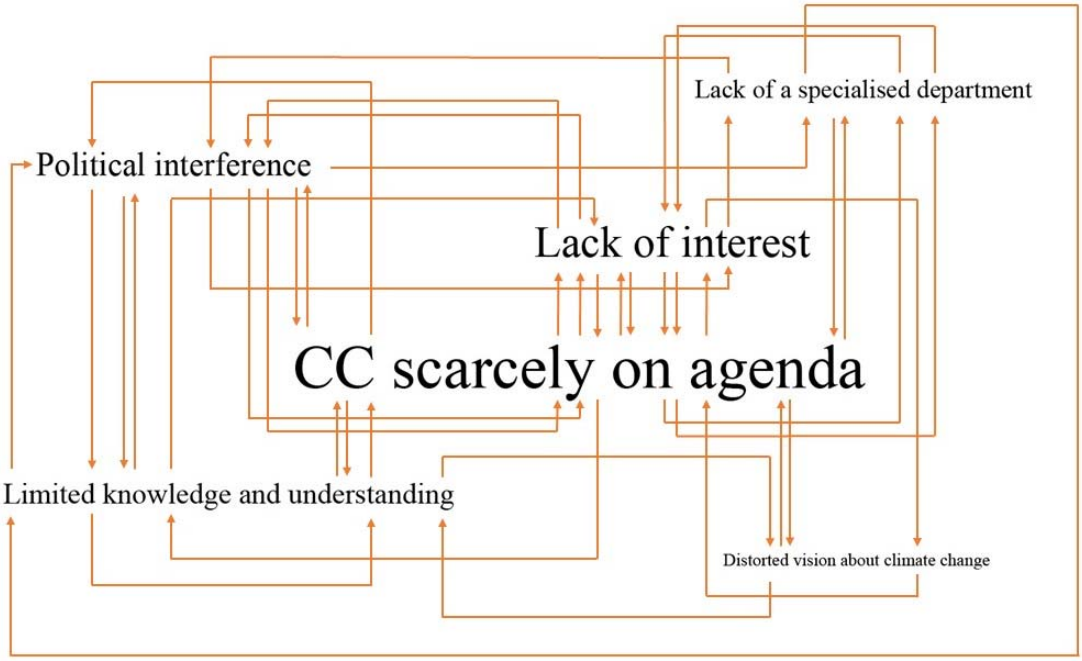

Figure 20. Graphic representation of all vicious cycles together. The bigger the name of a barrier is, the more often mentioned it was. "CC" stands for climate change. Double arrows refer to a reinforcing character of these barriers. Note: because many cycles are very similar it is useless to explain and graphically show every single one. This is to avoid repetition. For these practical reasons, some were 'joint' to other closely-related ones. This figure does merge all cycles in one graphic.

It can be said that, to a large extent, most barriers are associated to Climate scarcely on the agenda and the Lack of interest. From this cycle, many other cycles can appear augmenting the magnitude of the problem. However, the simple existence of an institutional barrier does not necessarily imply the creation of new barriers.

Though, it is important to highlight that the root causes of some barriers e.g. Climate scarcely on the agenda go beyond institutional matters. Climate scarcely on the agenda as mentioned by informants may be due to issues that are seen as more urgent such as the influx of Syrians into Lebanon due to the war and other issues (see Climate scarcely on the agenda barrier).

It is not surprising that the first five barriers that form vicious cycles – *Climate scarcely on the agenda, Lack of interest, Political interference, Limited knowledge and the Lack of a specialised department* – are also the first five barriers in the entire list of barriers. It is therefore inferred that these are the key barriers overall. The only barrier forming vicious cycles that is not a top barrier in the entire list is the *Distorted vision* which is in the middle of the table, number 8.

4.1.3 Opportunities to overcome barriers

Although the focus of this study is the institutional barriers and their interactions, opportunities to overcome them are also briefly provided. These opportunities were suggested by informants at express request.

Based on interviews, eleven frequently-mentioned opportunities to overcome institutional barriers were identified. Out of these 11 opportunities, 8 are institutional opportunities and 3 relate to other dimensions: *NGO's and civil society pressure, Media coverage* and *Private initiative.* Figure 21 shows the opportunities with the institutional category they belong to in brackets.

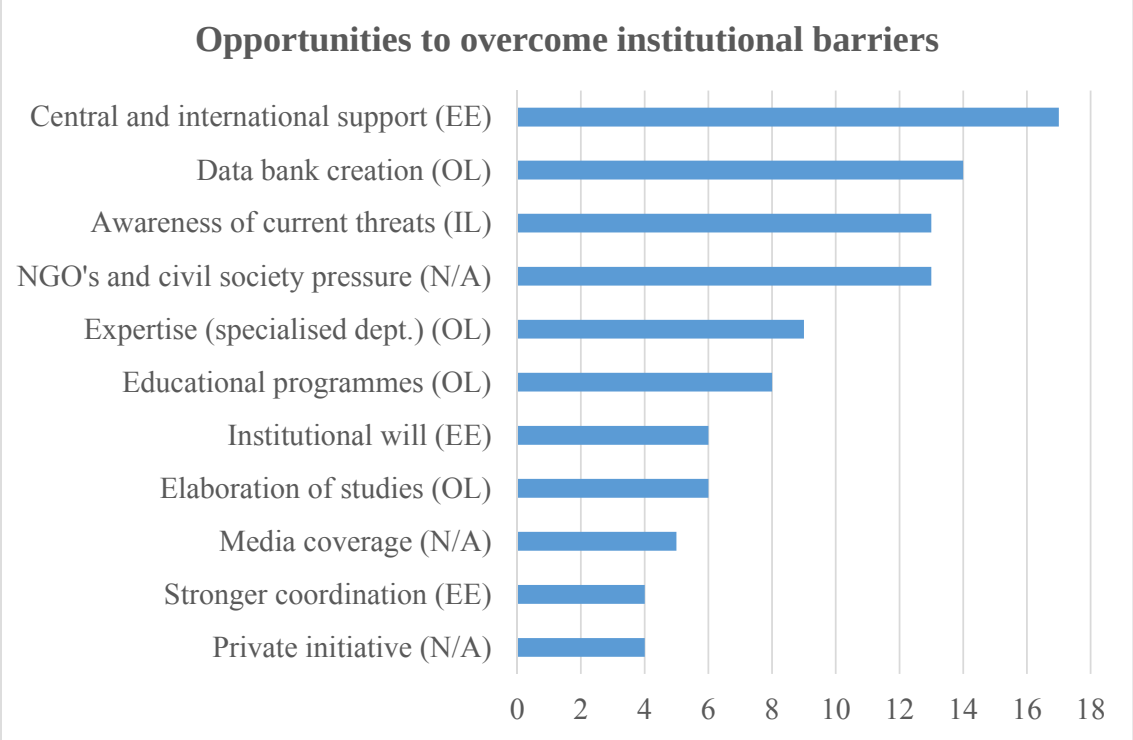

Figure 21. Opportunities to overcome institutional barriers. IL, individual level; OL organisational level; EE enabling environment level; N/A, not applicable. Note: some of the labels of opportunities were simplified to fit in the document

4.1.3.1 Individual level opportunities

Awareness of current threats and conditions

Awareness of the current conditions and threats that the city is vulnerable to was suggested as one of the main opportunities to try to initiate an adaptation process. This is the only opportunity that relates to the individual level of institutions. It is suggested to increase awareness among those who are not yet aware of climate change. It seems that this is the case of many individuals within the Municipality. Whenever it is known what can possibly take place in the city, what are the effects and specially how individuals can be personally affected, this can set an alarm for the Municipality. Informant 2 remarks:

> *"Actually the awareness is very important because as I said the Resilience Master Plan for the City doesn't only has one stakeholder, it has various stakeholders so because they have a role to play we have to increase their awareness and we take as the municipality have the lead because we are the*

party that is really close to people because we are part of the city and we know the people's problems, we know the problems of the city, where the city is vulnerable, so we know this and we are more close to people, it was taken like this, we have to involve many stakeholders and to involve them we have to increase their awareness".

Informant 2 related the awareness to the data and information (previous opportunity):

"…(First) to increase the awareness, then to have our budget in this, then to include it in our master plan then we have to know ahead on time what are our main shocks or stresses and to which extent we can be vulnerable to and the impact if it happens, so we need to have all this data and information ahead on time, so we can set our plans accordingly."

If a shock or stress, such as a severe flood from a strong storm surge, takes place this can potentially trigger awareness. The personal experience and perhaps the suffering from this type of climate hazards can make individuals interested since the scope and complexity of the issue is now tangible. Though this would be perhaps too late to recover.

4.1.3.2 Organisational level opportunities

Data bank creation

The creation of data bank centres such as observatories or institutes specially designated to collect data was recurrently mentioned as a crucial matter to be able to make climate plans. It is obvious that without precise scientific climatic information is not possible to make proper adaptation plans. These climate-related data involving statistics, trends, figures, etc., can be then converted into very relevant information to advise the climate planning and the policy-making. Informants suggest that this centre can be part of ay ministry and would inform the different municipalities of Lebanon. Informant 6 suggests:

"…a centre for climate change monitoring and climatic data monitoring. I believe this is very important. Okay? It can be like a part of any Ministry, like a small section in any Ministry and it must be concerned with the climate data, that could be a very good initiative in order to understand our climate in the Beirut level.

…we have to have a centre for climate in Lebanon or any entity or institution just for climate, and this centre or this institute would be joint with other Ministries and municipalities, like taking data and giving the results for them."

Informant 5 states:

"…there is a need of having some kind of observatory, when you go into logic of compiling data you should have some kind or archiving system and some kind of observatories that work on these issues. In the municipality of Beirut there's no even a GIS system…"

Before the introduction of the resilience plan, a database was proposed a few years ago (United Nations Office for Disaster Risk Reduction, 2011). However, given that back then the focus was on disaster risk reduction, this base looked at hazards that are not related to climate change such as earthquakes and tsunamis. This shows that there has been already attempts to tackle data issues though a climate change data centre would be ideal.

Knowledge and expertise (specialized department)

It was identified that the creation of a Climate Change Department within the Municipality would obviously increase the knowledge on climate change by local authorities and would facilitate the conditions towards the initiation of adaptation plans. Expertise, competences, a scientific background, previous experience and in general individuals with expertise and the 'know-how' on climate change would all set a path towards addressing climate adaptation in Beirut. Informant 4 suggests:

> *"…to dedicate a team recruited specifically working on environment / climate issues* (in the Municipality) *and provide all the funding, they could recruit the office but also do consultancy…"*

Although there are a few individuals with experience and studies on climate change related issues, a dedicated department must be constituted within the municipality, according to informants.

Capacity building and educational programmes

Activities such as capacity building workshops and educational programmes are means to increase the knowledge and awareness on climate adaptation. On one hand, capacity building workshops can share practical and quick information about climate change. In fact, the CNRS has hosted workshops. Interviewee 6 states:

> *"To make awareness they should be involved in the workshops, and they can learn about to work (sic) about climate change, we here at the Centre, sometimes we make workshops to trace the problem of climate change. So, if they attend, and they involve in this issue, they may understand something, and they will believe. This is very important."*

At some point this informant said that the CNRS has sent invitations to the workshops to Municipality members but they haven't attended. Interviewee 10 suggests:

> *"…its more about starting with the training sessions with municipalities, employees, some main sectors of the city to increase the awareness and for them to understand what the plan is…"*

This interviewee was referring to the Resilience Master Plan for Beirut. The interviewee further states:

> *"Actually, in December 2013 we launched a project and we started talking about it in the press, on tv, with all the ministries, we did workshops we were very active and at a certain point in time everything has stopped, and nobody is seeing anyone from the municipalities talking about it…"*

The informant suggests that given the change in administration last year with the municipal elections, the Resilience plan is halted. On the other hand, educational programmes included in public schools and universities' curricula would help the municipality in the long-term as an online video on Beirut (United Nations Office for Disaster Risk Reduction, 2011) and informants suggested. Informant 9 remarks:

> *"I think education is one of the most important things that could mobilize people, and this is a lot of NGOs, a lot of local initiatives or private initiatives are trying to do so in many universities or scholars…"*

Informant 4 from the Ministry of Environment adds:

"…in terms of education, we prepared something called teachers guide on CC based on the Lebanese Curriculum from grade 1 to grade 12 so the entire school system we are piloting it with UNESO because they have something similar and the plan is to incorporate into the national curricula within the coming couple of years"

Informant 9 further remarks:

"…we are trying to work with local public schools all over Lebanon in order to integrate these SDGs, understanding CC, so hopefully whenever they grow up they will have the basis and understanding of the importance of climate change and the SDG's (Sustainable Development Goals)*."*

However, it can be argued that the Lack of interest can constitute a barrier itself for this opportunity. The shortcoming of education programmes in universities is precisely that takes long time to accomplish results.

A statement by the Municipal Council of Beirut City (2011?) proposed to "initiate a pilot project for the safety of public schools". It can be inferred that this intervention aims to prepare schools to natural hazards such as earthquakes, increasing their resilience.

Elaboration of studies and assessments

In addition to the data bank centers, it is necessary to elaborate climatic studies such as the vulnerability assessment for the city of Beirut. Both were identified as elementary actions. On the one hand, the observatories provide scientific information, figures, etc. On the other hand, these studies transform the data collected by the observatories into practical information that can help the adaptation planning and policy-making processes. Informant 9 suggested that in order to start adaptation activities, studies are required:

"Well first of all, before implementing anything I need to make proper studies, which I don't think we have proper studies in the end"

Informant 10 stated that with the undergoing Resilience Study:

"…you will know more precisely how to make the city resilience, you will be able to define it more, you will be better informed basically. Once when (sic) *you have the risk profile of the city, that will help define better what resilience is and what you need."*

It can be therefore said that the data bank centers can lead to more accurate studies and assessments based on science.

4.1.3.3 Enabling environment opportunities

Central and international support

Informants suggested that central and international support for adaptation is required. This was the most frequently-mentioned opportunity to overcome institutional barriers. On one hand, some informants (1, 2, 4) stated that support from the central government of Lebanon would help to address adaptation issues because is when it can be mainstreamed more strongly to the city level. Informant 4 suggested that:

"…whenever the central government is giving this big push about couple of topics then it becomes a topic at a local level that's my reading but unfortunately the central government is not being able to pick that up."

Although the central government would have the potential to address adaptation and this may be sufficient for city governments to start to consider adaptation as this informant suggests, sometimes it does not do it either. On the other hand, other informants (2, 5, 9) suggested that international support can be the most effective manner to address adaptation. Informant 5 stated that:

"…back in the late 2000, 2006, 2007, 2008 there has been let's say a surge of strategic planning approaches, this has been backed by international donors, international cooperation, to have some kind of strategic documents that says where the municipalities will be investing their money…"

Although these documents relate to urban planning approaches, this can also be useful to climate adaptation planning. The National Communications to the UNFCCC, the COPs (conference of the parties) and climate agreements have at least pushed Lebanon to write down its commitments to climate change. This hasn't meant however that these commitments had been fulfilled due to political and corruption issues. If this type of issues are overcome, the international support can possibly have a positive impact.

There were also suggestions that programmes such as the 100 Resilient Cities of the Rockefeller Foundation, that can help to give an important boost towards resilience and adaptation. This programme "help cities around the world become more resilient to the physical, social and economic challenges that are a growing part of the 21st century" as stated on the webpage (http://www.100resilientcities.org/).

The nearby city of Byblos is one of the 100 selected cities and now it has preserved its central quarter and the historical heritage in good conditions. The World Bank backed the Resilience Master Plan for the City of Beirut which started at a good pace, but it seemed to be stuck at least during the fieldwork for this study. There is also the Global Environment Facility (GEF) that is a main funding source and has supported several studies in Lebanon. In general, interviewees suggest that any international help can initiate an adaptation process.

Institutional will

Climate adaptation requires the joint effort of various sectors, the water sector, energy, sector, etc. For the municipality of Beirut to be able to involve them, there must be mutual will or willingness. As a mean to show willingness on climate adaptation and environment issues, informants suggest having a committee specifically for climate among government institutions. Interviewee 7 suggested:

"…if you create a framework to lead them, to support them, to harmonize the action, to coordinate, if there is a body supported by the Ministry of Environment because they are responsible for climate change in Lebanon, is making synergy between the institution like now they have created the committee under the lead of the Ministry of Environment, they created a committee for the pollution of the (name in Arabic) river, and the Ministry of Environment is coordinating the action of this committee where every Ministry is represented. We need such action in every issue, including the climate change adaptation in the city of Beirut…"

Although the Institutional will is not literally stated, it can be inferred that with this kind of committees Municipality of Beirut can show their willingness to cooperate on environment and climate change related issues since a specialized department is lacking.

Stronger coordination

This opportunity is related to the Institutional will. However, in addition to having willingness to act upon adaptation, it is required to have coordination between institutions. Informant 4 commented on the Institutional will and a Stronger coordination though at a ministerial level:

> *"…if you have let's say every 3 month a cabinet meeting purely related on climate change given the emphasis of having stronger coordination of climate change within ministries between planning stuff, giving directives saying that any plan by any ministry should have a climate change component so eventually these are all trickle down into the local level you may have some champions at the local level that already may think of doing this…"*

The informant suggests that stronger coordination among ministries would eventually help local governments. This can also be applied within the Municipality of Beirut which would need to better coordinate with other institutions, for instance the data bank centre or the committee on climate change that have also been suggested, if it really wants to advocate for climate adaptation.

4.1.3.4 Non-institutional related opportunities

NGO's and civil society pressure

Together with an *Awareness of current threats and conditions,* NGO's and civil society are the third most frequently mentioned force that can also be an opportunity to tackle barriers. The case of 'Beirut Madinati' is a clear example of how members of the civil society organized themselves to put pressure on political parties to act on environment-related and several other issues.

The trash crisis exacerbated the discontent of Beirut citizens with the local authorities. Civilians pushed the municipality from that time to respond to this and all type of issues in a more serious way and to put end to the trash crisis. Although the crisis is still not yet solved, the NGO had an impact in the public life of Beirut and Lebanon and now it monitors the municipality's actions. Beirut Madinati was transformed into a political force that contented for the last local elections in 2016 and had huge support.

Some informants relate the civil society and NGO's work to a raise of awareness. A member and contender from Beirut Madinati (8) remarks how the NGO put pressure on the municipality:

> *"Awareness is under the pressure from us, from Beirut Madinati and other NGOs like 'You stink', these are the movements which are pushing for creating awareness among society, it's a bottom-up process so we are looking into ways to raise awareness not within the municipality but within society which might put pressure the municipality, it's the other way around, it's not the experts it's really the society which can put pressure on the municipality, that's a long way, a long shot but this is the way we are dealing with this corrupt system."*

This informant highlights that awareness should be raised through the civil society which then may be raised in the Municipality. This is a different approach which pledges to the long-term. Informant 5 suggests:

> *"…building what can be called climate change platforms with NGO's interested on these issues to establish an understanding of what's climate change first, it's not an issue now, but you have to have a group of people that come together and say let's consider this as an issue and this platform won't be put together by the municipality (…), NGOs can develop such thing."*

It can be implied that at least for these informants, civil society has played a key role in Beirut in recent years when it comes to put pressure on local authorities. Civil society and NGO's can raise awareness. On the other hand, climate change awareness in the civil society is perhaps beginning. However, if this kind of pressure and awareness raising continuous, future members of the Municipality are more likely to understand climate change but also to act upon it.

Media coverage

Media coverage is one of the identified opportunities that doesn't relate to the local government institutions. Media coverage can inform the civil society about the risks of climate change. Perhaps for 'not experts', just citizens in general is easier to understand climate change through a documentary with displayed images or videos together with an explanation, or a programme in the TV, an article in the newspaper, or a special guest's opinion on the radio. Informant 7 shared an opinion on this:

> *"…media must play a role here. Media is showing very well, but it's not enough (…). They are showing movies, they are showing films, short-films, about the diseases in the forest of Beirut for example, about the impact of* (unintelligible) *on the landscape, they are showing this, the river, the sea, solid waste disposal, mismanagement, they are showing but this is not converted into policy, it must be converted into policy."*

As the informant states, that is not enough, though it can be an initial step to raise awareness among civil society. Informant 10 also adds:

> *"I think also in general communication, for example the municipality hasn't had a website for a while and I think that communication from the municipality to people and to the public in general so other ministries I think it can be improved through a website always mentioning what is going on, press conferences and you tell people but there need to be a small update every month on the website".*

Some informants even suggest communicating adaptation activities updates through the municipality social media accounts such as Facebook, Twitter, etc. in this way general public can be aware of what the municipality is doing which was one of the issues during the Resilience Master Plan. Only few people within the municipality knew about it and the public was not informed about its existence.

A youtube video on Beirut's resilience (United Nations Office for Disaster Risk Reduction, 2011) also suggested to use the media as propaganda to increase awareness and understand how critical this issue is for the city.

Private initiative

Lastly, it was mentioned that in Lebanon the private sector is very strong and even it somehow controls some of the Beirut Municipality's decisions. It was therefore suggested that given their capacity and power, the private sector can importantly push nearly any activity, adaptation among them, if they want to. In other words, the private sector, perhaps ironically, can constitute an opportunity for the Municipality of Beirut regarding climate adaptation. Interviewee 9 suggested this:

> *"I think what is helping is mainly the private initiatives, there are some like the 'Achrafieh 2020' (…) so the municipality take the credit by supporting them."*

This informant suggests how this relation municipality-private sector can work. Both parties can come together to work on climate adaptation. On one hand, the private sector with its economic power can provide the tools and capacity. On the other hand, the municipality benefits from this as it would be a common good for citizens, just as they are doing with Achrafieh, a neighbourhood in Beirut that wants to be transformed into a "cleaner, greener, pedestrian friendly neighbourhood with an eco-friendly public transportation system, accessible by the disabled and a zero-tolerance traffic violation policy by the year 2020" as stated in the webpage (https://www.achrafieh2020.org/). This kind of actions can make the neighbourhood more attractive for tourists and for further investment as the neighbourhood has been revitalised.

The following pies show the percentage of encountered institutional barriers (figure 22) and opportunities (figure 23) per category.

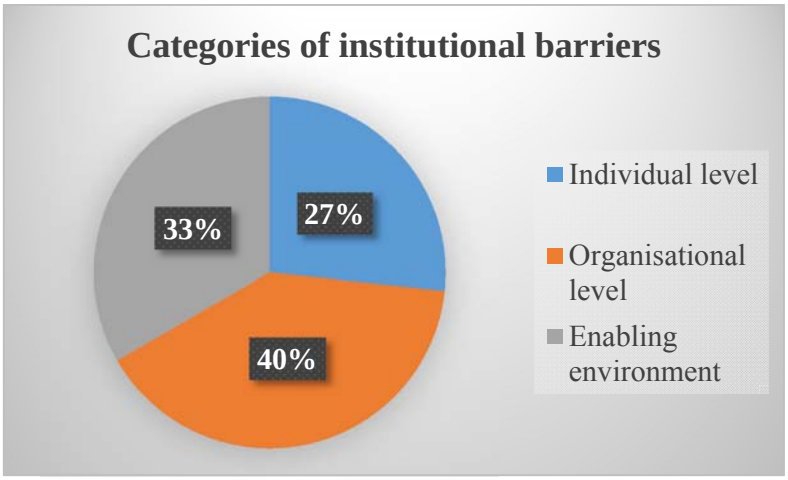

Figure 22. Percentages of institutional barriers per category

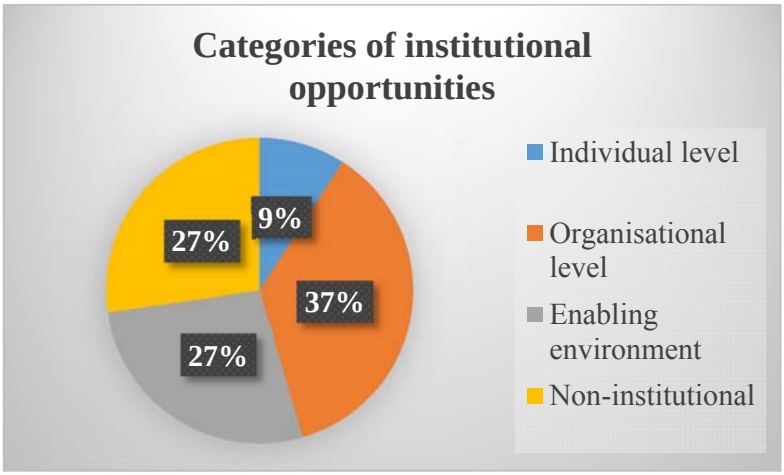

Figure 23. Percentages of institutional opportunities per category

It is interesting to notice that most of the barriers and opportunities relapse at the organisational level of institutions. Based on these figures, this means that *inherent attributes* of the Municipality of Beirut are the most deciding factor influencing the adaptation process. On the other hand, the individual level is where the least barriers and opportunities are.

However, when the number of times a barrier was mentioned is summed up per category (table 6), the result is different. The enabling environment level appears slightly more relevant than the organisational level. *Climate scarcely on the agenda* is obviously the barrier that has a very specific weight overall and which is changing the order of relevance of categories. To better grasp it, *Climate scarcely on the agenda* accounts for twice the times the *Lack of a specialised department* was mentioned, which is only the third barrier overall. It can be therefore inferred that both the organisational and enabling environment level play important roles when it comes to plan for adaptation.

Table 6. Total times a barrier was mentioned per category

Individual level		**Organizational level**		**Enabling environment level**	
Lack of interest	24	Lack of a specialised department	18	Lack of prioritization	36
Limited knowledge and understanding	14	Information unavailability	13	Political interference	14
Distorted vision about the problem	10	Institutional fragmentation	10	Corruption issues	6
Lack of awareness	6	Information fragmentation	6	Weak communication / coordination	3
		Information inaccessibility	4	Language / framing issues	3
		Problem seen as too big	6		
			4		
	54		**61**		**62**

On the other hand, the individual level, although has the least barriers, is not that irrelevant anymore since the number of times barriers were mentioned in this category is actually close to those of the other two categories, 54 against 61 and 62 respectively. In particular, the Lack of interest plays a role in the quantification.

Likewise, the most affected stage is the Problem detection. This suggests that from the very beginning a good number of diverse factors such as prioritization of other political, economic and social issues over climate adaptation, obstruct to have an elemental idea of it.

Some of these barriers create vicious cycles that affect different stages of the Understanding phase. Each Vicious cycle affect differently the adaptation process. Connected barriers in a vicious cycle affect the sum of stages each individual barrier affects. For instance, based on the entire list of barriers, *Climate scarcely on the agenda* affects the Problem detection. The *Lack of interest* affects the Problem detection and the Information gathering. Thus, they both together affect the Problem detection and Information gathering. The extent to which each vicious cycle affects the Understanding phase of adaptation therefore depends on the sum of affected stages per barrier in a cycle.

On the other hand, the *Lack of a specialised department* and *Institutional fragmentation* already affect the three stages by default. Though, the latter one was not identified as a barrier that leads to more barriers.

Based on interviews and deduction, Table 7 shows barriers and possible specific opportunities to overcome them individually.

Table 7. Specific opportunities to overcome specific institutional barriers.

Barrier	Opportunity (not necessarily in the same institutional level)
Individual level	
Lack of interest	Educational programmes and capacity building, Awareness of current threats, Media coverage
Limited knowledge / understanding	Educational programmes and capacity building, Media coverage
Distorted vision about the problem	Educational programmes and capacity building, Media coverage
Lack of awareness	Awareness of current threats
Organisational level	
Lack of a specialised department	Expertise (specialised dept.)
Information unavailability	Data bank creation, Elaboration of studies
Institutional fragmentation	Institutional will
Information fragmentation	
Information inaccessibility	
Problem seen as too big	Educational programmes and capacity building
Enabling environment level	
Climate scarcely on the agenda	Central and international support, NGO's and civil society pressure, Private initiative
Political interference	
Corruption issues	
Weak communication / coordination	Stronger coordination
Language / framing issues	

In some cases, opportunities are direct 'mirror images' of barriers as it is suggested in the literature (Ekstrom and Moser, 2014, Oberlack, 2017, Lehmann, Brenck, et al., 2013, Lehmann, Brenck, et al., 2013). *Lack of awareness* can be treated with *Awareness of current*

threats related to present climatic issues. A *Lack of a specialised department* can be obviously overcome with the creation of a *Specialised department. Information unavailability* can be tackled with the *Creation of data banks* that collect data and that openly release it, and with the *Elaboration of studies. Weak communication and coordination* can be addressed with *Stronger coordination.*

In other cases, barriers can be alleviated with opportunities that are not direct mirror images, but they are closely related to them. For instance, it can be inferred that The *Lack of interest* can be addressed through *Educational programmes and capacity building, Awareness of current threats* and *Media coverage.* These opportunities can increase individuals interest on climate change issues in different ways. For instance, *Capacity building workshops* teaching the negative effects of climate change in Beirut in or outside the Municipality as one of the informants stated, can increase individual awareness. *Awareness of current threats* can be provoked by a climatic disaster that takes place in the location such as a storm surge damaging housing. *Media coverage* about what could happen in the city in case of a shock or a stress, can make individuals more 'climate aware'.

Also, the *Climate scarcely on the agenda* which is the most frequent barrier overall, could be helped with *Central and international support, NGO's and civil society pressure* and through the *Private initiative.* It is clear that this barrier requires a higher-level support that may go beyond institutional capacity. These opportunities have attributes and capacity to importantly push the prioritization of climate change. It is worth to remember that climate change receives scant attention in Beirut, though it will have unprecedented impacts.

On the other hand, opportunities under a certain institutional category can help to overcome a barrier in a different category. This is the case for example of the, *Limited knowledge and understanding* and *Distorted vision* under the Individual level, that can be addressed through *Educational programmes and capacity building workshops* from the Organisational level and through *Media coverage* that does not relate to any institutional level.

It is worth to highlight that funding is not a problem for the Municipality. Several informants suggested that it has plenty of money, perhaps 200 million USD or more, but it is not allocated for climate change matters. No information was provided about where it is being invested. Likewise, a country brief (Republic of Lebanon, et al., 2009?) remarked that "investments in concrete mitigation and adaptation projects from government budgets are absent".

The statement by the Municipal Council of Beirut (2011?) suggested to allocate for the year 2012, "the necessary budget to address the requirements of integrating risk reduction into the development process (i.e. mainstreaming disaster risk reduction into the municipal policy structure)". As it was suggested by informant 2 the municipality shifted from disaster risk reduction to resilience with the comprehensive resilience plan, thus presumably this budget was at some point allocated. A video from the UNISDR (United Nations Office for Disaster Risk Reduction, 2011) restates that a budget was set for disaster risk reduction in Beirut.

4.2 Contrasting opinions between insiders and outsiders

Resulting from interviews to insiders and outsiders, it was found that there are contrasting opinions for specific factors influencing the climate change process. One is the prioritization of climate change by the municipality of Beirut. Members of the municipality stated that climate change used to be one of the priorities for the previous administration while external experts stated that it has not been a priority at any moment for the municipality. This may be

because the municipality is in the phase of planning, meaning that studies and assessments are currently being done such as the Comprehensive Resilience Master Plan, but practically none of them have been implemented.

Another factor is the private sector involvement in the municipality's list of priorities. When asked to insiders, they either suggested that there is no involvement, or they were reluctant in answering. Outsiders on the other hand, stated that the private sector has been involved in the Municipality of Beirut for a long time and this has had a repercussion on issues that the municipality prioritizes. They even suggest that it is not clear what are the priorities in general for the current administration.

There is certain scepticism that the Comprehensive Resilience Master Plan started by the previous administration would be embraced and promoted by current municipal members and decision makers. However, there is a few members trying to prioritize climate change and this is because they happen to have previous knowledge about it, so they individually put the topic on the table and lobby for it.

Another contrasting factor was the institutional coordination. Municipal members stated that they could coordinate relatively easy with different stakeholders such as the Ministry of Environment, Ministry of Interior, Ministry of Social Affairs, the Council for Development and Reconstruction or the Prime Minister Office, to introduce to them their plans and projects and how the municipality frames resilience including climate change. They do it through sending invitation letters to the municipality facilities. In this way, ministries were more responsive resulting in a more useful collaboration. On the other hand, external informants suggested that coordination across ministries is rather poor resulting in fragmented outcomes.

4.3 Critic to the adaptation planning process model of Moser and Ekstrom

It is confusing whether the 'Problem re-definition' actually takes place at any moment during the understanding phase. Based on different interviews it rather seems that there is no Problem redefinition stage. For instance, one interviewee stated that in order to start the Resilience project for Beirut, the office in charge first collected resilience-related information and then they depicted what the problem was. Therefore, the problem was defined only once since it has been already accurately detected.

In this case, the order of the Understanding stages would actually sort of invert, first the Information gathering and then the Problem definition which would constitute its Detection omitting the Problem 're'-definition.

Chapter 5: Conclusions and recommendations

The purpose of this research was to identify institutional barriers that hinder the understanding of climate change in the adaptation process within the Municipality of Beirut and to outline potential opportunities to overcome them. In addition, the research attempted to confirm whether connections between institutional barriers existed which would form a vicious cycle of barriers. This adds to the existing body of knowledge.

The current regional geopolitics in interplay with religion have acted against the national stability. This is then reflected in the Beirut's local politics and legislative conditions of the main public institutions that have exacerbated traditional problems (Goenaga, 2016).

Although these factors do not make a great momentum to deal with climate change, it does not automatically mean that Beirut cannot address it, on the contrary, Beirut must look at this issue because it is experiencing several effects from climate change which would have further effects on the socio-economic structure. However, the Municipality of Beirut lacks a specific plan for climate adaptation that may help to reduce climatic impacts.

On the other hand, there are research limitations. As for content, findings are context-specific and cannot be generalized given that this is a case study. As for practical matters, time was a constraint. Fieldwork was done in one month. Due to this, it was challenging to find sufficient interviewees which could be detrimental for the research validity.

5.1 Answering the research questions

5.1.1 What is the status of the adaptation process in Beirut?

The Municipality of Beirut is not following an adaptation process per se nor has a climate adaptation plan, however it has followed a process approaching climate and environmental issues within the resilience umbrella with the Resilience Master Plan for the City of Beirut which is currently in the phase of planning and developing resilience options. Due in part to this comprehensive approach, the planning phase has taken prolonged time. Nevertheless, there has been issues related to understanding climate adaptation.

On the other hand, there is common agreement among interviewees that to date no plans to address climate change and resilience have been implemented let alone the monitoring or evaluation. Informants are hesitant that this kind of projects would be implemented in the short-term. This is also suggested by Abdallah, Cartier, et al., (2016). Some external experts state that the municipality has not worked on climate change at all and that it is other institutions such as the Ministry of Environment who are working on it from the research perspective.

Though, to implement any climate adaptation project, it is necessary to go first through the stages of understanding and planning to then be able to manage and implement (Moser and Ekstrom, 2010). It is a normal process that this kind of projects require.

5.1.2 What are the institutional barriers and to what extent they affect the understanding phase of climate change in Beirut in terms of problem detection, gathering of information and problem definition?

There are 15 Institutional barriers encountered in the understanding phase. Affecting the Problem detection: Climate scarcely on the agenda; Lack of interest; Lack of a specialized department; Political interference; Limited knowledge and understanding; Institutional

fragmentation; Distorted vision about climate change; Lack of awareness; Corruption issues; Climate change seen as too big; Weak communication and coordination; Language and framing issues.

Affecting the Information gathering and use: Lack of interest; Lack of a specialized department; Information unavailability; Institutional fragmentation; Information fragmentation; and Information inaccessibility. Affecting the Problem redefinition: Lack of a specialized department; Institutional fragmentation; and Distorted vision about climate change.

Literature used (Ekstrom and Moser, 2014, Moser and Ekstrom, 2010, Oberlack, 2017, Füssel and Klein, 2004) suggested many common barriers that were also identified in this research. This shows that institutional barriers are not unique to Beirut, however, what it changes is their severity.

In the case of the Municipality of Beirut, climate adaptation is not on the agenda as a priority. In revised literature few authors such as (Sietz, Boschütz, et al., 2011) suggested this barrier. In Beirut, scarce climate presence on the agenda can be due, on one hand, to current political and social issues above mentioned. On the other hand, because other type of projects can provide short-term outcomes that benefit the political parties in power.

The main barriers besides *Climate scarcely on the agenda of the municipality* were, *Lack of individual interest* and *Lack of a specialised department within the municipality*. These three top barriers in Beirut belong to the three institutional categories of barriers: The Enabling environment, the Individual level and the Organisational level respectively. It is therefore concluded that there are crucial issues in the whole setting of the Municipality of Beirut that are hindering the understanding of climate adaptation.

Worth to note is that economic resources are not a problem for the Municipality. However, no funding is being allocated for climate adaptation matters.

5.1.3 How do barriers interact in vicious cycles to influence the understanding of the effects of climate change in Beirut?

It was identified that there are six interconnected barriers that are creating vicious cycles: *Climate scarcely present on the agenda of the municipality; Lack of interest; Political interference; Limited knowledge and understanding; Lack of a specialised department*; and *Distorted vision about climate change.*

Cycles are perpetuating institutional barriers within the Municipality of Beirut to plan for climate adaptation. The most common vicious cycle is between the two most frequent barriers overall: *Climate scarcely present on the agenda* and the *Lack of interest*. They were detected as having a mutual relationship since one leads to the other. Climate change scarcely present on the municipality's agenda is hindering individuals to be interested in it, and vice versa, the lack of interest by individuals is then reflected in the scarce presence of climate adaptation on the agenda as a priority.

This cycle is involving further barriers in the process. Scarce presence of climate on the municipality's agenda plus the Lack of individual interest on climate adaptation have led members of the Municipality to have *Limited knowledge* about it which in turns gives rise to have a *distorted vision* of it. This distortion about climate doesn't allow to put it on the municipality's agenda.

Moreover, it was suggested that *Political interference* on the decisions taken by the municipality has led to a *Lack of a climate change department* within the municipality. This

induces a general *Limited knowledge and understanding* about climate which is an entry point for further political interference since members wont advocate for climate change but for politically profitable issues.

Previous research has suggested to further investigate and, if applicable, confirm the existence of interconnected barriers (Füssel, 2007, Ekstrom and Moser, 2014, Eisenack, Moser, et al., 2014). This research concludes that interconnections or *vicious cycles*, as they were baptized, exist in the Municipality of Beirut, noting that not all fifteen barriers are interconnected to each other, but rather, just a few are which happen to be the main ones. This is in line with Mimura, Pilwarty, et al., (2014) who suggested that barriers are dynamic and context dependent across sectoral, spatial and temporal scales.

Vicious cycles naturally affect the sum of stages that the barriers forming them affect. The Problem detection is the only stage that is by default affected since all six barriers forming cycles include it. On the other hand, the only barrier forming vicious cycles that affects the three stages of adaptation process at once is the Lack of a specialised department. Thus, any cycle that connects with this barrier would automatically affect the three stages of the understanding phase.

5.1.4 Which opportunities exist to overcome the barriers to climate change adaptation?

In total eleven opportunities to overcome institutional barriers were identified. At the individual level: *Awareness of current threats*. At the organizational level: *Data bank creation; Expertise (a specialised department); Educational programmes and capacity building workshops; Elaboration of studies*. At the enabling environment level: *Central and international support; Institutional will; Stronger coordination; NGO's and civil society pressure; Media coverage;* and *Private initiative.*

Out of these 11 opportunities, 8 are institutional opportunities and 3 relate to other dimensions: *NGO's and civil society pressure, Media coverage* and *Private initiative.* Some institutional barriers can be addressed with these no institutional opportunities.

The most often mentioned opportunity was the *Central and international support* categorized under the Enabling environment level, followed by the *Data bank creation* under Organisational level and *Awareness of current threats* in the Individual level. Again, the three institutional levels are present in the main opportunities.

In some cases, opportunities are 'mirror images' of barriers as it is suggested in the literature (Ekstrom and Moser, 2014, Oberlack, 2017, Lehmann, Brenck, et al., 2013, Lehmann, Brenck, et al., 2013). In other cases, some barriers can be alleviated with opportunities that are not direct mirror images, but they are closely related to them. Moreover, opportunities under a certain institutional category can help to overcome a barrier in a different category.

5.1.5 Main research question: How do current institutional barriers influence the understanding phase of the climate adaptation process in Beirut, Lebanon?

Institutional barriers importantly influence the understanding of climate adaptation in the Municipality of Beirut. They mainly influence the Problem detection. Various factors such as the scarce presence of adaptation on the Municipality's agenda, which has a very specific weight overall, obstruct having a basic understanding of climate adaptation.

As for the institutional levels, the three institutional levels play a role. The enabling environment level is the most deciding level slightly followed by the organisational level. The individual level appears slightly behind the organisational level.

Some barriers create vicious cycles affecting, evidently, the problem detection mainly. This perpetuate some of the existent barriers. In turn, this hinders the municipality's ability to continue the adaptation process.

5.2 Recommendations

Since this research documented the existence of *vicious cycles* of barriers, it is recommended to investigate possible *virtuous cycles* of opportunities to overcome barriers and their relation to the vicious cycles. Figure 24 shows a hypothesized virtuous cycle. *Central and international support* can incentivize the *Creation of scientific databank centres* at the Beirut local level which could Raise awareness of climatic threats among the society and local government. Institutionalized awareness can demand further central and international support to address climate adaptation.

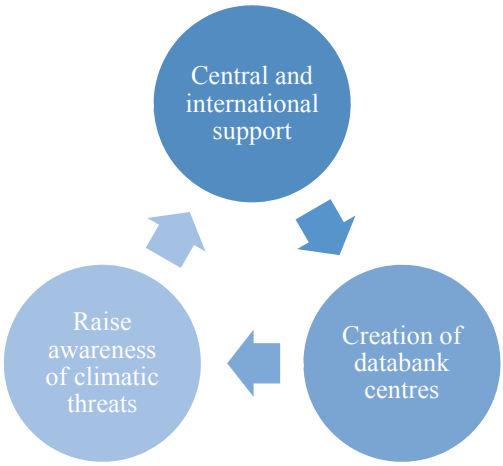

Figure 24. Hypothesized *virtuous cycle* of opportunities

As for policies, it is implied that tackling each of the top barriers per institutional category, *Lack of interest, Lack of a specialised department* and *Climate scarcely on the agenda*, would notably reduce issues overall. However, barriers should be addressed strategically in the Municipality of Beirut. The Municipality can address barriers that it has relative control of or are more feasible. For instance, the *Lack of interest* can be addressed through *Capacity building workshops and educational programmes*, or the *Lack of a specialised department* can be tackled precisely through the *Creation of a specialised department*. This would have a positive chain effect on other barriers alleviating them and consequently facilitating the adaptation process.

It is also suggested that the municipality publicly share any undertaken effort on climate adaptation even if they are seen insignificant. Starting to understand or plan can be relevant for some sectors. This can be done through public statements, declarations, social media, newspapers, tv, etc. which can change the existing perception that no climate/environment efforts are taken place.

Bibliography

Abdallah, C., Cartier, S. and Gillete, C. 2016. Une réponse institutionnelle incomplète. In: E. Verdeil, G. Faour and M. Hamzé eds., 2016. Atlas du Liban. Les nouveaux défis. Beirut: Presses de l'Ifpo; CNRS Liban. pp. 72-73.

Adger, W. N., S. Agrawala, M.M.Q. Mirza, C. Conde, et al., 2007. Assessment of adaptation practices, options, constraints and capacity. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds. Cambridge, UK: Cambridge University Press. Available at: http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter17.pdf [Accessed 18-oct-2017].

Al Jazeera news, 2016. Lebanon struggling with rubish collection again. Available at: http://www.aljazeera.com/news/2016/09/lebanon-struggling-rubbish-collection-160923162318470.html [Accessed 25-oct-2017].

Alkantar, B., 2014. Impact of climate change on MENA region to be 'catastrophic' by 2050. Available at: http://english.al-akhbar.com/node/22829 [Accessed 2017].

Berkhout, F., 2012. Adaptation to climate change by organizations. *Wiley Interdisciplinary Reviews: Climate Change,* 3 (1), pp. 91-106. Available at: http://dare.ubvu.vu.nl/bitstream/handle/1871/33093/Berkhout_WIRECC%202011.PDF?sequence=2%26origin=publication_detail .

Biesbroek, G. R., Klostermann, J. E., Termeer, C. J. and Kabat, P. 2013. On the nature of barriers to climate change adaptation. *Regional Environmental Change,* 13 (5), pp. 1119-1129.

Bulkeley, H., 2013a. Climate risk and vulnerability in the city. Climate risk and vulnerability in the city. 2013a. Cities and climate change (Critical introductions to urbanism and the city). Abingdon: Routledge. pp. 18.

Bulkeley, H., 2013b. Urban adaptation - towards climate-resilient cities? Urban adaptation - towards climate-resilient cities? 2013b. Cities and climate change (Critical introductions to urbanism and the city). Abingdon: Routledge. pp. 142-179.

Burch, S., 2010. Transforming barriers into enablers of action on climate change: Insights from three municipal case studies in British Columbia, Canada. *Global Environmental Change,* 20 (2), pp. 287-297. Available at: http://www.sciencedirect.com/science/article/pii/S0959378009001046 .

Burkett, V. R., Suarez, A. G., Bindi, M., Conde, C., et al., 2014. Point of departure. In: Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White ed., 2014. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

pp. 169. Available at: https://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-Chap1_FINAL.pdf.

Burohappold Engineering (unpublished) 2016a. Comprehensive Urban Resilience Masterplan for the City of Beirut.

Burohappold Engineering (unpublished) 2016b. Comprehensive Urban Resilience Masterplan for the City of Beirut. Srage B.

Burton, I., Malone, E., Huq, S., Lim, B., et al., 2005. Adaptation policy frameworks for climate change: developing strategies, policies and measures.

Carmin, J., Anguelovski, I. and Roberts, D. 2012. Urban climate adaptation in the global south planning in an emerging policy domain. *Journal of Planning Education and Research,* 32 (1), pp. 18-32.

Carmin, J., Dodman, D. and Chu, E. 2013. Urban climate adaptation and leadership. *OECD Regional Development Working Papers,* 2013 (26), pp. 0_1. Available at: https://www.researchgate.net/profile/Eric_Chu7/publication/304676267_Urban_Climate_Adaptation_and_Leadership_From_Conceptual_to_Practical_Understanding/links/5776d32a08aeb9427e2792fb.pdf .

Carmin, J., Nadkarni, N. and Rhie, C. 2012. Progress and Challenges in Urban Climate Adaptation Planning: Results of a Global. Progress and Challenges in Urban Climate Adaptation Planning: Results of a Global. 2012. Progress and Challenges in Urban Climate Adaptation Planning: Results of a Global. Massachusetts Institute of Technology (MIT).

Central Administration for Statistics (CAS), 2004. Main Characteristics of residences. Beirut: .

Dodman, D. and Carmin, J. 2011. Urban adaptation planning: the use and limits of climate science. Available at: http://pubs.iied.org/pdfs/17108IIED.pdf [Accessed 13-05-2017].

Dodman, D. and Satterthwaite, D. 2008. Institutional capacity, climate change adaptation and the urban poor. *IDS Bulletin,* 39 (4), pp. 67-74. Available at: https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/8193/IDSB_39_4_10.1111-j.1759-5436.2008.tb00478.x.pdf?sequence=1 [Accessed 26-oct-2017].

Duncan, 2010. Beirut's traffic gridlock a nightmare (online). Available at: https://www.thenational.ae/world/mena/beirut-s-traffic-gridlock-a-nightmare-1.559126 [Accessed 24-oct-2017].

Eisenack, K., Moser, S. C., Hoffmann, E., Klein, R. J. T., et al., 2014. Explaining and overcoming barriers to climate change adaptation. *Nature Climate Change : Perspective,* 4 pp. 867-872.

Ekstrom, J. A. and Moser, S. C. 2014. Identifying and overcoming barriers in urban climate adaptation: case study findings from the San Francisco Bay Area, California, USA. *Urban Climate,* 9 pp. 54-74.

Ekstrom, J. A., Moser, S. C. and Torn, M., 2011. Barriers to climate change adaptation: A diagnostic framework. Public Interest Energy Research (PIER) Program final project report CED-500-2011-004. Available at: http://www.energy.ca.gov/2011publications/CEC-500-2011-004/CEC-500-2011-004.pdf .

Fawaz, M., 2017. Exceptions and the actually existing practice of planning: Beirut (Lebanon) as case study. *Urban Studies,* 54 (8), pp. 1938-1955.

Füssel, H., 2008. Assessing adaptation to the health risks of climate change: what guidance can existing frameworks provide? *International Journal of Environmental Health Research,* 18 (1), pp. 37-63. Available at: https://www.researchgate.net/publication/5619917_Assessing_adaptation_to_the_health_risks_of_climate_change_What_guidance_can_existing_frameworks_provide .

Füssel, H. and Klein, R. J. T., 2004. Conceptual frameworks of adaptation to climate change and their applicability to human health. report no. 91. Potsdam, Germany: Potsdam Institute for Climate Impact Research (PIK). Available at: https://www.pik-potsdam.de/research/publications/pikreports/.files/pr91.pdf [Accessed 31-oct-2017].

Füssel, H., 2007. Adaptation planning for climate change: concepts, assessment approaches, and key lessons. *Sustainability Science,* 2 (2), pp. 265-275. Available at: https://www.researchgate.net/profile/Hans-Martin_Fuessel/publication/215677053_Adaptation_Planning_for_Climate_Change_Concepts_Assessment_Approaches_and_Key_Lessons/links/09e415099025ac7a1a000000/Adaptation-Planning-for-Climate-Change-Concepts-Assessment-Approaches-and-Key-Lessons.pdf .

Galaz, V., 2005. Social-ecological resilience and social conflict: institutions and strategic adaptation in Swedish water management. *AMBIO: A Journal of the Human Environment,* 34 (7), pp. 567-572.

Garrelts, H. and Lange, H. 2011. Path dependencies and path change in complex fields of action: climate adaptation policies in Germany in the realm of flood risk management. *AMBIO: A Journal of the Human Environment,* 40 (2), pp. 200-209.

Goenaga, A., 2016. Lebanon 2015: Paralysis in the Face of Regional Chaos. *Geographical Overview | Middle East and Turkey,* pp. 223. Available at: http://www.iemed.org/observatori/arees-danalisi/arxius-adjunts/anuari/med.2016/IEMed_MedYearBook2016_Lebanon%202015_Amaia_Goenaga.pdf [Accessed 31-oct-2017].

Government of Lebanon, U., 2017. Lebanon crisis response plan 2017-2020. Beirut: Government of Lebanon; United Nations.

Hegerl, G. C., Zwiers, F. W., Braconnot, P., Gillett, N. P., et al., 2007. Understanding and attributing climate change.

Hodgson, G. M., 2006. What Are Institutions? *Journal of Economic Issues,* 40 (1), pp. 1-25. Available at: http://dx.doi.org/10.1080/00213624.2006.11506879 .

Studying cities: social science methods for urban research. Research strategies, case study. 2017. [online] IHS (director) Rotterdam. IHS.[Accessed 27-May-2017].

Ioris, A. A. R., Irigaray, C. T. and Girard, P. 2014. Institutional responses to climate change: opportunities and barriers for adaptation in the Pantanal and the Upper Paraguay River Basin. *Climatic Change,* 127 (1), pp. 139-151.

IPCC, 2014a. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. Geneva, Switzerland: .

IPCC, 2014b. Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

Johnson, B., 2010. Institutional learning. In: Bengt-Åke Lundvall ed., 2010. National Systems of Innovation: Toward a Theory of Innovation and Interactive Learning. UK and USA: Anthem Press. pp. 23.

Kaloustian, N., Bitar, H. and Diab, Y., 2016. Urban Heat Island and Urban Planning in Beirut. Available at: http://www.sciencedirect.com/science/article/pii/S1877705816332118 .

Klein, R. J. T., Midgley, G. F., Preston, B. L., Alam Mozaharul, et al., 2014. Adaptation opportunities, constraints, and limits. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 899-943. Available at: https://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-Chap16_FINAL.pdf [Accessed 28-May-2017].

Krellenberg, K., 2011. Resilient Cities: Cities and Adaptation to Climate Change-Proceedings of the Global Forum 2010 (ed. Otto-Zimmermann, K.). Springer Science & Business Media.

Lehmann, P., Brenck, M., Gebhardt, O., Schaller, S., et al., 2013. Barriers and opportunities for urban adaptation planning: analytical framework and evidence from cities in Latin America and Germany. *Mitigation and Adaptation Strategies for Global Change,* 20 (1), pp. 75-97.

McGranahan, G. and Satterthwaite, D., 2014. Urbanisation concepts and trends (Working paper : urban : June 2014). London: International Institute for Environment and

Development (IIED). Available at: http://pubs.iied.org/pdfs/10709IIED.pdf [Accessed 30/09/2016].

Mimura, N., Pulwarty, R. S., Duc, D. M., Elshinnawy, I., et al., 2014. Adaptation planning and implementation. In: Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y .O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P .R. Mastrandrea, and L.L. White ed., 2014. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY: Cambridge University Press. pp. 869.

MoE (unpublished) 2005. National environmental action plan. Unpublished.

MoE/GEF/UNDP, 2011. Lebanon's Second National Communication to the United Nations Framework Convention on Climate Change. Beirut: .

MoE/UNDP/GEF, 2015. Economic Costs to Lebanon from Climate Change: A First Look. Beirut: Available at: http://climatechange.moe.gov.lb/viewfile.aspx?id=228 [Accessed 23-oct-2017].

Moser, S. C. and Ekstrom, J. A. 2010. A framework to diagnose barriers to climate change adaptation. *Proceedings of the National Academy of Sciences of the United States of America,* 107 (51), pp. 22026-22031.

Mukheibir, P., Kuruppu, N., Gero, A. and Herriman, J. 2013. Overcoming cross-scale challenges to climate change adaptation for local government: a focus on Australia. *Climatic Change,* 121 (2), pp. 271-283.

Mukheibir, P. and Ziervogel, G. 2007. Developing a Municipal Adaptation Plan (MAP) for climate change: the city of Cape Town. *Environment and Urbanization,* 19 (1), pp. 143-158. Available at: Mukheibir, P. and Ziervogel, G. (2007) 'Developing a Municipal Action Plan (MAP) for Climate Change .

Municipal Council of Beirut City (unpublished) 2011?. Statement. Official statement.

National Research Council, 2009. Informing decisions in a changing climate. Panel on Strategies and Methods for Climate-Related Decision Support of the Committee on the Human Dimensions of Global Change, National Research Council of the National Academies. Available at: https://www.nap.edu/catalog/12626/informing-decisions-in-a-changing-climate [Accessed 06-June-2017].

Navarra, A. and Tubiana, L., 2013. Regional Assessment of Climate Change in de Mediterranean. Springer.

New 7 wonders, 2017. New 7 wonders cities. Available at: https://about.new7wonders.com/ [Accessed Online, 16 October, 2017].

Noble, I. R., Huq, S., Anokhin, Y. A., Carmin, J., et al., 2014. Adaptation needs and options. In: Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M.

Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White ed., 2014. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. pp. 883. Available at: https://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-Chap14_FINAL.pdf.

North, D. C., 2016. Institutions and economic theory. *The American Economist,* 61 (1), pp. 72-76. Available at: http://journals.sagepub.com/doi/pdf/10.1177/0569434516630194 [Accessed 30-oct-2017].

Oberlack, C., 2017. Diagnosing institutional barriers and opportunities for adaptation to climate change. *Mitigation and Adaptation Strategies for Global Change : An International Journal Devoted to Scientific, Engineering, Socio-Economic and Policy Responses to Environmental Change,* 22 (5), pp. 805-838. Available at: https://link.springer.com/article/10.1007%2Fs11027-015-9699-z [Accessed 29-May-2017].

Reckien, D., Flacke, J., Olazabal, M. and Heidrich, O. 2015. The Influence of drivers and barriers on urban adaptation and mitigation plans—An empirical analysis of european cities. *PloS One,* 10 (8), pp. e0135597.

Republic of Lebanon, MoE and AUB, 2009?. National Economic, Environment and Development Study (NEEDS) for Climate Change Project. Country Brief Lebanon. Available at: http://website.aub.edu.lb/ifi/public_policy/climate_change/Documents/publications/20091208ifi_cc_NEEDS_CountryBrief_Lebanon.pdf [Accessed 2017].

Revi, A., Satterthwaite, D. E., Aragón-Durand, F., Corfee-Morlot, J., et al., 2014. Urban areas. Urban areas. 2014. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. pp. 535. Available at: https://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-Chap8_FINAL.pdf.

Sietz, D., Boschütz, M. and Klein, R. J. 2011. Mainstreaming climate adaptation into development assistance: rationale, institutional barriers and opportunities in Mozambique. *Environmental Science & Policy,* 14 (4), pp. 493-502.

Strobl, J., 2016. Lebanon's Garbage Crisis. Available at: http://revolve.media/lebanons-garbage-crisis/ [Accessed 25-oct-2017].

Teasdale, P., 2010. Multi-level governance: a conceptual framework. Multi-level governance: a conceptual framework. 2010. Cities and climate change. Paris: OECD Publishing. pp. 171-178.

UNDP, 2008. Poverty Growth and Income Distribution in Lebanon. Beirut: United Nations Development Programme Lebanon. Available at: http://www.undp.org.lb/PovertyReport.zip [Accessed 18-oct-2017].

UN-Habitat, 2011. Urbanization and the challenge of climate change. Urbanization and the challenge of climate change. 2011. Cities and climate change (Global Report on Human Settlements 2011). London: Earthscan. pp. 1-16.

UN-Habitat, 2016. World Cities Report 2016: Urbanization and Development - Emerging Futures. UN-Habitat. Available at: https://unhabitat.org/books/world-cities-report/ [Accessed 23-oct-2017].

United Nations Office for Disaster Risk Reduction, 2011. Making Cities Resilient. Available at: https://www.youtube.com/watch?v=Pob7A60m0lg [Accessed 2017].

Van Thiel, S., 2014. Research methods in public administration and public management: an introduction. Routledge.

Verdeil, E., Faour, G. and Dictaphone Group 2016a. Controverses sur le domaine public maritime. In: E. Verdeil, G. Faour and M. Hamzé eds., 2016a. Atlas du Liban. Les nouveaux défis. Beirut: Presses de l'Ifpo; CNRS Liban. pp. 58-59.

Verdeil, E., Faour, G. and Hamzé, M., 2016b. Atlas du Liban. Les nouveaux défis. Beirut: Presses de l'Ifpo; CNRS Liban.

Vine, E., 2012. Adaptation of California's electricity sector to climate change. *Climatic Change,* 111 (1), pp. 75-99. Available at: https://www.researchgate.net/publication/227583956_Adaptation_of_California's_Electricity_Sector_to_Climate_Change [Accessed 06-June-2017].

Wamsler, C., 2014. Sorting out the conceptual 'jungle' associated with urban risk reduction and adaptation. Sorting out the conceptual 'jungle' associated with urban risk reduction and adaptation. 2014. Cities, disaster risk and adaptation (Critical introductions to urbanism and the city). Abingdon: Routledge. pp. 15-34.

Willows, R., Connell, R., Reynard, N. and Meadowcroft, I., 2003. Climate adaptation: Risk, uncertainty and decision-making. UKCIP Technical Report. UK Climate Impacts Programme.

Winters, J., 2016. Beirut, Whose City? Available at: http://harvardpolitics.com/world/beirut-whose-city/ [Accessed 2017].

Wood, J., 2017. Beirut's beaches blighted by the rubbish crisis. Available at: https://www.thenational.ae/world/mena/beirut-s-beaches-blighted-by-the-rubbish-crisis-1.615291 [Accessed 25-oct-2017].

Annex 1: Interview guidelines

The following two interview guidelines are based on Ekstrom, Moser, et al., (2011) guideline though adapted for the specific objectives of this research. The guidelines, one for members of the municipality and other similar for external experts, were almost never fully asked. Rather, it was slightly adapted for each of the interviewees according to their position, relation with the Municipality in the case of the experts, and conditions in the moment of the interview.

Interview questions for key informants on coastal vulnerability and adaptation planning.

Members of the Municipality of Beirut.

Introduction:

This study is to document the processes undertaken by the Municipality of Beirut to address climate change adaptation. Basically, the information I am seeking from you includes background about you and your institution's involvement and role in coastal adaptation planning process and challenges you have encountered along the way.

I expect this interview will last no more than 1 hour. I would like to ask your permission to record the interview letting you know that the information will be treated confidentially, and it is for academic purposes only, specifically for my master thesis research.

I would like to mention that I refer to climate adaptation as adjustments of people, infrastructure or places planned by governments based on an awareness that climate conditions have changed or are about to change seeking to moderate its effects. Threats that coastal cities as Beirut face could range from modifications in means and extremes temperatures, changes in precipitation patterns, sea level rise in some areas or salinization of inland water.

Section 1: Background on institution and individual

1. Please tell me about your department management responsibilities and your own responsibilities.

FUP A: Could you tell me a bit about the *current priorities* your agency has?

2. What specifically does your work entail?

FUP A: So, you manage …. What does that actually mean as far as your daily work is concerned?

FUP B: How long have you been in this position?

FUP C: What is your education background (degrees and discipline)?

Section 2. Establishing how the informant thinks about adaptation and climate change (also part of identifying his/her problem framing).

Now I'd like to turn to how your work and your department's work, may be affected by climate change.

3. What do you think about climate change?

FUP: How important is it for and your office?

4. What does adaptation to climate change mean to you?

FUP: Would you say that the people you work with share your understanding of adaptation?

5. Do you think climate change is a threat for Beirut?

FUP A: Why?

FUP B: How important is adaptation to climate change for you and for the office you work in?

6. What are the main concerns about climate change for your department? How do you think CC will (or already does) affect the resources and responsibilities within your jurisdiction (including infrastructure, social well-being, ecosystems, etc.)?

FUP A: Over what time scale?

FUP B: Are you experiencing these threats now or has your department/city in the past?

FUP C: When do you think impacts are likely to start being felt, and in what way?

7. What do you think are the advantages of starting to adapt to climate change now?

FUP A: What are the disadvantages?

FUP B: Have these advantages and disadvantages played into your agency/organization`s decision to start adaptation planning?

Section 3. Establish where they are in the adaptation process

So now I'd like to understand your department's adaptation efforts.

8. Can you give me a sense of what your department has done to date in terms of adaptation?

9. I would like to better understand where you currently are in the adaptation process as an organization overall. Picking up on what you just said about what your agency has done so far, would you say you are still trying to understand the problem you need to adapt to, or have you moved on to trying to develop some plans of what to do, or are you actually already implementing some of these plans?

FUP A: For example, have you collected, discussed or used information on climate impacts for the [system of concern]? Or: have climate adaptation options been proposed/developed and if so, have these been assessed?

FUP B: *Probe for more detail on what they have or haven't done*.

10. What has your role been in these?

FUP A: Is this part of your job description?

FUP B: Is adaptation something that is added to your responsibilities or has it become part and parcel of what you do on a daily basis?

FUP C: And what has that been like?

Section 4: Understanding Phase and Associated Barriers

Now I'd like to learn more about the first steps you've gone through so far to better understand the process and any challenges you might have run into along the way.

A1. UNDERSTANDING: PROBLEM DETECTION

11. When did *climate change* first come to your attention as a concern?

FUP A: Do you remember if something in particular happened or raised the concerns? What triggered attention to the issue?

FUP B: Who initiated it?

FUP C: What were some of the first signs to you that it was a concern to the department?

FUP D: When was this?

12. How did you first learn about this issue?

FUP A: Back then, when you first heard about this, what did people in your department think about that? Where they interested, responsive? Did they take it seriously or dismiss it? What was it like?

13. What is your sense of why the issue was taken seriously/dismissed?

FUP A: Was there any reason why it was/was not? Did/do individual capacity support or prevent taking [impact of concern] seriously and responding to it?

FUP B: What other factors within you department support or prevent working on climate change issues? For instance, institutional gaps, communication issues with the staff, problems in the department or with other institutions.

FUP C: Has [climate impact of concern] previously been a problem prior to the concern over climate change? What populations, area, and/or infrastructure are at risk?

FUP D: Who is responsible for preventing [climate impacts of concern]?

14. What would you say can raise awareness about climate change in your department?

FUP: Have any actions been implemented to increase knowledge on CC? (e.g., educational programmes, workshops, capacity building?)

A2. UNDERSTANDING: INFORMATION GATHERING AND USE

15. Has information been compiled (or an assessment been done) about climate change impacts for Beirut?

FUP A: *If so,* what type of information has been collected? What led to this assessment? Who conducted or compiled the assessment or information?

FUP B: Did you look at potential climate change impacts on specific sectors or areas?

FUP C: If you had all the money you wanted, what exactly do you need to know about climate impacts—what would be the information? (e.g., new flood models, social vulnerability, forecasts?)

16. You mentioned earlier that your or your department's primary concerns for climate change were [impacts mentioned previously]. Do these issues fall within the department's priorities?

FUP A: Is your concern shared by others in your agency and your constituents (public, city residents, consumers of your resource, etc.)?

17. What kind of information was needed or wanted to assess the potential problems from climate change?

FUP A: Did you and your department agree on that or how was it decided what you would look at?

FUP B: If not, does this information exist somewhere? Was it just not accessible to you? What did you do without that information? Are there plans for obtaining what is needed?

18. Have you ever had difficulties regarding information compilation?

FUP A: If so, which ones?

FUP B: What have you done personally to overcome them?

FUP C: What has your department or the municipality done?

FUP D: In your perception, how do you think information challenges can be overcome? Which factors can trigger the development of information?

19. Do you think there are any constraints on what issues you looked at? For instance, given the jurisdiction of your agency, is there something you could not look at?

FUP A: What about your or anyone else's personal interests—anyone who has been involved so far?

FUP B: What about financial constraints?

FUP C: What about political considerations?

FUP D: Do existing policies or decision processes at all constrain what kind of information you can consider?

20. In terms of the information you gathered, how will you use that?

FUP A: Is the information compatible with existing decision-making processes and models?

FUP B: What made this information salient, credible and legitimate to you?

A3. UNDERSTANDING: PROBLEM (RE) DEFINITION

21. After information was collected, did your department's concerns about climate change modify from their original concerns?

FUP A: If so, how did they change?

FUP B: Were there any new people involved in the adaptation process?

FUP C: Did your own perception changed?

FUP D: Was there agreement on how the problem was defined between people and organizations involved? And was it important to have such agreement?

FUP E: If not, why? Can you elaborate?

22. Do the other agencies you work with agree on what the problem is?

FUP A: Do you personally agree?

FUP B: Which are there agencies? Are they local, metropolitan, national or international?

FUP C: Have you had to negotiate about this in any way?

23. Is there social/community support for addressing the threats?

FUP A: If so, in what way?

FUP B: If not, has there been opposition?

24. Does the private sector influence the decisions or actions made by the municipality?

FUP: If so, in what way?

25. What factors can improve the way climate change adaptation is analyzed and defined in your department?

FUP A: Are they likely to happen?

FUP B: If it were on you, what would you implement to better work on climate change adaptation?

26. Do you think, that the challenges you mentioned so far can act together to create vicious cycles? For instance, lack of effective communication leading to mistrust among

members of the municipality leading to coordination issues. Are some challenges or obstacles interrelated with each other?

FUP A: If so, can you give me an example?

FUP B: if not, are these barriers/challenges act in isolation?

27. Finally, what do you see as the biggest challenges in your department as you continue through this process of adaptation [or in dealing with X impact you mentioned before of climate change]?

FUP: What do you see as the biggest challenges for you as an individual?

Closing.

This is the end of the interview. Is there anything else we might have missed that you want to add about the adaptation process you've gone through so far?

This interview will be analyzed to find out what are the factors influencing the adaptation planning process. Thank you!

In addition, do you have documents on CC in Beirut such as policy documents or drafts, memorandums, presentations, newspapers or project reports that can help me elaborate more on my research?

Do you know other people that can contribute to my research, people in relevant positions in the Municipality or external experts that I can also interview? If so, can you introduce me with them

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Interview questions for key informants on coastal vulnerability and adaptation planning.

Experts.

Section 1: Background on institution and individual

1. Please tell me about your institution responsibilities and your own responsibilities.

2. What specifically does your work entail?

FUP A: So you work on …. What does that actually mean as far as your daily work is concerned?

FUP B: How long have you been in this position?

FUP C: What is your education background (degrees and discipline)?

Have you had contact with the Municipality of Beirut to work on any issues? Personal or institutional relations?

FUP: If so, in which way?

Section 2. Establishing how the informant thinks about adaptation and climate change in relation to the Municipality of Beirut (also part of identifying his/her problem framing).

Now I'd like to turn to how you think the Municipality of Beirut addresses climate change and adaptation.

3. Do you think the Municipality of Beirut works somehow on climate change issues?

FUP A: What do they specifically do?

FUP B: What are other current challenges for the municipality?

4. Is CC one of the priorities of the municipality?

FUP A: What are the current priorities of the municipality?

FUP: What kind of projects do they prioritize?

5. Do you think the municipality understands what climate change and climate adaptation are?

FUP: If so, to what extent they do?

6. Do you believe the municipality is a facilitator to work on CC?

FUP A: If not, why? Is it because of funds, interest, lack of political will..?

FUP B: In your daily work do you take them into consideration?

7. Do you think that decision makers, heads or officials of departments in the municipality care about adaptation to climate change?

FUP: Would you say there is a certain degree of understanding of adaptation?

8. What are the challenges you face when working with the municipality?

FUP A: Have you worked with the municipality? If so, doing what?

9. What are the main concerns about climate change in Beirut? How do you think CC will (or already does) affect Beirut (including infrastructure, social well-being, ecosystems, etc.)?

FUP A: Over what time scale?

FUP B: Are you experiencing these threats now?

Section 3. Establish where they are in the adaptation process

So now I'd like to understand the Municipality's adaptation efforts.

10. Can you give me a sense of what the municipality has done to date in terms of adaptation?

11. I would like to better understand where they currently are in the adaptation process as an organization overall. Picking up on what you just said about what the municipality has done so far, would you say they are still trying to understand the problem they need to adapt to, or have they moved on to trying to develop some plans of what to do, or are they actually already implementing some of these plans?

FUP A: For example, have they collected, discussed or used information on climate impacts for the [system of concern]? Or: have climate adaptation options been proposed/developed and if so, have these been assessed?

12. Have you had a role in these?

Section 4: Understanding Phase and Associated Barriers

Now I'd like to learn more about the first steps they've gone through so far to better understand the process and any challenges they might have run into along the way.

A1. UNDERSTANDING: PROBLEM DETECTION

13. When did the municipality first pay attention to *climate change* as a concern?

FUP A: Do you remember if something in particular happened or raised the concerns? What triggered attention to the issue?

FUP B: Who initiated it?

FUP C: When was this?

14. Do you think the municipality has sufficient capacity and tools to work on CC?

FUP A: Is the staff capable?

FUP B: Are there individual constraints? Such as knowledge on CC or the municipality itself simply doesn't know how to initiate work on CC?

15. What is your sense of why the issue was taken seriously/dismissed?

FUP A: Was there any reason why it was/was not? Did/do individual capacity support or prevent taking [impact of concern] seriously and responding to it?

FUP B: What other factors within the municipality support or prevent working on climate change issues? For instance, institutional gaps, communication issues with the staff, problems in the department or with other institutions.

FUP C: Has [climate impact of concern] previously been a problem? What populations, area, and/or infrastructure are at risk?

FUP D: Who is responsible for preventing [impacts of concern]?

16. What would you say can raise awareness about climate change in the municipality?

FUP: Have any actions been implemented to increase knowledge on CC? (e.g., educational programmes, workshops, capacity building?)

A2. UNDERSTANDING: INFORMATION GATHERING AND USE

17. Has information been compiled (or an assessment been done) by the municipality about climate change impacts in Beirut?

FUP A: *If so,* what type of information has been collected? What led to this assessment? Who conducted or compiled the assessment or information?

FUP B: If you had all the money you wanted, what exactly do you need to know about climate impacts—what would be the information? (e.g., new flood models, social vulnerability, forecasts?)

18. Is the municipality capable to compile information to asses CC challenges?

FUP A: What kind of information do they need or want to assess the potential problems from climate change?

FUP B: If not, does this information exist somewhere? is it accessible? Are there plans for obtaining what is needed?

FUP C: Who did the work to collect all this information? For instance, scientists, hired consultants, existing peer-reviewed literature or someone else or the municipality do it themselves?

19. What kind of difficulties or constraints exists in the municipality to collect CC information?

FUP A: In your perception, how do you think information challenges can be overcome? Which factors can trigger the development of information?

FUP B: What about financial constraints?

FUP C: What about political considerations?

A3. UNDERSTANDING: PROBLEM (RE) DEFINITION

20. After information was collected, did the municipality's concerns about climate change modify from their original concerns?

FUP A: If so, how did they change?

FUP B: Were there any new people involved in the adaptation process?

FUP C: Was there agreement on how the problem was defined between people and organizations involved? And was it important to have such agreement?

FUP D: If not, why? Can you elaborate?

21. Do the other agencies agree on what the problem is?

FUP A: Do you personally agree?

FUP B: Which are there agencies? Are they local, metropolitan, national or international?

22. Is there social/community support for addressing the threats?

FUP A: If so, in what way?

FUP B: If not, has there been opposition?

23. Does the private sector influence the decisions or actions made by the municipality?

FUP: If so, in what way?

24. What factors can improve the way climate change adaptation is analyzed and defined in the municipality?

FUP A: Are they likely to happen?

FUP B: If it were on you, what would you implement to better work on climate change adaptation?

25. Do you think, that the challenges you mentioned so far can act together to create vicious cycles? For instance, lack of effective communication leading to mistrust among members of the municipality leading to coordination issues. Are some challenges or obstacles interrelated with each other?

FUP A: If so, which challenges?

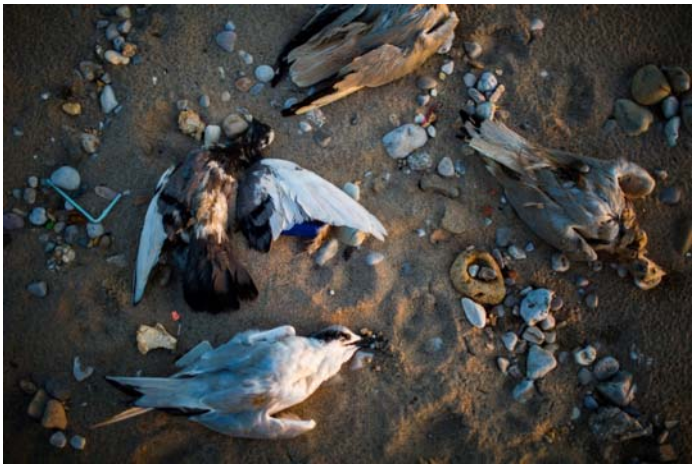
FUP B: if not, are these barriers/challenges acting in isolation?

26. Finally, what do you see as the biggest challenges in the municipality as they continue through this process of adaptation [or in dealing with X impact you mentioned before of climate change]?

Closing.

Annex 2: Garbage dumbs in northern Beirut next to the Mediterranean Sea

Photograph 1. Dump on a beach in Zaika, north of Beirut. Source: http://cdn.cnn.com/cnnnext/dam/assets/160224094108-08-lebanon-waste-crisis-super-169.jpg



Photograph 2. "Dead birds near the Costa Brava landfill. Birds attracted to the landfill pose a problem to civil aviation". Source: https://www.nytimes.com/2017/01/26/world/middleeast/on-lebanons-once-sparkling-shores-a-garbage-dump-grows.html

Photograph 3. Garbage dumps in Lebanon. Source: http://www.dw.com/en/lebanon-garbage-crisis-pollutes-mediterranean/a-36234663

Annex 3: IHS copyright form

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