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OPPORTUNITIES AND CHALLENGES TO DEVELOP AND IMPLEMENT CLIMATE CHANGE POLICIES: THE LEBANON CASE

by
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ABSTRACT
OF THE THESIS OF

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Climate change poses significant challenges to various sectors in Lebanon, particularly the water sector, where the absence of climate change considerations in policies and strategies leaves the sector vulnerable to climatic hazards. In response, the Ministry of Energy and Water updated its National Water Sector Strategy (NWSS) in 2022, aiming to address emerging challenges and enhance resilience.

This thesis examines the extent to which climate change is integrated into policies, focusing on the mainstreaming of climate change within the updated NWSS 2020-2035. Additionally, it evaluates the evolution of policies and strategies from NWSS 2010 to NWSS 2020-2035, including climate strategies aimed at enhancing water management practices.

The study explores the opportunities and challenges associated with mainstreaming climate change in policy planning in Lebanon, categorizing them into three levels: individual, organizational, and enabling environment. By analyzing institutional barriers and opportunities, the research aims to identify key areas for improvement and propose recommendations to enhance climate resilience within the water sector. Furthermore, it provides insights into the role of policy integration and coordination in addressing climate change impacts effectively, aiming to foster a more resilient water sector in Lebanon amidst the challenges posed by climate change.

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ABBREVIATIONS

AF	Adaptation Fund
CCA	Climate Change Adaptation
CCLW	Climate Change Laws of the World
CoM	Council of Ministers
COP	Conference of the Parties
CDR	Council for Development and Reconstruction
EU	European Union
GCF	Green Climate Fund
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resource Management
LDC	Least Developed Countries
MENA	Middle East and North Africa
Mm^3	Millimeters cubed
Mm	Millimeters
MoA	Ministry of Agriculture
MoE	Ministry of Environment
MoEW	Ministry of Energy and Water
MoI	Ministry of Industry
MoIM	Ministry of Interior and Municipalities
MoPh	Ministry of Public Health
MWI	Ministry of Water and Irrigation
NAP	National Adaptation Plan
NBER	National Bureau of Economic Research

NDC	Nationally Determined Contributions
NWSS	National Water Sector Strategy
OECD	Organization for Economic Co-operation and Development
RWE	Regional Water Establishments
SCCF	Special Climate Change Fund
SESA	Strategic Environmental and Social Assessment
SDG	Sustainable Development Goals
UNFCCC	United Nations Framework Convention on Climate Change
WEFE	Water-Energy-Food-Ecosystem
NWS	National Water Strategy
PPP	Public-Private Partnership

CHAPTER 1

INTRODUCTION

1.1. Background

Climate change poses a significant threat to natural resources, affecting various sectors. Developing countries are more vulnerable due to their high exposure, reliance on climate-sensitive livelihoods, and limited adaptive capacities (IPCC, 2022). The effects of climate change on water resources include increased water scarcity, lower precipitation rates, deep water tables, and higher evaporation rates (Piani et al., 2010; Yira et al., 2017). In the Arab Region, extreme weather events such as droughts and floods have resulted in socio-economic impacts and environmental degradation (ESCWA et al., 2017). Therefore, they are in an increased need of support for climate change adaptation.

In the MENA region, climate actions have been under analysis internationally for two years, especially with having the Conference of the Parties (COP) 27 in Sharm el Sheikh and COP 28 in Dubai (Saghir, 2024). The region in specific suffers from climate change impacts, it is known for extended periods of drought and increased water scarcity. According to the IPCC, the MENA region will be most affected by climate change consequences in the 21st century (MEI, 2017), leading to significant impact on the water resources.

Researchers argue that the increase in temperatures and decrease precipitation rates is often coupled with steep increase of the seasonal cycle and the frequency of extreme events (Piani et al., 2010; Yira at al., 2017). The variations and the witnessing of extreme weather events such as prolonged periods of heat and flash floods and storm

surges have become more occurring in the region, specifically along the coastal zone. This leads to significant damage to the livelihood and health of the population not to mention the degradation of infrastructure and depletion of resources (Saghir, 2024).

According to the World Resource Institute, 12 of the 17 most water scarce countries in the world are in the MENA region. Projections reflect on increased aridity, with temperatures rising at a faster rate than the global land average. This warming trend extends beyond annual and seasonal averages to include more frequent and intense heat waves. Hence, the region, characterized by extensive semi-arid and desert landscapes, faces heightened risks of water crises and chronic shortages, alongside exposure to extreme temperatures. These changes pose significant threats to various aspects of society, including economic activities and public health, potentially resulting in severe consequences, such as increased mortality rates (Borghesi & Ticci, 2019). Recent research by Ahmadalipour and Moradkhani (2018) suggests that even if global warming is limited to 2°C, the risk of individuals aged over 65 is projected to escalate three to sevenfold by the year 2100 due to rising temperatures.

The prevailing measures aimed at addressing the impacts of climate change are predominantly reactive and characterized by short-term approaches (Hoff, 2013). Such measures often fail to enhance the resilience of the sectors to withstand projected climate changes. Consequently, this reactive stance not only prevents the adoption of proactive strategies but also diminishes the potential for future adaptation priorities.

In Lebanon, the lack of proper water management is a main concern. Pollution of water sources is mostly due to its over exploitation to meet the increased demand of population, high losses and intermittent water supply at the distribution and transmission level due to poorly maintained networks, and low wastewater treatment

efficiency at the end, all of which with climate change amplified the issue of water scarcity (ESCWA, 2021). Lebanon has experienced a decline in precipitation in line with the predicted climate trends. The country is facing climate-related fluctuations that affects the availability of water resources leading to a potential drought (ESCWA, 2016). Climate change is further exacerbating water challenges, affecting the quantity and quality (World Bank, 2018).

There are water policies that addresses water issues without taking into account the role of climate change. Lebanon has recently updated its National Water Sector Strategy 2022, with a vision "to providing safe, equitable and affordable water and wastewater services to all, and to properly allocate the water resources to the different economic sectors (agriculture, industry, tourism, services, etc..) based on the priorities of the Government's recovery plan", (MoEW, 2022). The aim of this thesis to investigate the mainstreaming of climate change in the updated National Water Sector Strategy in Lebanon in 2022.

Hence, the main research question is "W*hat are the main opportunities and challenges to develop and implement effective climate change policies and practices in the Lebanon's National Water Sector Strategy 2020-2035?*

As for the objectives, it is to investigate:

1. How is climate change as part of climate adaptation integrated in the National Water Sector Strategy 2020-2035?
2. How are the existing climate change strategies connected to water management practices in the National Water Sector Strategy 2020-2035?

1.2 Outline of Research

To answer the research question, the second chapter is the literature review to conceptualize and understand the process of mainstreaming climate change and its historic development, including its associated challenges and opportunities.

The third chapter, Methodological framework, introduces the methodology used in this research to assess the NWSS 2020-2035 following a set of indicators.

The fourth chapter, Lebanese Context, sets the floor on the climate change in Lebanon and its impact on water resources along with estimated projections.

The fifth chapter, Discussion and Findings, it provides a timeline of the developed water policies between the initial National Water Sector Strategy in 2010 and the updated one in 2022. It investigates climate strategies that integrate water management practices. It also assesses the updated NWSS 2020-2035 and analyzes whether climate change is mainstreamed in the strategy. Following the analysis and subsequent results, the focus shifts to identifying the challenges and opportunities associated with mainstreaming climate change in Lebanon.

Ultimately, in the sixth chapter, recommendations are proposed to enhance the strategy's integration of climate considerations, aiming to ensure its alignment with climate change objectives.

1.3 Significance of Research

The significance of this research addresses the nexus between climate change and water resources in a region that is facing escalating water scarcity. It helps in improving policy that supports sustainable water management practices. The integration of climate change in the NWSS is part of climate adaptation which can be added to the

NDCs of the country. By highlighting the synergies between sustainable development and green recovery of climate-proofing strategies, it influences policy on integrating climate considerations into water management, and thus contributing to environmental sustainability. In addition to that, this research can be used as a policy-making tool to mainstream different concepts into sectoral strategies, using climate change as an example.

CHAPTER 2

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

In this chapter, we delve into a comprehensive review of existing literature pertaining mainstreaming climate change into policies. Through a systematic examination of scholarly works, this literature review aims to provide a thorough understanding of the current state of knowledge, key concepts, theoretical frameworks, and empirical finding to mainstreaming climate change into policies and strategies.

2.1. Climate Legislation Trends

Between the years of 1990 and 1999, 110 legislations and policies were passed targeting climate change both directly and indirectly (Eskandar et al., 2020). However, even though climate change was addressed in the 90s, the concept of "mainstreaming" was concretely grounded in 2002 during the World Summit on Sustainable Development in Johannesburg (Hofman, 2015).

The National Bureau for Economic Research (NBER) working paper "Global Lessons from Climate Change Legislation and Litigation," was the first academic synthesis showing the trends and patterns of Climate Change Law of the Word (CCLW) data. Figure 1, shows that the peak of climate change laws was most noticeable between the years 2009-2014, reaching an estimated 120 new laws getting passed each year in the developed and developing countries (Saverchenko et al., 2021). Developed countries passed important framework laws such as the European Union's 2020 Climate and Energy Package that was approved in this period. As for developing countries, the increase in development of new laws addressing climate change was mainly attributed

to development agencies' support (Saverchenko et al., 2021). During 2009-2014, most countries were still introducing the topic of climate change into their policies and laws, which explains the steep rate compared to the previous years. Averchenkoa et a. (2017) noted a substantial groundwork laid between 2009 and 2014, which led to a surge in climate-related policies during that period and explains the reason behind the decline in policies after the year 2016. The peak was also justified due to the Copenhagen Climate Summit and ending it with the Paris Agreement (Nachmany & Setzer., 2018). These global agreements likely spurred countries to enact policies aimed at addressing climate change and meeting their commitments under these accords.

The increase in climate laws and policies after the Paris Agreement in 2015 became evident. This is mostly due to that 160 countries committed to emission targets and mitigation and adaptation objectives through their Nationally Determined Contributions (NDCs) (Averchenkova et al., 2021).

Between 2010 and 2019, the number of new laws and rules increased by threefold, reaching to over 1,100. In 2019 (Table 1), a total of 1,800 climate change laws and regulations are in place globally.

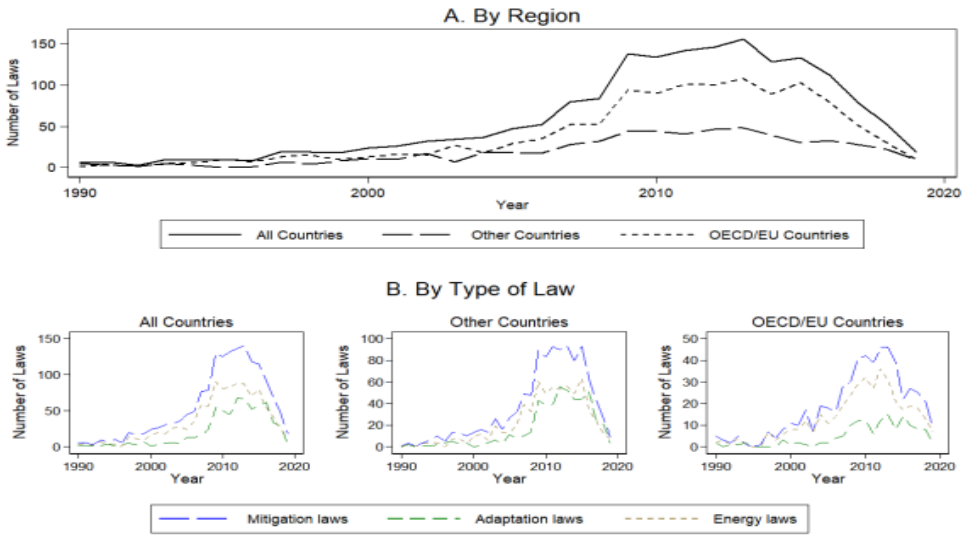

Figure 1: Climate Change legislation over time (Data from Climate Change Laws of the World; Eskandar et al., 2021).

The Paris Agreement and the Nationally Determined Contributions have created a level of obligation for countries to abide by while drafting their policies. After 2016, the decrease in legislation may have been due to the need by countries to adjust their current policies since the base infrastructure has been already established (Nachmany et al., 2017).

While the presence of laws addressing climate change demonstrates political and institutional engagement, the increase in the number of laws and policies drafted is not a may not necessarily serve as a definitive indicator of a country's commitment to climate action (Eskander et al., 2021). Simply counting the quantity of climate-related legislation overlooks their qualitative aspect, such as their effectiveness, comprehensiveness, and enforcement. Moreover, what matters is the efficient implementation of the laws, since its mere existence does not guarantee their impact on reducing greenhouse gas emissions or enhancing resilience to climate change. Therefore, while legislative activity can reflect a degree of governmental attention to

climate issues, it is not an indicator to evaluate the true extent of a country's commitment and effectiveness in addressing climate change.

Table 1: Descriptive Statistics on Climate Change Legislation (Eskander et al., 2021).

	All Countries (N = 198)	OECD-EU Countries (N = 42)	Other Countries (N = 156)
Total number of laws:			
Total	1,800	605 (33.6% of all laws)	1,195 (66.4%)
Pre-1990	35	24 (68.6%)	11 (31.4%)
1990–1999	110	38 (34.6%)	72 (65.4%)
2000–2009	554	203 (36.6%)	351 (63.4%)
2010–2019	1,101	340 (30.9%)	761 (69.1%)
Laws by topic (1990–2019):			
Framework laws	238	85 (35.7%)	153 (64.3%)
Laws addressing GHG emissions (mitigation laws)	1,620	549 (33.9%)	1,071 (66.1%)
Mitigation laws focused on energy (energy laws)	1,055	395 (37.4%)	660 (62.6%)
Laws addressing climate resilience (adaptation laws)	641	143 (22.3%)	498 (77.7%)
Laws by type (1990–2019):			
Executive orders or policies	1,023	244 (23.9%)	779 (76.1%)
Legislative acts	742	337 (45.4%)	405 (54.6%)
Number of laws by country (1990–2019):			
Mean	8.9	13.8	7.6
Standard deviation	6.3	7.5	5.2
Median	8	12	6
Minimum	1	1	1
Maximum	38	38	28

Note: All data from Climate Change Laws of the World. Some laws deal with multiple issues, hence the higher totals for "laws by topic" GHG = greenhouse gas.

Climate change laws covered different sectors varying between energy, transport, industry, forestry and land use, air quality, poverty, and food security (Averchenkova et al., 2017). Table 1 shows the laws and policies that target climate change across different sectors, such as the energy sector, which can be seen as the

focus when integrating climate concerns into energy policy represents 1,055 of the laws, indicating a significant emphasis on addressing climate change within this sector.

It is important to note that based on Figure 1, non-OECD and non-EU countries draft more laws targeting climate with a particular focus on climate resilience and adaptation between 2009-2014. The reason is due to the lower adaptive capacity rendering them vulnerable to climate change impacts than developed countries (IPCC, 2001b). In addition to that, they are more vulnerable to extreme weather events due to their climate-sensitive livelihoods (Tearfund, 2006).

Adaptation has subsequently emerged as one of the primary areas of activity in developing countries, stemming from the existing institutional architecture designed to address the requirements and demands of non-Annex I parties. Developing countries' adaptation in international discussions is motivated by the underlying principle of climate justice, encompassing both fair decision-making processes and equitable distribution of resources. They are at a unique position within the UNFCCC, with preferential access to financing for climate change adaptation and, traditionally, a decreased legal participation in emissions reductions under climate agreements (Sova & Schipper, 2019).

Working on adaptation help countries attract funds needed to compensate for the lack of "domestic resources" required to adequately finance climate change adaptation initiatives. Developing countries rely on international funds such as the Green Climate Fund (GCF), Least Developed Countries Fund (LDCF), Special Climate Change Fund (SCCF), and the Adaptation Fund (AF), with the cost of adaption to climate change varying between countries (Sova & Schipper, 2019).

2.2. Climate Mainstreaming and Climate Proofing

Klein et al. (2005) defined mainstreaming as the "integration of policies and measures to address climate change in ongoing sectoral and development planning and decision-making, aimed at ensuring the sustainability of investments and at reducing the sensitivity of development activities to current and future climatic conditions". The mainstreaming concept has been used to introduce different concepts into development planning such as gender; recently, it has been introduced in the context of climate change, however, there is a lack of clear definition and translation into practice (Oates et al., 2011). Fortunately, climate change risks are considered as part of the development policymaking and not as a separate entity of its own (Klein et al., 2007; Olhoff and Schaer, 2010). Climate mainstreaming involves integrating climate considerations into the planning of different policies and strategies. It is an assumption that a project/policy/strategy has a certain goal to be achieved and considers climate change impacts, enhancing the targeted outcome (Care, 2009). It is also argued that mainstreaming increases policy coherence, minimizes duplicate and contradictory policies, avoids maladaptation, and deals with trade-offs (Kok and de Connick p.588, 2007; Jordan & Lenschow, 2007; Juhola and Westerhoff, 2011).

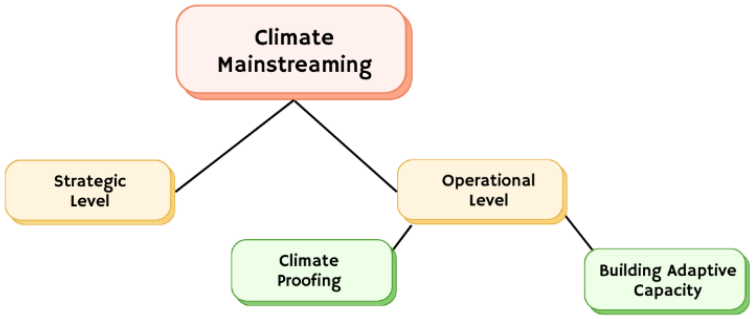

Figure 2: Types of Climate Mainstreaming (developed from Care, 2009).

There are two types of mainstreaming: 1) Strategic level mainstreaming, which is at the organizational environment where policies are implemented (Care, 2009). It focuses on the institutional context within which policies and programs are developed and implemented, tasks like raising staff awareness and capabilities, establishing suitable institutions, and pinpointing opportunities for implementing adaptation measures are associated with this type of mainstreaming (Olhoff and Schaer, 2010). 2) Operational level mainstreaming involves the day-to-day implementation of policies and programs, including resource allocation, hands-on activities, and monitoring and evaluation. Operational level mainstreaming, which includes: climate proofing and building adaptive capacity (Oates et al., 2011). Climate proofing is to guarantee that the development interventions are resilient to short- and long-term climate-related risks (Olhoff and Shaer, 2010), while building adaptive capacity considers the improvement of institutional ability to respond to climate change (Care, 2009). Therefore, climate proofing is within operational level climate mainstreaming.

Climate proofing is an adaptation method to climate change, it involves taking existing mainstreaming development activities and modifying them according to adaptation needs. It also means integrating climate change considerations into different sectors such as energy, agriculture, infrastructure, and water (Persson and Klein, (2008); however, one should identify where proofing should be addressed prior to its implementation. Climate-proofing primarily focuses on minimizing the risks posed by climate change to specific projects, activities, or stakeholders. It is often project-specific and may involve implementing certain actions to reduce vulnerability to climate-related risks. Measures include constructing seawalls, modifying building codes, and adjusting

water prices, and the adaptive capacity is its ability to adjust and withstand potential damages, take advantage of opportunities, or handle the consequences.

The integration of climate mainstreaming at the policy level has two dimensions: horizontal and vertical. The horizontal dimension is on coordination and communication between the different sectors such as agriculture, water, and energy which aims to ensure transparency and synergy while addressing interrelated issues (Persson and Klein, 2008), It requires collaboration among the departments which could result in an increase in conflicts if their interests are not aligned with the end goal. The vertical dimension is following the hierarchal process of policymaking, starting from the planning phase down to the implementation of the project while preserving the idea of "mainstreaming" throughout the lifecycle of the process (Persson and Klein, 2008). For the success of climate change mainstreaming, both dimensions should be equally addressed.

2.3. Guiding Principles to Climate Mainstreaming a Water Strategy

Water resources are highly affected by climate change such as the rise in temperatures, increase in evaporation and precipitation rates, and rise in sea levels, all of which have an impact on the quality and quantity of water available suitable for human use. This shows the importance of climate-mainstreaming water strategies and policies of a given country.

Based on the literature, there are 2 guiding principles that should be followed to successfully mainstream climate change prior to planning the water strategy. The main guiding principle is resilience, which absorbs the disturbances while maintaining structure and function (Rockstrom, Hoff et al., 2014). Building resilience to climate

change in the water sector involves implementing strategies and measures to enhance the sector's ability to withstand and adapt to the effects of climate change. It entails a comprehensive approach that addresses physical, institutional, and socio-economic dimensions to ensure sustainable water management and secure water supplies in the face of climate variability. There are three main levels of resilience i) persistence which is the degree of disturbance a system can withstand without changing state or structure; ii) adaptability which is the capacity of a system to adapt while maintain the same state; iii) and transformability which is the ability of a system to shift to a new state after a crisis (World Bank, 2014). Adhering to these three levels of this principle allows the water sector to respond strongly and efficiently to the climate uncertainties (MWI, 2016).

The second guiding principle is Integrated Water Resource Management (IWRM) which is an approach that can be implemented to achieve climate adaptation and for the Sustainable Development Goals. Looking at the SDGs, the ones relevant to the water sector are the following clean water and sanitation (SDG 6), no hunger (SDG 2), good health and well-being (SDG 3), affordable and clean energy (SDG 7), decent work and economic growth (SDG 8), industry, innovation and infrastructure (SDG 9), sustainable cities and communities (SDG 11), responsible consumption and production (SDG 12), climate action (SDG 13), and life on land (SDG 15) (MWI, 2016). This shows that building resilience and using IWRM principles does not only allow the water sector to cope with climate change, but also tackles other kinds of pressures as they are all inter-related among each other (MWI, 2016).

There are five IWRM principles: water policies and strategies, water legislation and enforcement, water institutional framework, water resource assessment, and capacity building (Bsiwas, 2004, 2008; Jurdi, 2003, 2008):

1. The water policies and strategies should be for the short and long term with the aim of protecting and promoting public health, limiting controlling, and protecting natural resources to avoid its degradation and deterioration (Jurdi, 2003, 2008). It should also ensure the integration of environmental concerns as an instrument for growth to ensure sustainable socioeconomic development of the country.
2. Water legislation and enforcement are legal classification based on the organization and administration, utilization, and control and protection of water resources (Jurdi, 2003, 2008). The lack of comprehensive water legislation will result in an inefficient development of integrated water resource management.
3. Water institutional framework that depends on magnitude and importance of water resource, type of water utilization, and degree of competition among water-using source, all three of which differ by country (Jurdi, 2003, 2008).
4. Water resource assessment should include programs to assess the quality and quantity of water resources. A reliable assessment of the water resources and propose accurate recommendations for mitigation measures for their protection (Jurdi, 2000, 2003, 2008).
5. Capacity building should serve as a backbone for the successful implementation of IWRM, through ensuring individuals governmental and private institutions, and international organizations are equipped with the necessary knowledge, skills, and tools to address water challenges effectively (Jurdi, 2003, 2008).

Additionally, it enables the active engagement of stakeholders in decision-making processes, promotes cross-sectoral collaboration, and improves water management systems' adaptive ability in the face of changing environmental, social, and economic conditions. IWRM invests in capacity building to address not just the current requirements of water governance, but also to provide the groundwork for long-term resilience and equitable water resource management.

In 2001, the Intergovernmental Panel on Climate Change (IPCC) acknowledged that IWRM is a flexible and adaptive solution to managing changes in water consumption, demand, and availability compared to conventional water managing methods. The consideration of climate change within the Integrated Water Resources Management (IWRM) framework depends on its adoption of a precautionary approach aimed at minimizing the risk of maladaptation. Maladaptation refers to the accidental implementation of adaptation measures that could undermine adaptation efforts (Cap-Net, 2018).

The incorporation of Integrated Water Resource Management (IWRM) principles adopts a nexus approach, aimed at aligning water-related solutions with Sustainable Development objectives (Hoff, 2011). Achieving this integration necessitates effective collaboration with institutions within and beyond the water sector, coupled with policy coherence, to cultivate robust strategies and encourage resilience for sustainable development (OECD, 2015). Furthermore, the Paris Climate Agreement underscores the evaluation of adaptation requirements to aid developing nations, proposing climate finance initiatives encompassing climate proofing and resilience strategies (MWI, 2016).

Once the guiding principles are fully developed, some solutions should be considered. The prioritizing of solutions needs to be integrated with existing water-sector criteria while taking into consideration the following factors (Stern, 2009; MWI, 2016):

- Cost efficiency that is measured in terms of water savings or additional water supply
- Feasibility of implementation which depends on agreement and synergy between the involved sectors
- Urgency for implementation
- Number of jobs created
- The potential for closing the gap between the water supply and demand
- Synergies between climate mitigation and adaptation

2.4. Water Strategy Case Study: Jordan

According to existing literature, the integration of climate change considerations into water management strategies remains a relatively underexplored area. Despite growing recognition of the interlinkages between climate change and water resources, the effective mainstreaming of climate considerations into water strategies has been limited. Studies indicate that a significant portion of existing synergies between climate change and water are discernible within countries' National Adaptation Plans (NAPs) (NAP Trends, 2024). National adaptation plans provide a platform for governments to articulate strategies for addressing climate change impacts across various sectors, including water resources management. Within the context of NAPs, opportunities for aligning water management strategies with climate change objectives are identified,

highlighting the potential for leveraging existing institutional mechanisms to enhance resilience and sustainability in water resource management practice.

There are several countries that have included their water sector in their NAP. According to the NAP Trend Analysis, 46 of the 52 NAPs submitted as of February 29, 2024 prioritized water and sanitation sector into their plans (NAP Trends, 2024). Bangladesh, Uganda, and Zambia are good examples of mainstreaming climate change. Uganda's NAP looked into the different steps into mainstreaming climate change adaptation in the water sector, including climate risk assessment, analysis of adaptation options, identification of the cost of the priority adaptation measures, implementation plan for adaptation measures, and monitoring and evaluation (National Adaptation Plan Global Network, 2019). As for Bangladesh, studies investigated the current climatic trends and future projections, and identified the vulnerability of the resources to climatic hazards (Government of Bangladesh, 2023). Additionally, it highlighted the importance of cross-sectoral mainstreaming and the role of different sectors in combating climate change. Like Uganda, Bangladesh's NAP sheds the light upon the prioritization of adaptation options under the water sector. Zambia's NAP addressed resource vulnerability to climate change by looking into the level of exposure climate change, the resource's adaptive capacity, the level of sensitivity, and climate risk level (Government of Zambia, 2023).

Drawing upon the analysis of the three NAPs above, it is evident that the documents used similar indicators to assess mainstreaming of climate change adaptation into policies and planning processes. This shows that the indicators can serve as a framework for mainstreaming into different strategies and policies with the required adjustments, thus facilitating their application in various contexts.

Apart from National Adaptation Plans (NAPs), examples of robust mainstreaming of climate change considerations within water management strategies are notably scarce. However, an interesting case study can be observed in the context of Jordan, as an Arab country confronting similar water challenges and comparable institutional constraints than Lebanon. Notably, Jordan suffers from issues such as dwindling water resources, exacerbated by climate variability and recurrent droughts, alongside institutional challenges that impede comprehensive water management strategies. Moreover, the country faces the compounding pressures of population growth and the influx of refugees, which further strain its water resources and intensify vulnerability to climate impacts. Despite these challenges, Jordan has demonstrated commendable progress in integrating climate change considerations into its water management frameworks, leveraging a combination of policy initiatives, technological innovations, and international collaborations (MWI, 2023). Through strategic investments in water infrastructure, adoption of demand management measures, and implementation of climate-resilient agricultural practices, Jordan displays a proactive approach towards addressing the intersection of climate change and water security, serving as a notable model for other regions dealing with similar challenges.

In 2023, Jordan's Ministry of Water and Irrigation (MWI) had updated its National Water Sector Strategy. The 2023-2040 NWSS was developed to provide the necessary "actions and commitments for the water sector to achieve the urgent national need for lasting water security for the Kingdom". The strategy has four main pillar goals on which it was built upon (MWI, 2023):

- Pillar Goal 1: Reform the legal and institutional framework.
- Pillar Goal 2: Restore the balance between water demand and supply.

- Pillar Goal 3: Achieve financial sustainability for water sector operations.
- Pillar Goal 4: Ensure impartial and transparent regulation of water sector services and costs.

The strategy is based on the following sections as presented in Table 2.

Table 2: Jordan's Water Sector Strategy Strategic Areas (MWI, 2023)

Strategic Area	**Consultative Group**	**Chapter**
Achieving a Sustainable Balance between Supply and Demand	Water Demand and IWRM	3
Integrated Water Resource Management and Environmental Protection		0
Utility Management and Services	Utility	5
Irrigated Agriculture	Irrigation	0
Financial Sustainability	Financial	7
Sector Governance and Institutional Development	Governance	0
Energy Efficiency and Renewable Energy in the Water Sector	Energy	0
Innovation, Technology, and Private Sector Engagement	Private Sector and research	10
Water-Energy-Food-Environment (WEFE) Nexus	Energy	11
Climate Change Resilience	Climate Change	12

The NWSS has a specific section dedicated to Climate Change Resilience where it addresses the role of climate change in affecting its goals (Chapter 12). For the indicator "Recognizing climate change as one of the pressures on water resources," it clearly mentions climate change as a threat to the water resources of the country. It states that the decrease in precipitation patterns (0.6 mm/year) and the high

temperatures in the summer (0.03 ℃/ year) is affecting water availability and it lacks to meet the growing population's demand (MWI, 2023). It also estimated future projections of climatic trends, further taking climate consideration has been mentioned in the strategy.

The water strategy has provided a comprehensive framework to achieve its goals and targets by updating its water policies (e.g. Groundwater Sustainability Policy, Water Reallocation Policy, Water Demand Management policy) (MWI, 2023), successfully implementing the first principle "water policies and strategies". As for the second principle, water legislation and enforcement, the strategy recognized the pivotal role of legislation in sustaining surface and groundwater resources highlighting the importance of enforcing regulations. The third principle, water institutional framework, has also been included through the clear assigning of roles to the appropriate institution. The fourth principle, Water resource assessment, has also been successfully addressed through the usage of remote sensing assessment to confirm current consumption levels. Finally, for the fifth principle, capacity building, the strategy aims to strengthen the capabilities of the individuals and institutions involved in water governance.

It clearly mentioned the vulnerability of water resources to climate change. The strategy also acknowledges Climate change and its impact on water resources. The exposure units were clearly mentioned (high temperature, decrease in precipitation, floods, drought, evaporation) as well as water resource sensitivity (reduced water quality, stress on water supply and sanitation infrastructure sector, increased water demand, disruption). Jordan's NWSS clearly identified adaptation measures under the section "Climate Resilience", however, with no specific prioritization.

In conclusion, Jordan's National Water Sector Strategy 2023-2040, shows that the strategy develops plans and tools to address the adverse effects of climate change. Furthermore, it shows that there are additional projects and measures that may help in building resilience to climate change and further aid in the adaptation of the water sector from vulnerabilities.

2.5 Challenges and Opportunities

2.5.1 Challenges

Unfortunately, in developing countries, there are challenges that need to be addressed for the successful integration of climate change adaptation in sectoral strategies and policies. For effective and efficient adaptation, all sectors should identify sectoral interconnectivity and policy entry points (Conway & Mustelin, 2014). Different sectors such as agriculture, water resource, energy, and infrastructure are interdependent, therefore the impacts on one sector can have cascading effects on the others. This enables policymakers to anticipate potential cross-sectoral vulnerabilities by integrating adaptation strategies that maximize climate resilience across multiple sectors.

Based on empirical research done to know the barriers for mainstreaming climate change, they have been divided as follows: political, organizational, cognitive, resource, characteristics of the adaptation problem, and timing (Runhaar et al., 2018). Factors that impact the process of mainstreaming include the absence of clear mandate, contradicting political interests, and organizational structures and practices. The most predominant are associated with managerial and inter-organizational factors impacting the mainstreaming process. It also mentions the lack of adequate identification of the

root causes of vulnerability. (Eriksen and O'Brien, 2007; Ribot, 2011) explained that vulnerability is not only due to climate change effects but also because of other factors such as poverty and unemployment.

Addressing of these vulnerabilities does not follow local policies, but collective national policies that only tackle broad scale with little incentives to acknowledge true political causes of vulnerability production.

Most of the barriers analyzed by the published literature are mostly institutional. In order to analyze these barriers, a paper written by Sietz, Boschütz, et al., (2011) had divided the institutional barrier into 3 categories: individual level, organizational level, and enabling environment. The explanations for each of the categories are provided below. Expert interviews were conducted for several of the developing countries to understand the challenges of mainstreaming climate change adaptation. While additional literature discusses the barriers to integrating climate change into policies exists, all identified barriers are classified into these categories.

2.5.1.1 Individual Level

It pertains to the personal expertise and understanding of individuals involved in addressing climate change matters within an institution (Reyes, 2017).

- Lack of interest: Individuals within institution lack interest in understanding the causes and impacts of climate change (Ekstrom and Moser, 2014).
- Limited individual capacity: Limited knowledge on the causes and impacts of climate change are related to the technical capacity to properly identify the climatic hazard.

- Low awareness: Individuals lack awareness regarding the presence of climate change.

2.5.1.2 Organizational Level

This reflects on the inherent characteristic of individuals within institutions to utilize their expertise and skills in adaptation planning (Reyes, 2017):

- Data and information issues: It pertains to the inadequacy of data and information accessibility, including records, figures, scientific information, vulnerability assessments, and dissemination, which are insufficient or lacking (Ekstrom and Moser, 2014, Moser and Ekstrom, 2010, Oberlack, 2017). For example, in Malawi, issues related to limited climate information use, it refers to scarcity and inadequacy of data or resources to climate and its impacts (Vincent et al., 2017).
- Lack of stable institutions: Absence of a well-funded institution with a clear legal framework that will facilitate adaptation process (Reyes, 2017).
- Institutional fragmentation: It concerns the dispersion of decision-making across different sectors (Reyes, 2017). Instead of having a centralize decision-making, where one authority makes decisions for the government, decision-making authority is divided among various sectors. This can lead to challenges in coordination, communication, and alignment of efforts, as decisions could be made independently by different entities without full consideration of the overall organizational or governmental goals.
- Absence of expertise: It pertains the absence of a specialized field that is equipped to address climate change issues (Erkstom and Moser, 2014).

2.5.1.3 Enabling Environment

It encompasses the conditions and interactions among stakeholders at local, regional, and national and international levels, which either facilitate or hinder the adaptation process (Reyes, 2017).

- Incompatible laws and regulations: It can involve conflicting laws that could cause ambiguity and complications in their implementation (Reyes, 2017). This may include that lack of alignment of sectoral policies with national commitments. According to Stringer et al., 2010, 2014, there is an absence of absence of "integrated planning between national policies and international environmental agreement communications". Additionally, a major challenge is the development of policies at separate distinct times leading to the misalignment of objectives which leads to inconsistencies in their implementation (England et al., 2017).
- Communication and coordination issues: It pertains to challenges in communication and coordination, whether within the same institution or between different institutions involved in the adaptation planning process (Sietz, Boschütz, et al., 2011). At the sectoral level, the main issue lies in the lack of coordination in policy development and implementation processes. The most occurring barriers are the lack of cooperation among sectors across varying domains (England et al., 2017).
- Overlapping of responsibilities: It refers to the absence of a clear mandate across sectors and institutions (England et al., 2017). This can lead to confusion, inefficiency, and potential conflicts as different parties may attempt to assert authority or make decisions on the same issues. The literature shows that the

political factor often leads to the unequal distribution of climate change responsibilities (Scoville-Simonds, Jamali and Hufty 2020).

- Absence of sources of adaptation funding: This could be attributed to insufficient capacity to obtain funding for adaptation planning, such as financial mismanagement, budgetary constraints, or inadequate decision-making processes (Ekstrom and Moser, 2014, Sietz, Boschütz, et al., 2011, Vine, 2012).
- Absence of technological resources: Lack of technologies and tools to address adaptation such as innovative systems for prioritization or data examination (Klein, Midgley, et al., 2014).
- Lack of adaptation prioritization on the agenda: Adaptation is not seen as something urgent and that of high priority. This can be due to the prioritizing the political agenda; corruption is the most prominent issue which impacts policy coherence (England et al. 2017).
- Lack of incentives for implementation: It refers to where there are insufficient motivations for actors to engage in adaptation measures. This may be due to no tangible benefits or rewards for taking proactive measures to address climate-related risks of vulnerabilities.

  Accordingly, all challenges are summarized in table 5.

Table 3: Summary table of the challenges of mainstreaming climate change

Individual Level	Organizational Level	Enabling Environment
Lack of interest	Data and information issues	Incompatible laws and regulations
Limited individual capacity	Lack of stable institutions	Cooperation and coordination issues
Low awareness	Institutional fragmentation	Overlapping responsibilities
	Absence of expertise	Absence of sources of adaptation funds
		Absence of technological resources
		Lack of adaptation prioritization on the agenda
		Lack of incentives for implementation

2.5.2 Opportunities

While there are challenges in mainstreaming climate change in strategies, there are opportunities that can be drivers for its integration. The main drivers recognized were political commitment, cooperation with the private sector, presence of policy entrepreneurs, focusing on climate events, and subsidies from higher levels of the government linked with sectoral preferences. However, the private sector's role and the focus on climate change adaptation are due to the support from the public and stakeholders for adaptation actions (England et al., 2017). One of the successful mainstreaming processes addresses the organizational and institutional barriers. For the strategies to be more effective, it should be placed with high leverage over others during ministerial meetings (Tearfund, 2006).

The opportunities fall into the following categories: information, institutions, inclusion, and incentives (Tearfund, 2006).

- Information: the government should engage more with experts within the community providing accurate climate-risk information. Not to mention that the information presented should address current and future climate change.
- Institutions: the government should implement climate change within the existing strategy objectives and targets.
- Inclusion: mainstreaming climate change is not the responsibility of one ministry or one sector, but rather it is a collective effort since as mentioned previously, all sectors whether public or private are interrelated. This means that inclusion of civil society, sectoral departments, and policymakers is highly crucial.
- Incentives: which refers to the motivation for the government or political figures to act for achieving a certain goal. Donors should provide incentives for developing countries to implement specific adaptation measures suitable for their respective local environment.

Therefore, local government prioritization, institutional incentives, credibility and reliability of information, and stability of funds, were proven as opportunities (Cuevas et a., 2016).

CHAPTER 3

METHODOLOGICAL FRAMEWORK AND INDICATORS

The following chapter explains the methodology used in this study. In developing countries, the concept of mainstreaming begins with an assessment of the existing policy landscape, followed by an analysis of the potential climate impacts, identification of the vulnerable population, prioritization of adaptation strategies, and the establishment of implementation and monitoring and evaluation platforms (UNFCCC, 2012). There are a variety of tools that can be used for developing countries that can enhance the adaptation measure, but the usage varies depending on the context of the countries (Sova, & Schipper, 2019).

Klein (2007) used in his research a set of indicators for the "Portfolio screening to support mainstreaming of adaptation into development assistance". Even though his article was primarily based on the assessment of climate mainstreaming in development projects, the indicators used are adaptable to various contexts. And were cited 410 times in different projects. Such as the "Climate proofing water resources development policy: the evidence of Bangladesh by Huq (2012) that studied the National Water Policy of Bangladesh using Klein's indicators for data collection and assessment. Additionally, Klein's work has been recently adapted by Fiacre Basson et al. (2021), in investigating the mainstreaming climate change into water policies in Burkina Faso. This work outlined the lessons learnt from the integration of climate change adaptation into the National Water Strategy (NWS).

Accordingly, methodological framework used to assess whether climate change is mainstreamed in Lebanon's National Water Sector Strategy based on relevant tools

adopted and used in climate proofing projects. Moreover, the developed indicators were adapted from various studies (Klein et al. 2007; Lebel et al. 2012; Huq et al. 2012; Plan Bleu 2011). The presented research work is thus based on a qualitative framework assessment and analysis of the major 6 indicators following the NWSS "climate-proof" approach (Huq et al., 2012).

Table 4: Climate Mainstreaming Assessment (Adapted from: Klein et al., 2007, Lebel et al. 2012, Huq et al. 2011, Plan Bleu 2011, and Basson et el., 2021)

Indicators	Scale	Score
Recognizing climate change as one of the pressures on water resources	0-2	
Mentioning of IWRM principles	0-2	
Mentioning concretely vulnerability of water resources to climate change impacts	0-2	
Identifying of adaptation measures	0-2	
Prioritizing of the adaptation measures	0-2	
Integrating the SESA document into the strategy	0-2	

These categories relate to:

- *Recognizing climate change as one of the pressures on water resources*: One of the main criteria to mainstream climate change into the water strategy is the concrete mentioning the term and recognizing the impact on water resources. This criterion looks for the mentioning of climate risk such as the increase in

temperature and decrease in precipitation rates. If the terms are not mentioned the score is 0; if the terms are mentioned but not elaborated the score is 1; if the term is concretely mentioned and elaborated the score is 2.

- *Mentioning of IWRM principles*: Based on the literature review, IWRM integration is a necessity for the mainstreaming of climate change into the strategy. This criterion this criterion will be assessed on whether the strategy has implemented the 5 IWRM principles: if 0-1 principles were mentioned then the score is 0; if 2-3 principles were mentioned then the score is 1; if there were 4-5 principles were mentioned then the score is 2.
- *Mentioning vulnerability of water resources to climate change*: The vulnerability is determined by: 1) the exposure showing the impact of the most relevant climate risks on the water sector. 2) Sensitivity that contains parameters that determine the robustness or weakness water systems towards exposure to climate change impacts, while the degrees of exposure and sensitivity determine the potential impacts of climate change. 3) The adaptive capacity is measured through institutional, socioeconomic, and financial parameters (ESCWA, 2017). The 0 score is attributed if the strategy does not mention water resource vulnerability to climate change; score 1 is attributed if the strategy briefly mentions water resource vulnerability; and score 2 is attributed if the strategy clearly mentions water resource vulnerability to climate change impacts.
- *Identification of clear adaptation measures*: Identification of adaptation measures are considered to address water challenges (Huq et al., 2012). Looking at the concrete mentioning of adaptation. Kramer (2007) conducted a study on the “Adaptation to Climate Change in Poverty Reduction Strategies”, and one of

the indicators measured is, “Adaptation projects”, which is the identification of adaptation projects and priorities. To measure this indicator, the author looks at the direct links between poverty and risk reduction. Henceforth, in this thesis, I will be looking at the concrete labeling of water management measurements as climate change adaptation. Score 0 shows that there are no measures that are attributed to CCA (Climate Change Adaptation); Score 1 shows there is a subtle/indirect linkage of measures that can be attributed to climate change adaptation (e.g. decrease in water demand, efficient irrigation…); Score 2 concrete labeling of water management measures as climate adaptation measures.

- *Prioritization of the adaptation measures*: is referred to the prioritization of adaptation measures to climate effects. If the adaptation measures are not prioritized to climate effects, the score is 0; if the adaptation measures are partially prioritized to climate effects score is 1; if the adaptation measures are prioritized to climate effects, the score is 2.
- *Integration of the SESA document into the Strategy*: Strategic Environmental and Social Assessment (SESA) is a document prepared to assess the environmental impacts of a policy or a document (Nautiyal & Goel, 2021). The objective of the report SESA is to study the environmental and social impacts of the updated NWSS, give recommendations and “high-level” policy guidance to MoEW to optimize the updated NWSS, and mitigate environmental and social impacts (CDR, 2021). If the NWSS does not integrate the SESA report, the score is 0. If the NWSS partially integrates the SESA, the score is 1. If the NWSS fully integrates the SESA report, the score is 2.

The scoring ranges from 0 score for not mentioned, 1 if identified but not elaborated and 2 for identified and elaborated.

Accordingly, each indicator in the table is scored on a scale of 0-2 and the total score is summed accordingly for analysis. The in-depth analysis categories are as follows (Huq et al., 2012):

- Scores 0-4: little or no progress in integrating climate change into the strategy under consideration.
- Scores 5–8: growing level of understanding of the requirements of climate-sensitive policies and recognizes the need to integrate climate-friendly measures into them.
- Scores 9–12: where the strategy develops plans and tools to address the adverse effects of climate change.

CHAPTER 4

LEBANESE CONTEXT

In this chapter, I will be investigating the Lebanese context, by looking at climate change in Lebanon and its impact on water resources. Moreover, I will be looking at the water policies timeline between the first NWSS 2010 reaching the NWSS 2020-2035 and whether climate strategies considered water management practices.

4.1. Climate Change in Lebanon

From the years 1991-2020, Lebanon has been witnessing a sharp increase in yearly temperature mean of 1.6°C. Across Lebanon, the annual average temperature estimates from 14.22°C in 1901 to 15.83°C in 2020, the coastal regions experiencing warming at a slower rate due to the cooling effect of the sea breeze. As for the precipitation, there has been a declining trend for the period 1950-2020 with 0.53 mm per decade, and it has become less evident for the period 1990-2020 with 0.35 mm per decade. In the period 1950-2020, the precipitation strongly varied across the years, having an average of 500 mm in the years 1960, 1961, 2001,2010, and 2019 and an average of 900 mm for the years 1968-1970, 1994, and 2004. Unfortunately, there has been a rise in natural disasters due to climate change since 2010, having three times the number of floods in 2015 and an increase in heatwave intensity in 2020 (MoE/UNDP/GEF, 2022). Table 5 shows the major climatic events that were witnessed in Lebanon from the year 2007 till 2020.

Table 5: Climatic events in Lebanon (Adapted from Verner et al., 2018); MoE/UNDP/GEF, 2022).

Date	Climatic events
2007	Severe heat waves, where temperatures exceeded the 90th percentile during the summer months. Heat waves reached temperatures above 40°C for five days in June and seven days in July. This led to large local forest fires. Rainfall was also 50 % lower that summer.
2008	Well-below-average temperatures and drier-than-average conditions.
2009	Warmer-than-average temperatures prevailed throughout the country, followed by severe rainfall causing flooding.
2010	The average air temperature ranged from 2°C to 4°C higher than normal, with November being very dry. Lebanon received less than 40% of normal precipitation levels. Heatwaves were recorded over the Bekaa Valley (September 2010). In December, an extratropical cyclone brought heavy rainfall and strong winds to the eastern Mediterranean. Along the coast of Lebanon, waves reached ten meters tall.
2011	Temperatures and rainfall levels were normal. Flood damage in the Akkar, Danieh and Hasbni area.
2012	Summer was significantly warmer than normal with anomalies between +1°C and +3°C, reaching +4°C. Despite some extreme precipitation events, 2012 was slightly drier than normal, especially during the warm season. Precipitation surplus resulted in a wetter-than-normal winter with rainfall reaching 125% to 140% of long-term mean precipitation, especially in January. Spring was dominated by mostly dry conditions. Lebanon received 50 mm less precipitation than normal or 40% of the long-term mean.
2013	The Middle East was +1°C to +2°C warmer than normal, including winter and summer months. In the first days of January, snow, frost, and thunderstorms affected parts of Lebanon and surrounding areas. In March, a heatwave hit with maximum temperatures reaching nearly 40°C. Flash floods were recorded in North Bekaa and East Lebanon (November 2013).
2014	Temperatures in the Middle East were 1°C to 2°C above the long-term mean and annual precipitation below average.
2015	Temperatures were +1°C to 2°C warmer than the long-term mean in the Middle East. Windstorms and frost were recorded on the coastal areas in South Lebanon (January 2015), snow, wind frost in Mount Lebanon (March 2015) and floods of Nahr el Kabir in Akkar area (February, 2015).
2016	Landslide caused by heavy rain and snow in Chouf, Mount Lebanon.
2017	Heatwaves and strong winds caused forest fires in several areas in Akkar.
2018	Snow, heavy rain and flooding have been observed in Tripoli in February 2018, recording 81 mm of rain for 24 hours.

	Torrential rain caused by storm “Norma” in December 2018 along with freezing wind and snow, damaging infrastructure, roads, and homes.
2019	Flooding in December 2019. Heat wave temperature >36.5 ℃ in coastal and inland areas in July 2019.
2020	Heat wave for 2 weeks in July and August; temperatures reached >40℃.

4.2. Impact of Climate Change on Water Resources in Lebanon

Climate change heavily affects the water resources through the floods, droughts, and storms, making water and climate change interlinked (Tremblay et al., 2020). The natural disasters can destroy water services and thus heavily impact the quality and the quantity of water available, which in turn might lead to detrimental effects on the human health (WHO, 2019).

The availability of the water resources is dependent on the temperature and precipitation rates. If the average temperatures increased between 1 to 3℃, there would be a slight change in the monthly precipitation mean, resulting in a decrease in water availability ranging from 6% to 12% of the volume of water resources (MoE/GEF/UNDP, 2011).

Unfortunately, even though Lebanon is known to having abundance of water, it has been facing several water-related issues due to over-exploitation, and deterioration of the water resources. The amount of water available in Lebanon has been declining over time due to the dual impacts of climate change and anthropogenic sources (Halwani, 2009). Conventional water resources are heavily impacted by hydrologic droughts leading to the decrease in the number of springs and their discharge. As for the aquifers, the excessive pumping groundwater aquifers influenced the water quality (Halawani, 2008).

Along the coastal zones, the coastal groundwater aquifers are already stressed due to high water demands in over-populated areas nearby resulting in excessive

extraction. The aquifer salinity may worsen as a result of projected changes in temperature and precipitation are rendering the systems more vulnerable to climate change (MoE/GEF/UNDP, 2022).

According to recent studies, the volume of the major groundwater aquifers has already by 35% to 40% over the past 40 years. This has led to a lowering of the water table by 30-35m and increased contamination of the shallow groundwater as a result of inadequate irrigation water and the overuse of chemicals and fertilizers (Shaban, 2019). Climate change heavily influences groundwater and water quality by drought. High temperatures and evapotranspiration, along with reduced snowfall have a substantial effect on the quantity and frequency of groundwater extraction. Furthermore, droughts will raise the levels of chemical and biological pollutants in surface and groundwater, particularly in the Litani River's Bekaa and South Lebanon regions (Verner et al., 2018). The heavy rainfall over short periods does not allow the recharge of groundwater aquifers which results in saltwater intrusion thus influencing the water's quality. In addition to that, the vulnerability of the water infrastructure hinders its ability to withstand heavy rainfall.

The impact of climate change on river basins was conducted on Nahr el Kabir River Basin, and the upper-Litani Basin and Nahr Ibrahim (ACSAD/ESCWA, 2017; Hreiche et al., 2007). Drier conditions are expected in the Nahr El Kabir watershed because of rising of rising temperatures and falling cold spells, but no catastrophic or extreme drought events. The basin is expected to increase in the level of the peak flow and frequency of flooding (ACSAD/ESCWA, 2017). For Nahr Ibrahim, it is projected that the variation in precipitation and increase in temperature will alter the mean daily discharge and discharge distribution, as well as magnify the runoff coefficient by 2. As

a result, it is expected that droughts would start 15 days to 1-month sooner and the snowmelt floods would be replaced by rainfall floods with a peak flow taking place 2-months prior (Hreiche et al., 2007). The Upper Litani River Basin would suffer a decline of 120 million cubic meter annually by 2050 due to increase in water demand. Unfortunately, beyond 2050, the gap would increase significantly to surpass 200 million cubic meters annually, as the impacts of climate change and increased demand becomes more evident (Alameddine et al., 2018).

With rising temperatures and shifting in precipitation patterns, Lebanon faces heightened risks of water scarcity, exacerbated by increased evaporation rates and changes in runoff patterns. These changes threaten the availability and quality of water resources, posing significant challenges to agriculture, industry, and human livelihoods.

CHAPTER 5

DISCUSSION AND FINDINGS

In this chapter, I will be studying the different water policies developed between 2010 and 2020 and checking the SESA report to check how climate change was addressed throughout which will help in the analysis of the updated NWSS 2020-2035 in the next section. Finally, based on the results of the assessment, I will be looking at the challenges and opportunities for mainstreaming climate change in Lebanon.

5.1 Water Policies in Lebanon

5.1.1. Water Policies Timeline

Figure 3 shows the main events that occurred from the development of the 1st NWSS in 2010 till the development of the updated NWSS in 2020. From 2010 to 2015, significant developments took place in the water sector. The National Water Sector Strategy (NWSS) was formulated in 2010 and officially endorsed in 2012. Decision 8213/2012 underscored the importance of conducting a Strategic Environmental and Social Assessment (SESA) report that was subsequently developed by ECODIT in 2015. The Water Code adopted in 2018 under Law 77 that proposed additional reforms in the water sector. The Water Code elaborates on and strengthens the water law. It establishes access to fundamental right for citizens and outlines the institutional framework and responsibilities for water management and conservation.

The initial NWSS 2010 addressed key challenges facing Lebanon's water sector, such as water scarcity, pollution, and inefficient management practices. However, between 2010 and 2021, Lebanon experienced escalating environmental pressures exacerbated by instabilities resulting from the Syrian conflict, which significantly

impacted the country's economy and water resources. In response to these challenges, the NWSS was updated to reflect the current situation of the country and its public institutions in the aftermath of the multiple crises that occurred in 2019 (October 17th revolution, economic, financial and political crises, and Covid-19 pandemic). Consequently, the NWSS underwent a series of revisions and updates to align with evolving socio-economic and environmental conditions. The updated version of the NWSS in 2020 presents a more holistic and integrated approach to water management, encompassing considerations for climate change, stakeholder engagement, and technological advancements.

In 2020, MoEW revised the National Water Sector Strategy (NWSS) 2010, updating its priorities and addressing past challenges to develop the NWSS 2020-2035, while Law 192/2020 recently amended Law 77/2018, establishing the Water Code. The modification is significant step in updating the legal, financial, and institutional components of the water sector. The MoEW is responsible for managing public water sector assets, as outlined in Article 7 of the law. According to Article 17, the MoEW is responsible for creating master plan for the sector based on an integrated approach to water resources management, with the goal of ensuring sustainable management in Lebanon. The law requires the development of a master plan in collaboration with other ministries, including the Environment, Agriculture, Public Works and Transport, and Industry, and approved by the CoM. Article 56, RWEs are responsible for delivering water-related services.

The implementation of the water register would empower public authorities in several ways. Firstly, it would facilitate the inventorying of water resources, providing essential data for effective management. Additionally, it would establish the National

Water Council and enable the enforcement of a water masterplan. This includes defining the legal status of water basins, creating basin management plans using an integrated approach, and articulating the guiding principles of legal conventions related to the water sector. Moreover, the implementation would identify institutional, environmental, economic, and financial requirements, including the imposition of tariffs and financial compensation for water pollution incidents. Furthermore, it would explore new management tools such as public-private partnerships (PPPs) and public-public partnerships with municipalities, as outlined in Law 192/2020 (SOER, 2020).

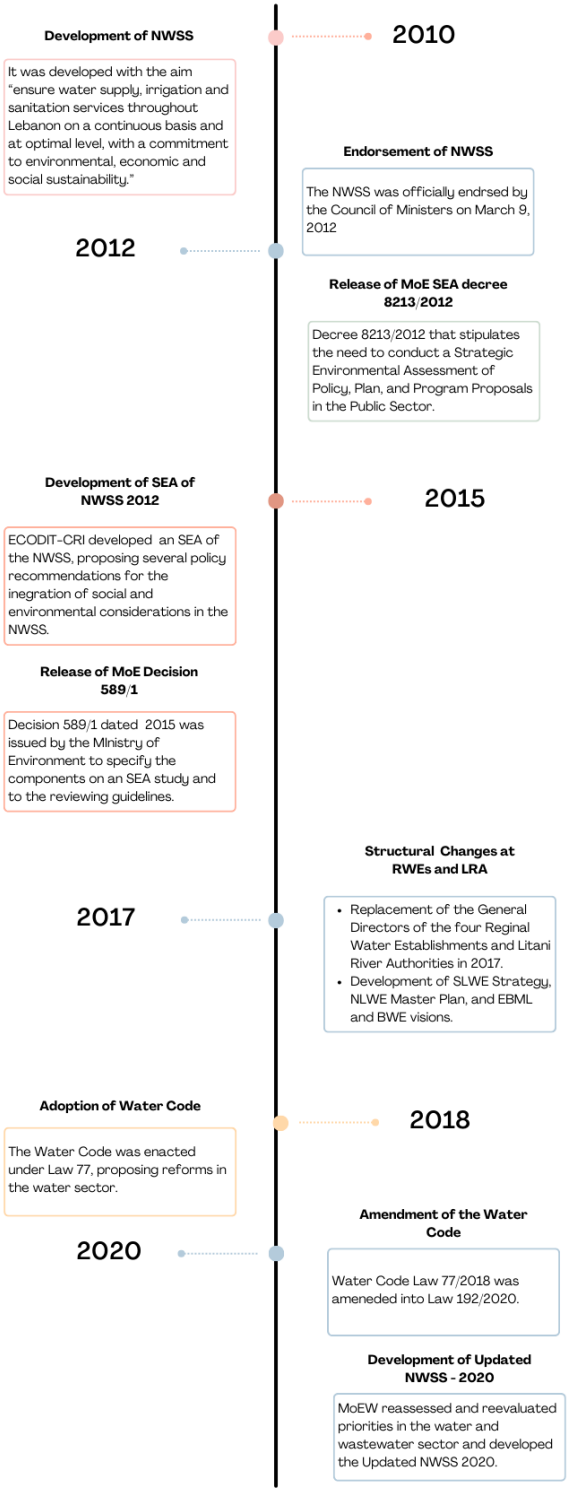

Figure 3: Timeline of Main Water Sector-Related Events 2010-2020 (ECODIT, 2021).

5.1.2. Strategic Environmental and Social Assessment

The Strategic Environmental and Social Assessment (SESA), undertaken in 2021, aims to comprehensively evaluate the environmental and social impacts of the NWSS 2020-2035 while giving recommendations for better implementation and improvement (ECODIT, 2021). The report addressed climate change and used the guiding principles mentioned in the literature review above to assess the strategy. It dedicated a section studying the climate change current and future projections in Lebanon as well as the vulnerabilities of the sector to climate change.

Furthermore, the report mentioned the importance of the role of the different institutions and ministries for a successful implementation of the NWSS. The proper coordination and cooperation among the different sectors help in overcoming several challenges including institutional and political challenges. The SESA took on a comprehensive approach upon proposing solutions to the challenges mentioned, it stressed on the importance of cross-sectoral coordination among the different ministries (MoA, MoI, MoE, MoIM, MoPH, MoEW, Regional Water Establishments, and Litani River Authority) (ECODIT, 2021). It also offered insights into various regional and national strategies relevant to the water sector in Lebanon. These strategies have a similar objective, which is building a resilient water sector and providing water to the entire population without risking its deterioration and degradation.

The evaluation of climate change adaptation is included in section 7.1.3.1. It provides additional recommendations such as choosing construction material resilient to climate change for the water, wastewater, and irrigation infrastructure projects and evaluating potential climate change impacts when updating existing infrastructure. The work recommends using high-resolution, physically based distributed models for

managing water resources to evaluate resource availability and incorporate it into projects and management plans in the water sector. It also proposes a model that incorporates: (1) intra-annual (seasonal) climatic variations, (2) climate fluctuations within watersheds and projections of climate change, and (3) the re-prioritization of both macro- and micro-level proposed projects in the strategy. This could be achieved by simulating combinations of proposed measures under different scenarios, to evaluate their effectiveness and identify optimal measures. The main purpose of the Climate Change section was to ensure that the recommended reforms in the Strategy have the flexibility and resilience to accommodate climatic variability to avoid the risk of maladaptation (ECODIT, 2021).

5.2. Analysis of the Updated NWSS 2020-2035

The strategy outlines the Updated National Water Sector Strategy (NWSS) by MoEW in Lebanon for the period 2020-20235. It focuses on achieving a financially sustainable water sector, improving service coverage, and implementing reforms to enhance sector governance. The aim of the updated strategy is to ensure equitable access to water and sanitation services for all in Lebanon. It focuses on implementing legal, institutional, technical, and financial recommendations and actions, along with proposed projects across the country. The strategy aims to have a wide range of impacts on Lebanon's various economic sectors and social groups. The strategy is structured around 3 main pillars: 1) Implementing reforms and improving sector governance, 2) Achieving integrated water resource management, 3) Improving service coverage.

Table 6: Assessment of Lebanon's NWSS 2020-2035.Indicators	Scale	Score	Chapter/ Section/Page	Explanation
Recognizing climate change as one of the pressures on water resources	0-2	2	2/2.2.4.2.1/p.36	"The expected increase in temperature as described in previous section has a considerable impact on the snow cover, main source of freshwater resources in Lebanon. It was estimated that a 2°C increase in temperature would cause a decrease of 50% in snow depth in addition to a significant reduction in the maximum volume of snowpack from 1,200 Mm^3 to 700 Mm3; a 4°C warming would further reduce it to 350 Mm^3. The altitude of sustained snow cover would also shift upwards from 1,500 m to 1,700 m for a 2°C warming, and to 1,900 m for a 4°C warming"
Implementing of IWRM measures	0-2	1	2/2.2/p.27	It meets 3 of the 5 IWRM principles.
Mentioning concretely vulnerability of water resources to climate change impacts	0-2	1	2/2.2.4.2.1/p.38	The water supply vulnerability due to the expected increase in population and demand per capita, coupled with longer periods of water shortage. Drought's impacts on groundwater usage for agriculture are considerable. It increases irrigation demand, which is met almost entirely by groundwater abstraction during dry seasons. Also, large agricultural areas depend on spring systems, while the discharge of these springs fluctuates in response to climate affecting changing snow cover and precipitation. While autonomous adaptation through changing of sowing dates is possible in the agriculture sector, the shortening of the season when aquifers and springs recharge will necessitate the construction of surface and underground storage reservoirs that can store enough water for the longer dry season
Identifying of adaptation measures	0-2	1	2/2.1.6/p.22	Increasing surface water storage and artificial aquifer recharge. Rehabilitation and upgrade of existing water resources. Increasing wastewater collection and treatment. Improving water efficiency.
Prioritizing of the adaptation measures	0-2	1	2.3/p.53	No clear prioritization of adaptation measures.
Integrating the SESA document into the strategy	0-2	0	3/ p.75	There is a section dedicated for the SESA but the recommendations are not integrated throughout.

5.2.1. First Indicator: Recognizing Climate Change as one of pressures on water resources

NWSS-MoEW (2020) has dedicated a section on the role of climate change in Lebanon section 2.2.4., "Impact of Climate Change", in specific, 2.2.4.2.1. It provided analysis on the variation of precipitation and temperature. The clear mentioning of "It was estimated that a 2°C increase in temperature would cause a decrease of 50% in snow depth in addition to a significant reduction in the maximum volume of snowpack from 1,200 Mm^3 to 700 Mm^3; a 4°C warming would further reduce it to 350 Mm^3. The altitude of sustained snow cover would also shift upwards from 1,500 m to 1,700 m for a 2°C warming and to 1,900 m for a 4°C warming". Therefore, the first indicator on mainstreaming climate change a score of 2.

5.2.2. Second Indicator: Implementing IWRM measures

The NWSS-MoEW (2020) Pillar 2, is dedicated for implementing the IWRM measures, under the title of: Integrated Water Resource Management which highlights the importance for the integration and implementation of the IWRM principles for the sustainable use of water resources. The first principle, Water Policies and Strategies, is evident throughout the strategy, demonstrated by the integration of Law No. 63/2016, which aims to develop a plan for addressing water pollution in the Litani River basin (NWSS-MoEW, 2020). In addition to the policies and strategies that aim at optimizing utilization of surface water, water use efficiency, and protection of water resources from pollution. The second principle, Water Legislation and Enforcement, the Water Code Law along other laws is fully addressed by the strategy. The third principle, National Institutional Framework, Annex I allocates the roles of the different ministries over the water resources (MoEW, MoA, MoE, MoPH). The fourth principle, Water Resource

Assessment, within the strategy is based on water demand and supply data. Regarding supply data, emphasis is placed on both quantity and quality aspects. For quantity, the NWSS-MoEW (2020) outlines measurements of precipitation, evaporation rates, surface flow at various locations, and groundwater reserves. The strategy indicates that real evapotranspiration accounts for approximately 30% of total precipitation, while total surface runoff both within and outside Lebanon is about 25%, with groundwater infiltration comprising around 45% (NWSS-MoEW, 2020). However, the strategy falls short in addressing the sources of pollutants and types of contaminants affecting surface and groundwater quality The annual water demand data is estimated at 1,505 Mm3/year for 2020, with a network efficiency of 75% (1,837 Mm^3/year for a network efficiency of 50%) (NWSS-MoEW, 2020). Extraction rates are projected at around 990 505 Mm3/year as is presented in Figure 14 of the document. For the fifth principle, Capacity Building, there was no mentioning of how to increase awareness and mobilization for the proper implementation of the strategy. Henceforth, the strategy has successfully met 3 of the 5 principles, which means the second indicator on mainstreaming climate change earns a score 1.

5.2.3. Third Indicator: Mentioning concretely vulnerability of water resources to climate change impacts

The strategy mentions the following section 2.4.2.1: “Upon the recharge of most springs’ aquifers, early snowmelt will reduce the available water supply for irrigation during summer and increase floods by up to 30%. This will have adverse impacts on rivers and groundwater recharge and will affect water availability during summer season and drought periods” (NWSS-MoEW, 2020). For the exposure units, the document discusses the impact of climate change on water availability, including

changes in temperature and precipitation, which directly affect water resources. As for the sensitivity, it mentions the challenges faced by the water sector due to reduced snowpack, longer dry seasons, and increased irrigation demand influencing groundwater usage for agriculture, addressing the sensitivity of the water resources. Finally, for the adaptive capacity, the strategy emphasizes the importance of storing surface and groundwater to ensure water availability during longer dry seasons, indicating a proactive approach to adapt to changing climate conditions. While it does address the three parameters (exposure units, sensitivity, and adaptive capacity), it lacks the clear mentioning of the vulnerability of the water resources to climate change. The score of 1 was given for the third indicator on mainstreaming climate change.

5.2.4. Fourth Indicator: Identifying adaptation measures

The NWSS includes four adaptation measures that were under climate change adaptation:

a. Increasing surface water storage and artificial aquifer recharge.
b. Rehabilitation and upgrade of existing water resources.
c. Increasing wastewater collection and treatment.
d. Improving water efficiency.

While the measure proposed are within the umbrella of "climate change adaptation", the strategy did not elaborate on the steps needed to achieve them. In addition to that, there are other relevant measures proposed in the strategy but were not categorized as part of climate change adaptation. For example, water tariffs, updating the irrigation systems, and disaster risk management (NWSS-MoEW, 2020), therefore the score for fourth indicator on mainstreaming climate change is 1.

Fifth Indicator: Prioritizing adaptation measures

Section 2.3 as well as Annex IX of the strategy, provided a summary table for the reforms and action plans to implement the NWSS based on priorities for implementation. However, the recommendations for climate change adaptation of the water sector do not explicitly prioritize measures while keeping in mind climate effects. Therefore, the fifth indicator on mainstreaming climate change gets a 1 score.

Sixth Indicator: Integrating the SESA document into the strategy

Chapter 3 titled, "Strategic Environmental and Social Assessment", summarizes the SESA document and compiles the main findings of the report. However, there were no adjustments to the strategy based on the recommendations provided by the SESA report. Therefore, the sixth indicator on mainstreaming climate change earns a score of 0.

Table 7: Summary of the scores and results of the NWSS-MoEW 2020.

Indicators	Scale	Score
Recognizing climate change as one of the pressures on water resources	0-2	2
Implementing of IWRM measures	0-2	1
Mentioning concretely vulnerability of water resources to climate change impacts	0-2	1
Identifying of adaptation measures	0-2	1
Prioritizing of the adaptation measures	0-2	1
Integrating the SESA document into the strategy	0-2	0
Final Score	12	6

Based on Table 7, the addition of the six indicators would give a final score of 6 which shows growing level of understanding of the requirements of climate-sensitive policies and recognizes the need to integrate climate-friendly measures into them. The

absence of clear steps for the integration to build a climate-resilient water sector affects the final scoring of the strategy. Even though the NWSS-MoEW (2020) addressed climate change and its impact on the water resources in Lebanon, there is the lack of complete integration that prevents the mainstreaming of climate change into the strategy.

5.3. Existing Climate Change Strategies Connected to Water Management Practices

Lebanon has committed to reducing its greenhouse gas emissions and adapting to the impacts of climate change though its Nationally Determined Contributions (NDCs). It outlines Lebanon's climate action plans and goals in line with the objectives of the Paris Agreement. The NDCs have several focus areas including mitigation, adaptation, and finance. The area of adaptation in specific, given Lebanon's vulnerability to climate change impacts such as water scarcity, increased temperatures, and extreme weather events, adaptation measures are crucial. The NDCs outline strategies for building resilience in sectors such as agriculture, water resources management, urban planning and coastal zone management.

In the NDCs targeting adaptation, there are different priorities to build resilience to climate change, economic shocks, and other potential disasters. The principles and priorities identified are aligned with national sectoral strategies as per paragraph 11 of Article 7 of the Pars Agreement, Law 115/2019 and paragraph 11 of Decision 9/CMA.1 (UNFCCC, 2022).

Table 8: NDC Adaptation Priorities related to the Water Sector (UNFCCC, 2022; MoEW, 2022).

Adaptation Priorities		NWSS 2020-2035
Adaptation Priority 3	Structure and develop sustainable water services, including Irrigation, in order to improve people's living conditions.	Pillar 2: Integrated Water Resource Management. Pillar 3: Service Coverage. Component 4: The Financial and Commercial Frameworks. Upgrading of the irrigation systems and the use of water-efficient irrigation systems with the of the MoA.
Adaptation Priority 5	Reduce vulnerability of climate change impacts on coastal zones, especially in cities.	Pillar 2: Integrated Water Resource Management Assessing sea-water intrusion in the major coastal aquifers.
Adaptation Priority 7	Reduce disaster risk and minimize damages by mitigating and adapting to climate-related natural hazards and extreme weather.	Pillar 2: Integrated Water Resource Management. Disaster risk management (2.2.9).

There are 3 out of the 7 adaptation priorities that target water and water management. These priorities are integrated in the NWSS 2020-2035 as seen in Table 8. Adaptation priority 3 is implemented throughout the strategy as it focuses on sustainable water resource management and efficient irrigation practices. The key activities mentioned in the NDCs are integrated within the NWSS 2020-2035. The importance of shifting to a more sustainable and less energy-consuming sources. Adaptation priority 5 is also evident especially in the Groundwater resources management and monitoring (2.2.6), "enhancing the artificial recharge of some selected aquifers and performing progressively the modeling of the karstic, saline, and porous aquifers" (MoE, 2022). Adaptation priority 7 is implemented in the Disaster Risk Management (section 2.2.9) including flood and drought risk management and forest fires having specific strategies to address hazards in Lebanon.

5.4. Challenges

While there are several barriers when addressing the issue of integrating climate change into policy, most of which are categorized under institutional barriers. However, within institutional challenges, there are three different levels of barriers: individual, organizational, and enabling environment (Sietz, Boschütz, et al., 2011). In the case of Lebanon, the several papers addressing the issues of mainstreaming climate change into policy are categorized under the three levels.

5.4.1. Individual Level

Lack of Interest: Individuals are not interested in topic related to climate change and thus don't take it into consideration. Therefore, climate change in this case is not considered as an exciting topic to address. Another reason may be due to the fact that usually citizens look for problems that require immediate response and solutions, in this case, climate change is of no prioritization since it doesn't have an immediate solution. Additionally, members of political parties tend to aim to achieve tangible and short-term projects for the society. The private sector also heavily influences political parties since it endorses profit-oriented projects that do not address climate change issues. This means that individuals are often looking for immediate monetary benefits and profit (Reyes, 2017).

Limited knowledge and understanding of climate change: There is lack of knowledge on the clear negative impacts of climate change. Being ignorant about the topic of climate change can be attribute to the lack of care for the problem. The proper understanding of the topic can help in implementing the appropriate adaptation measures (Reyes, 2017). There is also weak knowledge on IWRM principles and

implementation in the water sector. In addition to the limited understanding of wastewater, greywater, groundwater replenishment and stormwater reuse (MoE/UNDP/GEF, 2016).

Misinterpreted vision about the problem of climate change: The way the concept of climate change is often misinterpreted. The varying precipitation levels, drought and flood patterns, and rising temperatures are handled as separate entities. This misleading vision can hinder the definition of climate change having an inaccurate idea of what it actually is thus not identify its consequences (Reyes, 2017).

Lack of awareness: Lack of informed decision making that do not take into account the complexity of climate change is also an important that should be addressed. Lack of awareness is linked with problem detection, meaning that if there is no proper awareness on the complexity, magnitude, and impacts of climate change, then it would not be seen as a problem (Reyes, 2017). Such as the lack of awareness on water conservation techniques and methods (MoE/UNDP/GEF, 2016). This implies that individuals are not fully informed about ways to reduce water usage, prevent wastage, or optimize water resources effectively.

5.4.2. Organizational Level

Information Unavailability: The NWSS relied on outdated data such as (Najem, 2007), while the strategy was published in 2022, thus preventing the accuracy and reliability of the data provided. This shows the lack of updated data with regards to climate change trends such as precipitation patterns, temperature increase, droughts and floods. Having the needed data can help understand the current trends of climate change.

Information fragmentation: Absence of reliable data for well-informed planning, developing strategies, formulating policies, and prioritizing investments (World Bank, 2024). The fragmented nature of data and knowledge impedes efforts to develop comprehensive strategies and policies for climate adaptation and mitigation. The lack of centralized data systems hinders the ability to assess the full scope of climate –related risks and opportunities (MoE/UNDP/GEF, 2016). Without access to reliable integrated and standardized information, decision-makers struggle to accurately assess the risk, identify priority areas for action, and allocate resources efficiently. Furthermore, information fragmentation can hinder collaboration and coordination among stakeholders, limiting the effectiveness of collective effort to tackle climate-related challenges. It is attributed to political protectiveness as well as insufficient enforcement of information sharing mechanisms which can be seen through the lack of implementation of the Access to Information Law in 2017 (Gharios et al., 2021).

Information inaccessibility: Data may not be easily accessible for everyone (Khalil, 2022). It is apparent that multiple factors contribute to the inaccessibility of information. As noted previously, political conflicts and instances of corruption play a significant role. When information is accessible, political factors may obstruct access for others (Reyes, 2017). These elements collectively impede the process, influencing both the gathering and utilization of information.

5.4.3. Enabling Environment

Climate is scarcely on the agenda: Political issues, economic crisis, and war conflicts are some barriers that do not allow climate change to be part of the agenda (Reyes, 2017). Furthermore, the geographical of Lebanon, situated between Syria and

occupied Palestine, has been marked by prolonged tension, leading Lebanon to prioritize security measures aimed at safeguarding its borders against potential invasions. Henceforth, political instability, refugee crisis, and border tensions and conflicts shifts climate change adaptation further down the priority list within governmental agendas (MoE/UNDP/GEF, 2016).

Political interference: It encompasses political activities that hinder climate change planning, whether directly or indirectly. This is associated with the disinterest demonstrated by individuals affiliated with political parties and adhere to specific agendas (Reyes, 2017). Additionally, collusion between business and political interests further hinder the policy-making process. Proving that dysfunctional systems foster corruption and inefficiency in monitoring essential water services (Gharios et al, 2021).

Weak communication: The 3rd National Communication document for Lebanon highlighted the lack of coordination among ministries regarding critical water issues and shared priorities (MoE/UNDP/GEF, 2016). It refers to the process of communicating the climate change adaptation measures among ministries. Deficient coordination among stakeholders exacerbates the limitation posed by the lack of cooperation between various water authorities (World Bank, 2024; Darwish, 2004). When communication channels are ineffective, key information are not shared leading to gaps in understanding and action. Weak coordination may result in failure in prioritizing adaptation measures in decision-making process. Furthermore, it can hinder the mobilization of resources since stakeholders may not be aware of available funding opportunities and best practices leading to limited implementation of adaptation projects.

Institutional Duplication and Fragmentation: One of the most recurring barrier s found in the case of the water sector in Lebanon is institutional duplication and fragmentation. With the different constraints addressed in this section, the allocation of responsibilities between MoEW, CDR, and RWEs heavily affects policy planning and implementation (Darwish, 2004). Despite having RWEs as primary governmental agencies in control for water management, their role is only administrative, meaning that they cannot control financial budgeting, laws and regulations, and environmental practices (Gharios et al., 2021). Knowing that the government is heavily centralized, delegating responsibilities and powers to regional authorities' results in mismanagement and overlapping of responsibilities (Riachi, 2013). This is further supported by the World Bank (2024) "Country Climate and Development Report". It highlighted fragmentation across ministries in water management responsibilities resulting in duplication of responsibilities and lack of accountability.

Scarce sources of adaptation funding: After the revolution of 17 October 2019, and magnified by the Covid-19 pandemic, Lebanon suffered an economic and financial crisis. The monetary value of the Lebanese pound has depreciated, and the black market exchange rate has prevailed. This has hindered the allocation of funds towards enhancing basic service provision and expanding storage capacity for building climate resilience (World Bank, 2024). Unfortunately, there is also the inadequate allocation of funds whereby a market-oriented policy framework disregarding sectoral needs including but not limited to domestic, agricultural, industrial, and refugees (Gharios et al., 2021).

Policy and Governance: Failure to prioritize climate change priorities across different institutions, which influences the capacity of the water sector to respond.

Knowing that climate change is not one of the key items on the policy agenda, most laws often neglect its role. Weak governance has resulted in weak implementation of policies and lack of accountability as well as limited capacity to adapt climate change (World Bank, 2024). Weak governance has encouraged informal and illegal activities such as the illegal groundwater abstraction due to the illegal drilling of wells (MoE/UNDP/GEF, 2016). Additionally, the institutional and legal structures was not put into practice as intended; whereby essential decrees, especially the ones that support Law 221 (targets the organization of the water sector) have yet to be enacted. This highlights the gap between the policy and their actual implementation and shows the lack of enforcement of policies. Policies and laws disregard the public being the main beneficiaries of the resource and not taking their opinion on the issue (Gharios et al., 2021). Therefore, there is limited space for public participation and input in decision-making processes. Finally, weak implementation is also justified by the fact that the NWSS is a non-binding document, which means that it does not enforce any legal requirement for its execution (Oxfam, 2017).

5.5. Opportunities

5.5.1. Individual Level

To address the primary challenge faced at the individual level, namely the lack of awareness regarding the impacts of climate change, the key solution lies in raising awareness among individuals. Raising awareness should happen before a climate hazard occurs, since once a hazard such as flood reaches, it might be too late for the system to recover (Reyes, 2017).

It is essential to establish synchronized channels of communication horizontally and vertically, activities involving launching national awareness campaigns and

organizing activities, including production of short films, informative posters, and initiatives that highlight sustainability and adaptation. Furthermore, organizing challenges and activities at the youth and civil society levels can inspire and empower young people to join the movement, utilizing social media platforms to amplify climate-related challenges and initiatives (National Adaptation Plan Global Network., 2023).

5.5.2. Organizational Level

To mitigate issues stemming from fragmented information and outdated data in climate change adaptation planning, the institution of centralized data banks and research institutes is recommended (Reyes, 2017). These repositories would serve as essential resources for developing effective adaptation strategies by ensuring access to accurate and up-to-date information. Furthermore, ensuring collaboration and coordination among relevant stakeholders, including government agencies, research institutions, and local communities, is essential for maximizing the utilization and impact of these resources in addressing climate change challenges effectively. This approach enhances the reliability and effectiveness of adaptation planning processes, thereby contributing to more resilient responses to climate change challenges.

Additionally, the integration of specialized expertise into the policy planning process is essential to facilitate informed decision-making. For instance, embedding the Climate Change Unit within the MoE ensures comprehensive consideration of climate change issues across various sectors, recognizing their interconnectedness. This approach enhances the effectiveness of policy responses by harnessing expertise to address complex climate-related challenges beyond the realm of water management. By

investing in training and skill-building activities, sectors can better equip themselves to address climate-related challenges and implement adaptation measures effectively.

5.5.3. Enabling Environment

Ensuring the assigning of clear roles and responsibilities among sectors is essential to prevent the overlap of responsibilities, which could impede the adaptation process. Effective coordination among ministries is paramount in this regard, as it mitigates the risk of overlapping policies and strategies. By establishing transparent frameworks for collaboration and communication across sectors, governmental bodies can streamline efforts and optimize resource allocation for climate adaptation initiatives. This systematic approach enhances coherence and efficiency in policy implementation, thereby fostering a more integrated and effective response to climate change challenges.

At the policy and government level, accountability and transparency are key to ensure the integration of climate change into policies (Gharios et al. 2021). By fostering accountability, stakeholders are had responsible for their actions and decisions, ensuring that climate-related policies and implemented in a transparent manner. It ensures the equitable access to information and data as well as public awareness and participation in the policy-making process, making it difficult for political actors to interfere.

The NWSS 2020-2035 a binding document where its implementation should be mandatory instead of voluntary. Not to mention that the reassessment of the Water Code should guarantee the integration of modern water management practices into policies while also cancelling outdated laws that are no longer relevant. Additionally, the laws and regulations developed should be in a comprehensive manner to avoid

inconsistencies and overlapping of responsibilities and ensure policy coherence (Gharios et al., 2021).

At the financial level, since most of the monetary resources allocated are from international funding. Therefore, the plans and strategies developed should be aligned with the donor's requirements to avoid the duplication of efforts. Moreover, international donor agencies should prioritize the adoption of existing legislation rather than introducing additional, customized texts that may further strain post-conflict governments already facing challenges (Gharios et al, 2021). By fostering collaboration and coordination between donors and recipients, resources can be optimized, and the development of initiatives can be more effectively implemented to address critical needs. Aligning adaptation measures with international commitments facilitates access to international funding mechanisms like the Adaptation Fund, which is the most likely fund that the water sector in Lebanon to attain (UNDP, 2021).

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

This thesis assessed the trends of mainstreaming CCA into strategies and its application in Lebanon's NWSS 2020-2035. Henceforth, it has given a detailed investigation and analysis of the strategy as well as the opportunities that can implemented at the institutional level for the successful adoption of CCA such as sharing updated data, clear communication and coordination across ministries and sectors, accountability and transparency, and raising awareness.

Even though the results have shown that Lebanon's NWSS has a growing understanding of mainstreaming climate change into its report, it still has a long way to fix and improve to achieve water sector resilience. Addressing climate change challenges in Lebanon necessitates multifaceted approaches. Raising awareness among individuals through national campaigns and educational initiatives is crucial. Additionally, establishing centralized data banks, promoting stakeholder collaboration, and ensuring transparent policy-making processes are essential for effective adaptation planning and implementation.

Based on the results and findings, the following is recommended to properly mainstream CCA into the NWSS 2020-2035:

- Enhance governance through:
    - Better coordination among ministries and international organizations with clear assigning of responsibilities.
    - Raise awareness among policymakers on the importance of mainstreaming.

    - Create win-win situations between sustainable development and climate change adaptation.
    - Link climate change adaptation to higher development goals such as water and food security.
    - Improvement in data generation and accessibility.
    - Capacity building and upscaling of personnel through training and skill-building activities.
- Conduct a detailed impact assessment of climate change on the water resources.
- Conduct vulnerability assessment on water resources.
- More prioritization of adaptation measures based on projected climate risks.
- Concretely and clearly include CCA in the strategy.
- Monitoring and evaluation of the proper implementation of the strategy.

Although the thesis focused on mainstreaming Climate Change Adaptation (CCA) into the NWSS 2020-2035, it is important to note that the indicators can be adjusted and modified to mainstream various other topics into policies. Additionally, the recommendations presented have been forwarded to the Ministry of Energy and Water (MoEW) for consideration in the forthcoming updated version of the NWSS.

APPENDIX

CLIMATE MAINSTREAMING ASSESSMENT FOR JORDAN'S NATIONAL WATER SECTOR STRATEGY 2023-2040

Indicators	Scale	Score	Explanation
Recognizing climate change as one of the pressures on water resources	0-2	2	Recognizes the change in temperature and precipitation impacts water availability and quality.
Implementing of IWRM measures	0-2	2	The strategy clearly implements the 5 IWRM principles.
Mentioning concretely vulnerability of water resources to climate change impacts	0-2	2	Clear mentioning of the vulnerability of water resources to climate change.
Identifying of adaptation measures	0-2	2	Adaptation measures were identified and clearly labelled under climate adaptation
Prioritizing of the adaptation measures	0-2	1	No clear prioritization of adaptation measures to expected climate effects
Integrating the SESA document into the strategy	0-2	0	There is no SESA document prepared for the NWSS.

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