

A comparative analysis between two European climate change «hot-spots»: Baltic and Mediterranean Sea

Kyriaki A. Liparou*, Spyros K. Golfopoulos

University of the Aegean, Department of Financial and Management Engineering, 82132, Chios, Greece

*Corresponding author: E-mail: fmer16002@fme.aegean.gr

Abstract

The last decades climate change has been defined as one of the utmost threat worldwide. Reports and data in Europe highlight the conversion of climate patterns. Under the pressure of these changes European Union appended to its climate change policy agenda, the adaptation policy. European Union Member States started to elaborate and to develop their own adaptation and mitigation strategies. This paper presents a general overview of the National Adaptation Strategies (NASs) at the two of the most important climate change «hot spots» in Europe: the area of Baltic Sea and the area of Mediterranean Sea. The main object of this work is to compare the developing strategies in these two regions and in which way each region tries to tackle climate change according to its own dynamic. The analysis of the strategy is based on six axons. The first one refers to the up today action. The second has to do with the integration of the strategy in the other policies, ensuring their synergies. The third one examines the dissemination of information in order to raise awareness of the society. The fourth studies the different levels of governance that evolved in the implementation of the actions and measures. The fifth is being associated to the monitoring and evaluation of the implemented measures, including the indicators to obtain accurate results for designing the next steps. The last one concerns the research that is being carried out in the field of climate change and the produced knowledge for the NASs performance that rising under the new context. This analysis concludes that in the examined regions climate change adaptation policies, although some have lagged far enough, follow the same paths for the development and elaboration of adaptation policy.

Keywords: climate change, Baltic, Mediterranean, National Adaptation Strategies, HotSpot.

1. INTRODUCTION

Mediterranean is located in a particular zone, influenced by both the dry climate of Africa and the rainy and warm climate of Europe, making it particularly sensitive to climate change (European Commission, 2009; European Environment Agency, 2015; Giorgi and Lionello, 2008). According to Luterbacher (2006), Mediterranean has experienced great climate change in the past and is therefore considered one of the most important "HotSpot" (Giorgi and Lionello, 2008; Luterbacher et al., 2006) to the changes expected in the future due to climate change (European Environment Agency, 2017). Through a series of simulations that have been carried out on the issue of climate change in the area, with regard to various scenarios for greenhouse gas emissions, the results are not very encouraging: by the end of the 21st century the temperature will increase significantly, the height of precipitation will follow a downward trend (mainly in the southern and eastern

Mediterranean), the heat and drought days will increase remarkably, resulting in increased fire risk by destroying forest land and ecosystem thus limiting the populations living in the affected areas. Systems that will generally be affected by climate change in the Mediterranean countries include forests, water resources, coastal areas and marine ecosystems, infrastructure and industry, insurance and financial institutions, health, biodiversity and agriculture, and therefore food security. However, it is assumed that many more sectors will be affected through multiplying mechanism (Berkhout, 2005). Although Mediterranean Sea is a particularly sensitive area and of great economic importance to the countries it affects, there is no joint effort, a common strategy to tackle climate change at least by those who are members of the E.U. Efforts are fragmented, mainly on INTERREG programs. Most efforts seem to tie in mitigation policies than adjustment policies (EEA, n.d.). The countries bordering the Mediterranean and belong to the E.U. are Croatia, Cyprus, France, Greece, Italy, Malta, Slovenia and Spain.

Regarding the Baltic Sea, according to studies and in particular to the study carried out by the ASTRA program (a document – guidance, for decision makers about adaptation strategies and developing policies in Baltic Region. It was funded by the European Regional Development Fund in the context of INTERREG IIIB Baltic Sea Region Program) the temperature in the Baltic region is expected to raise. Changes are also expected in rainfall patterns, both spatial and seasonal. Concerns also focus on issues related to floods or potential shortages of water in some areas. Coasts are expected to be affected by ice loss and rising sea levels, all of which are anticipated to affect biodiversity and maritime safety. The same problems face all the countries in the region and therefore the cooperation between them is necessary. Based on models for potential climate change scenarios in the Baltic region, an average annual temperature increase, of about 3-5°C is expected till 2100. However, the models show that the temperature changes will be higher during the winter (4°-6°C). Floods and storms are already a threat to the area, which is reinforced when the phenomena of extreme weather events follow one another without the system itself recovering. With regard to the 20th century rainfall, there is a change, corresponding to an average annual increase of about 10-50mm. Significant fluctuations of rainfall occur seasonally and spatially during the winter season, showing an increase of up to 35% in some areas, while the summer becomes drier. Changes in temperature and rainfall are expected to affect a significant part of each country's economic sectors (agriculture, tourism, health, land use, transport, energy, etc.) (Hilpert et al., 2007). The E.U.'s countries bordering Baltic Sea are Denmark, Estonia, Germany, Latvia, Lithuania, Poland, Sweden and Finland.

2. METHODOLOGY

The main aim of this review is to study the National Adaptation Strategies (NAS) in two areas of Europe that was presented above. These two regions were chosen because they are characterized - according to the literature review of climate change - as «hot-spots». Both are facing important challenges in their climate: increases of temperature and extreme weather events, changes in the patterns of precipitation while their coastal systems are confronting important problems due to the rise of sea level. The research was based basically on literature review using key words like multilevel governance, implementation, integration, monitoring /control /indicator and evaluation of national adaptation strategies as well as on the policy and strategies papers developed in the countries of each region and in general, on legal documents of European institutions and organizations. In almost half of the cases, were used the official strategy papers of the states, but in the remaining half, and

due to the linguistic restriction, were used data from the Climate Adapt platform of the E.U.

3. PRESENTING THE NATIONAL ADAPTATION STRATEGIES

In the light of the aforementioned developments in the Mediterranean and Baltic Sea region, the evolution of Regional climate change Adaptation Strategies (RAS), based on the principles set out by the White Paper (2009) is of vital importance to the E.U. The text of the latter makes clear the importance and the role of governments at national, regional and local level, as well as the need for cooperation between them and with the E.U. and beyond with the international organizations. An adaptation strategy, understandable and coherent, that can be adopted by the E.U. regions will have substantial effects and will positively influence the quality of RAS (European Commission, 2009).

According to the report of Ribeiro (2009) the climate change adaptation strategies requires 4 steps in order to be successful: (1) preparation (support and integration of adaptation policy to regional plans, programs and policies), (2) assessing the vulnerability of the area (a good understanding of the risks faced in the studied area and its adaptability), (3) definition of strategy directions (the basic principles, that could help area to address the vulnerability, are defined), (4) design and implementation of appropriate measures (a precise action plan will be organized on where and how the measures will be implemented)(Ribeiro et al., 2009).

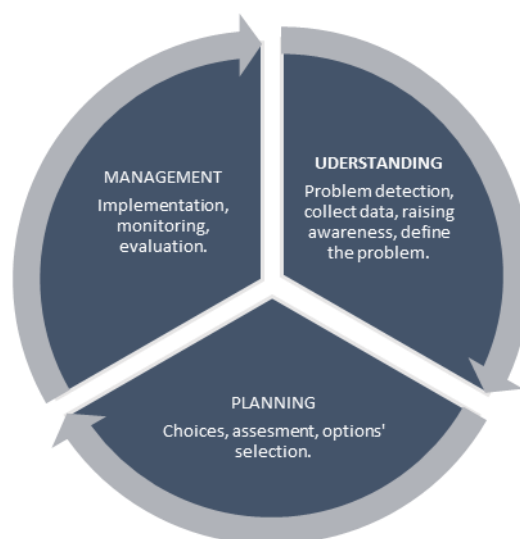


Figure 1: Cyclic Process of NAS Evolution (Moser &Ekstrom, 2010)

Mostly important in the whole process is the cyclical procedure of monitoring, evaluating, reviewing and redesigning or complementing the measures that is also highlighted by Moser and Ekstrom (2010). For them, the adaptation strategy follows a cyclical path: definition (understanding the problem), choice of solutions/proposals (planning) and control, evaluation and redefinition (management) (Moser and Ekstrom, 2010) (figure 1).

The following sections analyze the climate change National Adaptation Strategies (NAS), in the countries located in the Mediterranean and Baltic Sea. The analysis is structured on six axes according to literature references as well as to the E.U. legislation (Biesbroek et al., 2010; European Commission, 2013; Martins and Ferreira, 2011): (1). up to now actions and future developments, (2). research and development, (3). dissemination of information, (4). relationship with other policies, (5). multilevel governance and (6). monitoring and evaluation.

3.1.Up to now actions and future developments

Scenarios and Models: Most strategies present the potential climatic changes - reaching up to 2100 using mainly 1960-1970 as a reference year - that are broadly the same for all countries including temperature and its extreme gauge prices, rainfall and severe weather events, wind speed, sea level rise, ice melting (for the Nordic countries). The resulting

scenarios usually present the best and the worst case as well as some middle ones. Greece's strategy presents three scenarios: non-action, mitigation and adaptation (ΕΣΠΚΑ, 2016). In Sweden, interactively, four scenarios are being given. Between them, the scenario based on Special Report on Emissions Scenarios (SRES) produced by the Intergovernmental Panel on Climate Change (IPCC) (EEA, 2017a; SMHI, n.d.). France, Denmark and Finland follow the same scenario (Danish Government, 2008; Marttila et al., 2005; M.T.E.S., 2016). In Slovenia among others, they used 18 regional models to cover the country which are geographically reduced to achieve a better resolution (EEA, 2018a). In certain countries, climate scenarios developed relatively early, like in Germany where the first climate scenarios developed in 2005, in Spain in 2006 (EEA, 2018b; F.G., 2008). Some countries moved at a slower pace, such as Lithuania that has completed modeling for its regions in 2015 (EEA, 2017b). The data for the implementation of the models and the configuration of the scenarios were mainly collected and carried out in all countries by the Meteorological Service of each one.

Vulnerability Studies are the basis for each country to identify the vulnerable and less sensitive areas, the effects of climate change, many of which are common to all countries. However, northern European countries functioned much faster in this area, and so Finland, Germany and Sweden have already presented the first vulnerability studies since 2005 followed by Lithuania and Latvia (EEA, 2017c) in 2007 and 2008. The southern countries seem to be moving at a slower pace. Apart from Spain and France, the remaining countries started to implement vulnerability studies after 2010-2011. However, some of them present early sectoral vulnerability studies such as Slovenia which presents in 2004 the impact of climate change on the agricultural and forestry sectors while Croatia under the supervision of UN presents in 2008 a report regarding "Climate change and its impact on society and economy in Croatia" (EEA, 2017d; UNDP, 2008). Most strategies have a horizontal distinction (agriculture, health, water, soil) in combine to sectoral approaches (agriculture, livestock farming, regional development, rainwater, drinking water). Some of them have been developed in several areas, such as the Danish strategy (in 19 areas) or the Finnish strategy (in 16 sectors) while others such as the strategies of Cyprus and Malta, are limiting their action to 11 and 12 sectors respectively. This differentiation is mainly due to the environment (political, cultural, economic), the needs and the priorities of each country as the proposed strategies reflect the specific conditions of each one or at least what each of them considers to be necessary to its citizens and its territories so that they can respond in the best possible way to climate change. That is why we observe that France, Spain and Germany are developing a policy for the mountainous regions, Finland for reindeers and hunting, Italy for desertification and Po basin (EEA, 2018c) and Greece for its cultural heritage, areas that underlines both the uniqueness and the political and economic values of each country. It can be said that all countries, albeit with some delay, have identified their vulnerable sectors. Most of the countries are giving weight to the agricultural sector, biodiversity, water, public health, energy and forests. For most countries, water resources are among the most critical sector since many others depend on, such as agriculture, public health, tourism (Swart et al., 2009). Rather important are the sectors of fisheries, transport and infrastructure sectors.

Possible opportunities: Apart from the negative impacts on some sectors of each country there are also positive components that may arise from the upcoming changes (Hilpert et al., 2007). However, for the states of the Baltic region, the potential seems more clear-cut. The rise in temperatures and the shortening of snow cover will change there will be an increase in the country's production capacity, a reduction in heating needs that will lead to less natural resources use, producing positive results for mitigation policies. Even the

patterns of tourism are changing as the snow disappears which winter tourism is fading. Therefore, countries should be prepared to take advantage of the emerging opportunities of the emergence of a new production base. On the other hand, things for the Mediterranean countries are much more difficult and less clear, since high temperatures, water scarcity and drought create particularly difficult conditions that lead to the reduction of production and tourism, new production base (new, more resistant crops requiring less water) and improvement of health structures. The only clear positive element that seems to accompany the climate change in the Mediterranean is that the winter heating is going to be less. Nevertheless, this positive outcome will be offset by the increasing cooling needs during the summer months.

3.2. Research and development

Directly related to the issue of opportunities is the area of research and development that is the basis for adaptation to climate change. All countries through research structures seek to comprehend and analyze the concept of climate change by identifying not only the impacts but also the costs and benefits that come with it, seeking innovative and pioneering solutions to enable them to tackle the problem of climate change in the best possible way. Indeed, for some of these countries, such as Malta and Cyprus (CYPADAPT, 2014; MRRA, 2017), the study of this issue is prioritized by the national research council. It is important to understand what the Swedes advocate, that *tackling climate change can only be realized through the new knowledge* (EEA, 2017a). It is worth mentioning the example of France which, through the process of implementing and evaluating its strategy, identifies the "knowledge gaps". Therefore, in the first project that has implemented a percentage of more than 90% of the gaps identified, have already been funded for research (EEA, 2017e). But also, the example of Sweden, which in the last few years consist an important example in the field of research, by achieving social development and economic competitiveness, even at the long-term focus (EEA, 2017a). However, at the beginning of this effort, research for some countries started alongside the development of support centers, which not only focusing on how to develop and implement the strategy, but also and information and knowledge exchange centers. Examples of such centers are the "KomPass" (Competence Center on Climate Change Impact and Adaptation) in Germany, the "Adaptation Coordination Forum" in Denmark, the "Observatoire National sur le Réchauffement Climatique (ONERC) in France (Danish Government, 2008; EEA, 2017e; F.G., 2008)

3.3. Dissemination of Information

Informing the public about the problems arising from climate change and about the efforts to address them is one of the most important issues. The purpose of disseminating information is to raise awareness of society which, if it understands and accepts the problem and is not a passive receiver, will react by influencing both politics and science which (science) will ultimately affect both the citizen and politics. Through this cyclical process (figure 2), the proper adaptation policy is ensured (Swart et al., 2009).

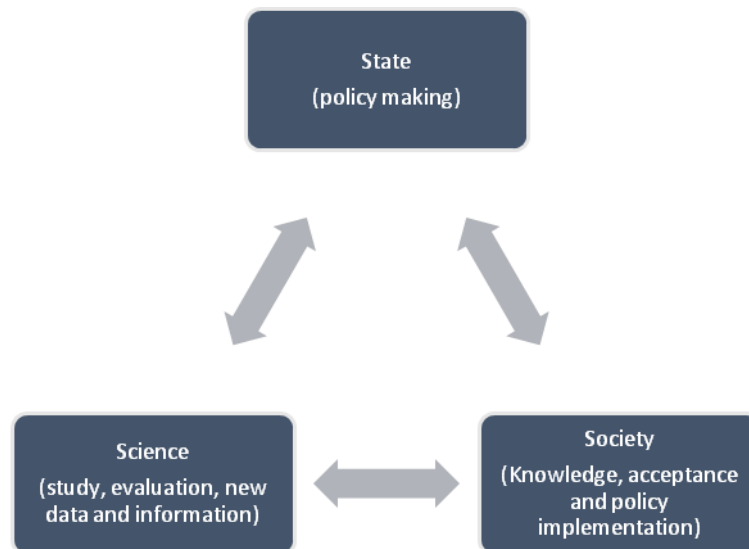


Figure 2: The Route of Information (Swart et al., 2009)

Means of communication: In this endeavor, the media have an important role to play with the internet being considered as the most important information transmitter through which information is disseminated not only to the closely defined local / national level but also to the European and international ones. Anyone can search for the information that they want and the subject that they are interested in. Of course, the most countries presenting limited information on the potential opportunities arising from climate change or how climate change is mainstreaming in every aspect of life. It is worth mentioning the case of Malta that distinguishes its population in groups, avoiding seeing the citizens on a single, common basis, trying to ensure the best way to update each of them (MRRRA, 2017, 2012). The second case concerns Finland, which attaches great importance to the evaluation of the information, so that the information that reaches the interested parties to be accurate and correct. Some countries, such as Sweden pay special attention to information and exchange of information between the various levels of the government (EEA, 2017a). Since the creation of the German strategy, orientation has been made to the design of "national communication" and the importance to be given to the design of the educational system. Together with Finland, they recognize the importance of local, regional and local/municipal administrations for the development of the adaptation policy (F.G., 2008; Marttila et al., 2005). But there are some states such as Greece and Spain which, although in their strategy recognize the particular importance of the dissemination of the strategy they don't enclose any special action (EEA, 2018b; ΕΣΠΙΚΑ, 2016)

Information Providers: In the national strategies under consideration, information is mainly provided by the central government through the relevant ministry on adaptation to climate change or through the ministries involved, as well as through the links they have on the specific issues that concern them, such as in the case of Sweden. Sweden has set up a special platform for the presentation of its strategies in the framework of the "Knowledge Center for Adaptation to Climate Change", France disseminates information through the ONERC organization, Spain through AdapteCCa which consist a "multi-directional communication channel", Cyprus and Finland have created a special website, the CYPADAPT and the climate.fi respectively, in which their strategy is presented in detail. Some other countries, such as Latvia, Greece and Malta, have been delayed in developing a separate website. In these cases, the dissemination of information is realized by the responsible for climate change ministry or through the sectoral policy websites. The lack of a website that provides information on strategy is a negative factor for those countries. The

limited information provided, for example, through the Ministry of Environment and Energy (MEE) in Greece, does not support the citizens, the stakeholders, to evolve in country's strategy or to identify the stage of its implementation nor any actions that are taking place within it. The given information is limited.

Education and NGOs: In the context of proper information, the role of education in some countries is remarkable. Certain countries not only inform citizens, with seminars and sessions on climate change or publish brochures (Croatia), newsletter (Spain), organize exhibitions and make videos (France), organize conferences and debates (Poland) (EEA, 2018d; MŚ, 2013) but they really go into their educational systems, starting from the early school years of children. Such cases are Malta and Sweden, which introduce the issue of climate change into formal education from a very early stage. Finland has moved furthermore as it integrates or is trying to incorporate climate change into university studies to ensure appropriate training for professionals. For example, doctor is aware of the consequences that climate change may have to health but also about his/her abilities to deal with them. The role of NGOs is quite important as they play an active role in disseminating information to society and schools through actions and updates. In the case of Malta, the non-profit organization KOPIN (Koperazzjoni Internazzjonali) has organized a training program for farmers entitled "Facing climate change in Malta's agriculture". The aim of this program was to inform the farmers about the existing links between the agricultural practices and the causes and effects of climate change so as to encourage practices capable to defend both the environment and food safety (MRRA, 2017).

3.4. Relationship with other policies

Adapting to climate change is fundamentally an attempt to integrate the adjustment policy into other (sectoral) policies so that each sector can become accustomed to the new arising conditions. The adjustment effort should be initiated by the administration, meaning the formation of the legal framework and the improvement of constitutional structures of government agencies, measures which do not require special costs but will help faster and easier adaptation since they prepare the ground for the policy implementation (EEA, 2016; Marttila et al., 2005; MRRA, 2012). By integrating policy adaptation into sectoral policies, it is ensured the participation of all (society and actors) in the effort as well as the avoidance of overlapping or contradictory actions, as policy objectives often resemble at certain points or oppose each other (the implementation of infrastructure projects to increase protection from climate change can lead to an increase in greenhouse gases by adversely affecting mitigation policies). With the country's integration policy, two key objectives are achieved. Firstly, policy coherence and coordination is ensured, and secondly by "forced" intervention, the state does not leave the policy of adaptation to "luck" by ensuring its integration into the socio-economic field of the country (Swart et al., 2009). Thus, in the countries studied, the responsible institution for policy co-ordination and integration is the ministry responsible for adaptation, always in co-operation with the ministries involved or a central governmental committee, as is the case in France and Slovenia. In France, the ONERC is responsible for many issues related to adaptation to climate change, but it always works under the auspices of the Interministerial Committee on Sustainable Development, which coordinates the overall adjustment effort. In Slovenia the Interdepartmental Working Group on Climate Change Adaptation is responsible for the coordination (vertical and horizontal) of adaptation.

However, for integration to work properly and to ensure possible synergies between policies, each policy must overcome its limits in order to find contact points with climate change policy and to achieve the maximum benefits (Daly, 2012; O'Brien et al., 2008). Of

course, coexistence of policies is not limited to the development of relations between two policies but can and must consider a set of policies by forming a complex system that requires administrative organization and intervention. For example, incorporating climate change into poverty policies will help poorer populations to cope better with climate change. By incorporating in the same framework, the health policy, the latter will contribute to the improvement of health structures to which, the most economically weak, are going to turn in difficult situations that rising from climate change (as in the case of high temperatures - heat wave). By integrating education and work policies into the system, it is likely that some people will manage to get out of poverty (Agostini, et al., 2013; Eriksen et al., 2011; Mearns et al., 2009).

To achieve this it is important to have, political action, will and vision, understandable by the society (for this reason national strategies are voted by the council of each country or the highest governmental body and most of the ministries are involved in its implementation), flexible administration (Finland and Malta are giving maximum weight to their administrative structures by trying to upgrade and strengthen the administrative structure of their ministries), proper monitoring and interpretation of the results without the intervention of external actors (Malta and Finland highlight the importance of having correct results and correct interpretation, Sweden conceptual relevance of terms within E.U.), clear targeting (all the strategies put a central objective which is analyzed in subordinate targets that will support the central one), severity in their implementation, updating and re-checking (timetables, evaluations, control, indicators - most strategies have gaps at this stage) and in general to develop tools that could be useful to the state, helping the process of adaptation (France since its first strategy manage to develop a set of basic tools / levers - laws, regulations, methodological tools, observation systems, etc. to ensure the transition of the country) (Swart et al., 2009).

3.5. Multilevel Governance

The success of the adjustment policy requires inter alia the integration of the strategy at different levels of government and society. The concept of governance concerns the relations and synergies developed between different levels of government (European - national - regional - local) and among them and non-governmental stakeholders such as universities, research institutes, NGOs and individuals (Biesbroek et al., 2010; Neil Adger et al., 2005). European Union is the second level of governance (after the international one) which is directly related to international organizations, binding in parallel its Member States. At the same time, it develops its own legislation by guiding its Member States and stressing the joint effort to achieve adaptation targets at European and international level. However, it leaves the national governments, the third level, to decide on their own, based on their own needs and priorities. The national level will address to the regional and local one as well as to the actors involved. However, for the Baltic Sea countries, there is also another level of governance related to the transnational cooperation of the countries directly affected by the Baltic Sea, including non-EU countries, such as Russia and Belarus. Through the projects they have developed, such as Baltadapt, they have identified the problems of the wider region and are trying to decide on common goals and solutions. In this way, a country's decisions do not invalidate the actions of another but act in a complementary way. This of course also ensures cooperation between them at all levels, such as the exchange of knowledge (Beazley et al., 2004; Hilpert et al., 2007).

State Administration: The national level is responsible for, transposing legislation from the E.U. inner the country, shaping policy adjustment, coordinating and implementing it at lower levels of governance. This third level will create the appropriate framework for

better policy implementation by adjusting legislation to the needs of its stakeholders and its territories, providing incentives for those involved, removing any obstacles and synchronizing the work to be done. Of course, the national level exists in all countries studied, although its role and degree of intervention may vary. France, Spain, Italy, Croatia, Denmark, Germany and Sweden work at all levels of governance (national, regional and local) but some other countries operate at fewer levels. Finland is pursuing a more sectoral policy, leaving the regional and local level. Malta, due to its small size, is limited to the national level, but that doesn't mean that it does not develop its action at other levels of government, i.e. cooperation with private bodies, universities or NGOs. Slovenia is mainly working locally, but there are commitments to develop activity at the regional level. Estonia (EEA, 2018e) and Poland are the only countries with limited activity at sub-national levels. Even Latvia, which does not yet have a strategic plan, recognizes the importance of the local level and its involvement in the implementation of the policy. Greece belongs to the category that attaches great importance to the regional level, and the regional plans are still in the phase of shaping.

Non-governmental organizations: In all strategies, the involvement of non-governmental groups such as universities, institutions, businesses and unions, is a fact. Universities and institutions contribute through their research programs and the knowledge that they provide (Biesbroek et al., 2010). Organizations related to the subject are trying to inform the society, to raise public awareness and to influence governments. Businesses provide all the data needed to measure and monitor the effort of tackling climate change (especially in Sweden they are contributing on how indicators are formulated and modeled) while they endeavor to implement climate change in their long-term investment and potentially exploiting and harnessing emerging opportunities.

The responsibility for adaptation: The way in which each country defines and designs its policy determines on how responsibilities are shared at different levels of governance (Committee of the Regions, 2012; European Commission, 2009). Thus, Sweden and France seem to distribute responsibility for implementation at all levels Finland distributes responsibility to the ministries in authority for implementation (and for this reason one of its objectives is to restructure the administrative form of the ministries so that they can push the whole sector). Countries like Greece or Lithuania and Latvia place more weight on one of the two sub-national levels of government.

For the concept of governance to function properly, roles between sub-national levels of governance must be clarified so that they do not overlap (preventing money wastage) or cancel each other. Therefore, proper communication is required, eliminating the obstacles that undermine the goal of adaptation, such as bad or incomplete information, correct understanding and interpretation of information, clarification of issues related to the funds and their management etc (Swart et al., 2009). The distinction between the jurisdictions at each level requires study and possible reconstruction of the administrative structure, separation and definition of responsibilities by the state or a responsible operator. Finland and Malta are examples of countries working in the field of reorganization of the ministry's administrative sector.

3.6. Monitoring and evaluation

Adaptation strategies mainly concern the future and rely heavily on predictions and scenarios. At the same time, the uncertainty (Biesbroek et al., 2010; Hallegatte, 2009) that characterizes the issue of change, which is reinforced by the impact of external factors (aggravation of extreme weather phenomena) (Sylves, 2014), the interactions with other policies, the restrictions (political, legal, social, economic) that are shaped and developed

over time, influence the proposed solutions. Thus, a proposed action (at the time of its conception) can be judged satisfactory, but in its implementation and development it may eventually be inadequate or even inappropriate. Strategies cannot therefore be seen statically and unchanged.

Indicators: The issue of indicators is constantly being considered and evolving as one of the most important problems of policy adaptation. There are questions about the indicators to be used (qualitative, quantitative, necessity, efficiency, effectiveness, economic viability), the data that will be needed, if it is easy or not to collect them. However, as the Finnish strategy rightly points out, “*this is not the mere accumulation of information that ultimately will only serve to fill the state's records with useless information*” (Marttila et al., 2005). The collected data must be appropriate and capable of providing the necessary information for the development of indicators to identify the factors that contribute and support the adaptation or those that impede the effort. The aim of all this is to properly assess the data that will form the basis for the next steps and the subsequent decisions, whether they are measures or decisions for newcomers in the process or for review and reconstruction or simply for continuation. Thus, the policy of the strategy follows a cyclical course: definition (understanding the problem), selection of solutions / proposals (planning) and control, evaluation and redefinition (management) (Moser and Ekstrom, 2010) (figure 1). However, to get to the point of completing a first cycle, as outlined above, the strategy must go through the control stage. To do this, each measure and action selected must convey the way it is measured and present accurate timetables. The aim is to provide continuous feedings with the latest data, to monitor progress and to highlight shortcomings or even its mistakes. The debate on the choice of indicators develops in all countries in a different way. Sweden seeks to ensure the (conceptual) comparability of the terms with the EU terminology. France faces problems in completing them, as there are shortages of mainly economic data and Cyprus faces problems with data collection. Regarding the Danish strategy it is more than clear that the process will be long-lasting with continuous adjustments and consequently constant controls and revisions. Nevertheless, indicators are not mentioned. In Germany's strategy, references to indicators are limited to their importance in the evolution of adaptation strategy. However today, Germany has successfully developed a system of 102 indicators, which has been in force since 2014, contributing to the first report on the German strategy published in May 2014 (EEA, 2018f). Poland has also developed a system of indicators based on 6 objectives, without excluding the use of others (EEA, 2018d). It is worth noting that in the Finnish strategy indicators were set based on the sustainable development indicators. A preliminary list of key adjustment indicators was created in 2016. This list was discussed with all stakeholders, during 2017, and continues to be developed based on feedback information (EEA, 2016).

Evaluation: There is also a void about who will do the assessment and how the new data will enter into the system, by the policy maker or by a special team/service that has undertaken the project. Most countries have set up a national inter-ministerial group with other stakeholders (universities, representatives of meteorological services, NGOs, etc.) but with a wide range of responsibilities. In these groups, evaluation and monitoring of the strategy is often a small part of their responsibilities and sometimes they are non-existent. There are also some countries reporting on the monitoring and control of lower levels of governance, local and/or regional such as Sweden and Lithuania.

References: In the field of information, things are more organized as countries have obligations at international (UN) and European level (Swart et al., 2009). However, if there are no measurable results (France) and indicators (Greece), these reports remain simple

reviews presenting data collection. Therefore, these reports may need to be enriched with additional data related to the effectiveness of the measures. This means that reports should include results from the indicators used and perhaps data from the metadata sheet that supports them. Through the national adaptation strategy (till today) no country has developed a dedicated service dealing exclusively with these issues, while gaps in this area are particularly important as they prevent good information, and therefore, good feedback on the strategy.

4. RESULTS AND REFLECTIONS

Based on the 6-axis study, some general NAS findings can be identified and presented. It is noted that some countries have started their efforts to tackle climate change early on. They quickly develop models and scenarios and, as a result, vulnerability studies, with Finland to present the first adaptation strategy in 2005. Others have moved less dynamically, limiting their action to shaping sectoral sensitivity studies. These countries operated before the EU White Paper and the Green Paper, before the guidelines of E.U. (Biesbroek et al., 2010). The adaptation effort, as it may seem geographically, shows rapid growth in northern Europe (not all countries) and in Western Mediterranean Europe. On the other hand, the countries located in the Central and Eastern Mediterranean are not particularly active in these early years, moving at a slower pace. Countries in this category are awaiting the adoption of the EU guidelines. They do not take the initiative for adjustment themselves. However, the development of action by the pioneers creates a "positive precedent" that can be exploited by those who follow. However, whether a country is a precursor or a follower in tackling climate change, it certainly has a variety of influences on the evolution of the country's strategy and adaptation effort (Heidrich et al., 2015).

Action at a very early stage provides a significant lead to the countries that have been working faster since they were able to provide information on future developments, identify their sensitive areas and sectors, to speed up the impact of climate change on natural and anthropogenic systems and start a first planning. Finland, for example, presented its first strategy paper in 2005, which means that it is rather old in relation to EU directives coming in the years to come, and cannot serve as an example for a country that has shaped its strategy in 2015 (for this reason, Finland has already developed its second strategy). According to the research made, today most countries have completed climate change adaptation strategies or at least tend to complete them. Countries that started their efforts late, following the EU guidelines, followed the proposed policy without contributing to its shaping or direction (Heidrich et al., 2015). However, within the framework of the E.U.'s single policy, instructions are given, but each state is free to operate based on its own data and its own needs.

Yet, there are many sectors and consequently policies and strategies, that can have a direct impact on efforts to tackle climate change (energy policy, waste, transport, industry) (Heidrich et al., 2015; Villarroel Walker et al., 2014) and therefore finding the entry points between the involved policies is particularly important as it can strengthen or weaken efforts to tackle climate change. Typical examples that will contribute decisively to the strategic adaptation goals are, increase in infrastructure projects to protect society against hydrological hazards, support for the vulnerable population groups and the poorest during the summer from the unpleasant consequences of warming (heat waves), the creation of parks that will ensure clean air and coolness in the city etc.

However, adaptation policies also require integration that takes place at the highest national level for most countries and goes to the regional one. The regional level is the most appropriate to tackle climate change issues (Swart et al., 2009). However, local

strategies in order to develop requires co-operation between all levels of government as well as non-governmental (businesses, institutes, universities) (Heidrich et al., 2015). There may be policy overlaps but with the correct division of responsibilities it can be avoided (Biesbroek et al., 2011). This requires administrative convenience. Relationships and communication developed between levels of governance should be clear to make a major contribution to society. Pollution-related policies on an island of Greece or in a village in Italy cannot simply be formulated at national or regional level without considering local knowledge and experience (Heidrich et al., 2015). These two factors will provide what is necessary to properly address the problems of climate change even for those countries that have not yet established links with the local level or more generally with one of the two sub-national levels such as Finland. But who will be responsible for controlling and implementing policy at levels is different.

Given that climate change-related data is constantly changing, the latter is continuously on process of evolution. This means that adaptation policies must be judged and reviewed periodically to ensure their effectiveness. For this reason, the monitoring of the strategy is one of the most important issues and problems for decision-makers. Even though the importance of redefinition and evaluation is identifiable in all the strategies under consideration, although some are delayed. However, implementing a strategic control system is vital for the sustainability of the strategy itself, as without it the strategy will remain static and therefore incomplete and mistimed. A non-stoppable feedback will highlight shortcomings and possible mistakes while selection of the right items is crucial (Moser and Ekstrom, 2010).

Nevertheless, to ensure the continuous feedback of the strategy, monitoring is not enough. Communication and research are equally necessary. Therefore, what emerges is that all countries, less or more, more specialized or less, either in the North or in the South, are engaged in research and innovation, which is currently one of the pillars of the European strategy, known as Europe 2020. In addition, a key feature of the developed countries of the European continent (and not only) is their accessibility (in relation to the developing ones) to the technical and financial resources and the better institutional and administrative structures that give them an important advantage (Gagnon-Lebrun and Agrawala, 2006).

The aim is to find solutions to the problems that climate change will create so as to achieve the best possible adaptation. They should focus on exploring new opportunities that will lead to the creation of new products and services able to protect natural and artificial systems, increase labor supply and, potentially, boost the country's economy while ensuring the desired sustainable development. This means that research should focus on issues beyond the effects of climate change that will lead away from a possible deadlock. At this point the importance of the relationship between the three key stakeholders: society, science and politics is highlighted. The development of communication channels between the three is extremely important as their relationship is interrelated since they define and influence adaptation strategies (Swart et al., 2009).

All this requires a renewed and flexible administration as well as political will, energy and vision that could easily be understood by society (Swart et al., 2009). Over the years, all countries, either in northern Europe or in the South, have promoted the processes of shaping their strategies, using almost the same principles and methods. This is due to the fact the all countries work within the EU, having the same goals, are experiencing, more or less, the same problems and they have to work under the uncertainty surrounding the issue

of change. However, between the two areas described above were noted some crucial differences and similarities.

5. CONCLUSIONS

Comparing the Baltic and the Mediterranean region, based on the above 6 axes, similarities and differences are observed. Below, are going to be presented the main similarities that have emerged between the two regions.

Both areas, according to the bibliographic review, are characterized as the European "hot spots" related to climate change. A key element in their effort is to simulate climate change by presenting a range of possible outcomes, ranging from optimal to worst case. The latter help to the development of vulnerability studies for the country as well as for its sectors, so that each one could be aware of its shortcomings towards the forthcoming change in order to be prepared (as best as possible), setting primarily clear objectives. All countries follow the E.U. guidelines but the final decision regarding the strategy is based on the specific characteristics and needs of each one. In this context the society, the citizens, the businesses and the state have the possibility to adjust towards the upcoming change. All countries recognize, accept and endeavor to apply some basic principles associated with the issue. These are, the integration of climate policy into the rest policies so as to find contact points and to ensure the diffusion of climate change policy in all aspects of economic and social life, the proper development of multilevel governance, so as to support the effort of change as it ensures the participation of the society, the continuous effort to inform and raise public awareness (while main transmitter of information features the cheap internet), the integration of climate change problem in education and finally, the recognition of the importance of frequent monitoring and evaluation as they are going to ensure a sustainable policy on climate change. Although, in both areas, all the above are recognized and significant efforts are being made, significant gaps still exist, especially in the domain of indicators, monitoring and evaluation. However, to have an adaptation effort, with truly positive results, it is necessary to involve research and innovation, the importance of which is also recognized by all countries. And as they already know what the consequences of the upcoming change will be (without forgetting that they are facing a problem that is characterized by uncertainty), they also know what they should look for, to prevent negative results. In almost all countries responsible for the adjustment processes is the central government, the responsible ministry for shaping the adaptation strategy while there is no separate service (for most countries) dealing with the issues of climate change.

In addition to the mentioned similarities, there are also significant differences. The countries belong to Baltic Sea place particular emphasis on working together, developing a common policy for the area, that will ensure coherence in their policies, support for the weak and exchange of knowledge and experience. Through the changes that are expected to affect the region, some potential opportunities that emerge from climate change have been already identified giving them the advantage to use them for their benefit. This knowledge gives them the lead in the field of research, which is however more general. This lead has been determined by the first steps of climate change efforts with the first simulations, vulnerability studies and strategies to be launched in the area of Baltic Sea.

Concerning the Mediterranean, efforts for joint action are based on the INTERREG programs (they concern European territorial cooperation at border, national and regional level trying to promote a harmonious economic and territorial development of the Union as a whole (European Commission, 2017), but there is still no common framework for action, a common policy for the whole region. Efforts are being made, but they are limited to the

transnational co-operation mainly of neighboring countries and in specific sectors. This is partly due to the large size of the Mediterranean Sea. The opportunities presented in the area are not yet clear. On the contrary, the situation seems to be quite difficult while research and innovation must identify the new opportunities to help countries cope with climate change and ensure sustainable development. However, the Mediterranean countries are moving at a slower pace and are therefore facing delays in their planning and strategy development.

Efforts to tackle climate change are continuous and require cooperation from everyone. However, there are many issues that need to be explored, which relate mainly to: the networks of information among science, policy and society, the successful integration, the multilevel governance, the control and evaluation of the measures and actions implemented.

References

- Agostini, C., Sabato, S., Jessoula, M., 2013. Europe 2020 and the fight against poverty: searching for coherence and effectiveness in multilevel policy arenas., Working Paper-LPF. Centro Einaudi, Italy.
- Beazley, C., Gahler, M., Hassi, S., Ilves, T. as H., Kristovskis, G.V., Lax, H., Stubb, A., 2004. Europe's Strategy for the Baltic Sea Region.
- Berkhout, F., 2005. Rationales for adaptation in EU climate change policies. *Clim. Policy* 5, 377–391.
- Biesbroek, G.R., Swart, R.J., Carter, T.R., Cowan, C., Henrichs, T., Mela, H., Morecroft, M.D., Rey, D., 2010. Europe adapts to climate change: comparing national adaptation strategies. *Glob. Environ. Change* 20, 440–450.
- Biesbroek, R., Klostermann, J., Termeer, C., Kabat, P., 2011. Barriers to Climate Change Adaptation in the Netherlands. *Clim. Law* 2, 181–199.
- Committee of the Regions, 2012. Building a European Culture of Multilevel Governance: Follow-up to the Committee of the Regions' White Paper, CIVEX-V-020.
- CYPADAPT, 2014. Εθνικό Σχέδιο Προσαρμογής της Κύπρου στην Κλιματική Αλλαγή (in greek). Υπουργείο Γεωργίας, Φυσικών Πόρων και Περιβάλλοντος Κύπρου, Cyprus.
- Daly, M., 2012. Paradigms in EU social policy: a critical account of Europe 2020. *Transf. Eur. Rev. Labour Res.* 18 (3), 273–284. <https://doi.org/10.1177/1024258912448598>
- Danish Government, 2008. Danish strategy for adaptation to a changing climate. Danish Energy Agency, Copenhagen.
- EEA, 2018a. Climate - ADAPT. Sharing adaptation information across Europe. Slovenia. [WWW Document]. Clim.-ADAPT. URL <http://climate-adapt.eea.europa.eu/countries-regions/countries/slovenia> (accessed 10.4.18).
- EEA, 2018b. Climate - ADAPT. Sharing adaptation information across Europe. Spain. [WWW Document]. Clim.-ADAPT. URL climate-adapt.eea.europa.eu/countries-regions/countries/spain (accessed 3.20.18).
- EEA, 2018c. Climate - ADAPT. Sharing adaptation information across Europe. Italy [WWW Document]. Clim.-ADAPT. URL <http://climate-adapt.eea.europa.eu/countries-regions/countries/italy> (accessed 3.20.18).
- EEA, 2018d. Climate - ADAPT - Sharing adaptation information across Europe. Poland. [WWW Document]. Clim.-ADAPT. URL <http://climate-adapt.eea.europa.eu/countries-regions/countries/poland> (accessed 3.27.18).
- EEA, 2018e. Climate - ADAPT - Sharing adaptation information across Europe. Estonia. [WWW Document]. Clim.-ADAPT. URL <http://climate-adapt.eea.europa.eu/countries-regions/countries/estonia> (accessed 3.25.18).

- EEA, 2018f. Climate - ADAPT. Sharing adaptation information across Europe. Germany. [WWW Document]. Clim.-ADAPT. URL <http://climate-adapt.eea.europa.eu/countries-regions/countries/germany> (accessed 3.29.18).
- EEA, 2017a. Climate - ADAPT - Sharing information across Europe. Sweden.
- EEA, 2017b. Climate - ADAPT - Sharing information across Europe. Lithuania [WWW Document]. Clim.-ADAPT.
- EEA, 2017c. Climate - ADAPT - Sharing information across Europe. Latvia [WWW Document]. Clim.-ADAPT. URL http://climate-adapt.eea.europa.eu/countries-regions/countries/latvia/index_html
- EEA, 2017d. Climate-ADAPT. Sharing adaptation information across Europe. Croatia. [WWW Document]. Clim.-ADAPT. URL <http://climate-adapt.eea.europa.eu/countries-regions/countries/croatia> (accessed 3.20.18).
- EEA, 2017e. Climate-ADAPT - Sharing information across Europe. FRANCE [WWW Document]. Clim. - ADAPT - Shar. Adapt. Inf. Eur. URL <http://climate-adapt.eea.europa.eu/countries-regions/countries/france> (accessed 1.29.18).
- EEA, 2016. Climate - ADAPT - Sharing information across Europe. Finland.
- EEA, n.d. Climate-ADAPT. Mediterranean Area. [WWW Document]. Clim. - ADAPT - Shar. Adapt. Inf. Eur. URL (accessed 10.2.18).
- Eriksen, S., Aldunce, P., Bahinipati, C.S., Martins, R.D., Molefe, J.I., Nhemachena, C., O'Brien, K., Olorunfemi, F., Park, J., Sygna, L., Ulsrud, K., 2011. When not every response to climate change is a good one: Identifying principles for sustainable adaptation. *Clim. Dev.* 3, 7–20. <https://doi.org/10.3763/cdev.2010.0060>
- European Commission, 2017. Interreg: European Territorial Co-operation [WWW Document]. Policies Inf. Serv. URL http://ec.europa.eu/regional_policy/en/policy/cooperation/european-territorial/ (accessed 4.14.18).
- European Commission, 2013. Environment Action Programme - European Commission [WWW Document]. URL <http://ec.europa.eu/environment/action-programme/> (accessed 3.25.17).
- European Commission, 2009. White paper - Adapting to climate change: towards a European framework for action, 147.
- European Environment Agency, 2017. Climate change, impacts and vulnerability in Europe 2016: An indicator-based report. (No. 1). EEA, Copenhagen.
- European Environment Agency, 2015. Mediterranean Sea region [WWW Document]. Eur. Environ. Agency. URL <http://www.eea.europa.eu/soer-2015/countries/mediterranean> (accessed 4.2.17).
- F.G., 2008. German Strategy for Adaptation to Climate Change (Deutsche Anpassungsstrategie, DAS). The Federal Government, Berlin.
- Gagnon-Lebrun, F., Agrawala, S., 2006. Progress on adaptation to climate change in developed countries. An analysis of broad trends. OECD, Paris.
- Giorgi, F., Lionello, P., 2008. Climate change projections for the Mediterranean region. *Glob. Planet. Change* 63, 90–104.
- Hallegatte, S., 2009. Strategies-to-Adapt-to-an-Uncertain-Climate-Change.pdf. *Human and Policies Dimensions* 19, 240–247.
- Heidrich, O., Reckien, D., Olazabal, M., Foley, A., Salvia, M., Gregorio Hurtado, S. de, Orru, H., Flacke, J., Geneletti, D., Pietrapertosa, F., Hamann, J.J.-P., Tiwary, A., Feliu, E., Dawson, R.J., 2015. National climate policies across Europe and their impacts on cities strategies. Elsevier Ltd, *Journal of Environmental Management* 168, 36–45. <https://doi.org/10.1016/j.jenvman.2015.11.043>

- Hilpert, K., Mannke, F., Schmidt-Thomé, P., 2007. Towards Climate Change. Adaptation in the Baltic Sea Region. Developing Policies and Adaptation Strategies to Climate Change in the Baltic Sea Region. GTK, Finland.
- Luterbacher, J., Xoplaki, E., Casty, C., Wanner, H., Pauling, A., Küttel, M., Brönnimann, S., Fischer, E., Fleitmann, D., Gonzalez-Rouco, F.J., others, 2006. Mediterranean climate variability over the last centuries: a review. *Dev. Earth Environ. Sci.* 4, 27–148.
- Martins, R.D., Ferreira, L.D.C., 2011. Opportunities and constraints for local and subnational climate change policy in urban areas: insights from diverse contexts. *Int. J. Glob. Environ. Issues* 11, 37–53.
- Marttila, V., Granholm, H., Laanikari, J., Honkatuki, J., Heikinheimo, P., Aalto, A., Yrjölä, T., Järvinen, H., Liski, J., Merivirta, R., Paunio, M., 2005. Finland's National Strategy for Adaptation to Climate Change.
- Mearns, R., Norton, A., Ribot, J., 2009. The Social Dimensions of Climate Change: Equity and Vulnerability in a Warming World, World Bank. ed, *New Frontiers of Social Policy*. World Bank, Washington.
- Moser, S.C., Ekstrom, J.A., 2010. A framework to diagnose barriers to climate change adaptation. *PNAS* 107, 22026–22031. <https://doi.org/10.1073/pnas.1007887107>
- MRRA, 2017. Climate - ADAPT - Sharing information across Europe. Malta. [WWW Document]. *Clim. - ADAPT - Shar. Adapt. Inf. Eur.* URL <http://climate-adapt.eea.europa.eu/countries-regions/countries/malta>
- MRRA, 2012. National climate change adaptation strategy. Malta. MRRA, Malta.
- MŚ, 2013. Polish National Strategy for Adaptation to Climate Change (NAS 2020). MŚ - Ministry of the Environment Republic of Poland, Warsaw.
- M.T.E.S., 2016. Adaptation de la France au changement climatique. ONERC, Paris.
- Neil Adger, W., Arnell, N.W., Tompkins, E.L., 2005. Successful adaptation to climate change across scales. *Glob. Environ. Change* 15, 77–86. <https://doi.org/10.1016/j.gloenvcha.2004.12.005>
- O'Brien, K., Sygna, L., Leichenko, R., Adger, W.N., Barnett, J., Mitchell, T., Schipper, L., Tanner, T., Vogel, C., Mortreux, C., 2008. Disaster risk reduction, climate change adaptation and human security. *Rep. Prep. R. Nor. Minist. Foreign Aff. Glob. Environ. Change Hum. Secur. Proj. GECHS Rep.* 3.
- Ribeiro, M., Losenno, C., Dworak, T., Massey, E., Swart, R., Benzie, M., Laaser, C., 2009. Design of guidelines for the elaboration of Regional Climate Change Adaptations Strategies [WWW Document]. URL <http://ecologic.eu/sites/files/publication/2015/1926-ras-final-report.pdf> (accessed 4.4.17).
- SMHI, n.d. Climate scenarios [WWW Document]. SMHI. URL www.smhi.se/klimat/framtidens-klimat/klimatscenarioer?area=swe&var=tmin&sc=rcp85&seas=ar&dnr=99&sp=en&sx=0&sy=451 (accessed 11.1.18).
- Swart, R., Biesbroek, R., Binnerup, S., Carter, T.R., Mela, H., Loquen, S., Henrichs, T., Cowan, C., Morecroft, M., Reese, M., Rey, D., 2009. Europe Adapts to Climate Change Comparing National Adaptation Strategies (No. 1). PEER, Helsinki.
- Sylves, R., 2014. Disaster Policy and Politics: Emergency Management and Homeland Security. CQ Press.
- UNDP, 2008. A Climate for Change: Climate change and its impacts on society and economy in Croatia.
- Villarreal Walker, R., Beck, M.B., Hall, J.W., Dawson, R.J., Heidrich, O., 2014. The energy-water-food nexus: Strategic analysis of technologies for transforming the

urban metabolism. Elsevier Ltd, Journal of Environmental Management 141, 104–115. <https://doi.org/10.1016/j.jenvman.2014.01.054>
ΕΣΠΚΑ, 2016. Εθνική Στρατηγική για την Προσαρμογή στην Κλιματική Αλλαγή. Υπουργείο Περιβάλλοντος και Ενέργειας, Αθήνα.