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I-STORMS

Integrated Sea sTORm Management Strategies

STRATEGY


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CONTENTS

1. Introduction: general objectives and new challenges of climate change.....2

2. **The response: a strategy for the ADRION basin.....9**

2.1 The main priorities and thematic pillars.....12

2.1.1 Data & Information sharing for integrated tools.....15

2.1.2 Cooperation & Coordination.....18

2.1.3 Communication & Stakeholder involvement.....20

2.1.4 Exercises & Volunteers.....23

2.2 Cross-cutting issues..... 25

3. Missing links and critical issues to be overcome.....27

4. Conclusions.....29

1. INTRODUCTION: GENERAL OBJECTIVES AND NEW CHALLENGES OF CLIMATE CHANGE

Coastal areas are border areas between land and sea where the impact of human activities interacts and adds to the natural dynamics in a complex, delicate and precarious balance between all visible anthropical objectives of an economic and social nature (tourism, urbanization, aquaculture, fishing, etc.) and again so by the limits imposed by the characteristics and evolution of the marine-coastal environment.

Due to **climate change**, storm surges will increase in number and intensity in the coming years, with **consequent negative impacts on coastlines**. The "Special Report on the Ocean and

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Cryosphere in a Changing Climate"[1] approved in September 2019 by IPCC (Intergovernmental Panel on Climate Change) states that: during the 20th century the global mean sea level rose by about 15 cm; **sea level is currently rising** more than twice as fast and will further accelerate reaching up to 1.10m in 2100 if emissions are not sharply reduced; **extreme sea level events** which now occur rarely during high tides and intense storms **will become more common** and many low-lying coastal cities and small islands will be exposed to risks of flooding and land loss annually by 2050, especially without strong adaptation.

Global warming and the progressive lowering of the territory due to subsidence, which in some areas of the Adriatic basin is constantly increasing, has led to a consequent rise in the average relative sea level, which contributes to and amplifies the **increase in the vulnerability of the coasts along the Adriatic-Ionian basin**. The coastal flooding phenomena is one such threat and comes as a result of storm surge (for exam-

Venice 2019

1. https://www.ipcc.ch/srocc/home/

ple high water in Venice) and meteo-tsunami (for example in Croatia).

Damage to structures and infrastructures due to intense weather and marine events and the alteration of the few remaining natural coastal environments have a direct impact on the lives of citizens, with significant repercussions on cultural, environmental, social and economic heritage.

Sea storms, storm surges and storm tides indeed have significant impact in many areas:

- Damage to the population and infrastructures
- Damage to cultural heritage
- Damage to the environment and ecosystems
- Damage to industry (aquaculture, fisheries, tourism)

These impacts may be further aggravated by a combination of short-lived and strong-intensity river floods which, finding difficulty in water outflow to the sea, can be a cause of further disruption to the areas along the coastal strip as well as to those areas behind it.

The I-STORMS project aims precisely to give an answer to these events in terms of **prevention** and **early warning**, and in

so doing provide citizens, civil protection and authorities with the tools to develop **appropriate management measures** to deal with territorial challenges connected to coastal flooding in the Adriatic-Ionian (ADRION) region.

I-STORMS intends to overcome the scarce sharing of information through the cataloging of sea storm events occurred, observed data, forecasts, prevention methodologies, alert procedures and emergency management among the countries bordering the Adriatic-Ionian basin, and so facilitating cooperation. The aim of the project is to **enhance transnational cooperation by sharing knowledge, data and forecasts** through a common infrastructure, as well as **joint strategies** to deal with sea storm emergencies, thus improving at the same time each countries' capacity in **interoperability among data, early warning and civil protection procedures**, in alignment with the EU Civil Protection Mechanism.

In the current context of climate change, the development of new and effective environmental policies that avoid reaching levels of no return is urgently required. Furthermore, and whilst awaiting specific counter-measures, it is necessary to implement **adaptation and prevention actions to counteract the coastal risks** of intense weather-marine phenomena, and so **building resilience paths** as quickly as possible.

The goal of the collaboration among the project partners is to **create synergies** to tackle phenomena common to the countries of the Adriatic-Ionian basin through the **exchange of tools, experiences and good practices**, as well as risk and emergency management. This is fundamental as, despite the vulnerability of a specific stretch of coast and its dependence on different variables being linked to the particular and intrinsic characteristics of the area considered, there are always common elements that allow for an **integrated approach** to be developed.

At international level many initiatives (e.g. UN Decade of Ocean Science for Sustainable Development 2021-2030[2], UN Global Ocean science report[3]) foster the cooperation among countries and the creation of comprehensive digital atlas and ocean observing systems, as well as the improvement of ocean-related multihazard
warning systems, capacity building, education, and ocean literacy efforts. These initiatives identify roadmaps that spur UN member states and others to implement adaptation strategies and policies, and catalyze investments in ocean science and support for sustainable development.

The I-STORMS Strategy addressed to **national/regional key players** of the **ADRION basin** aims at suggesting the most effective way to deal with **management of data and forecasts and related Early Warning procedures**. The strategy is based

2. United Nations Decade of Ocean Science for Sustainable Development
3. Global ocean science report: the current status of ocean science around the world

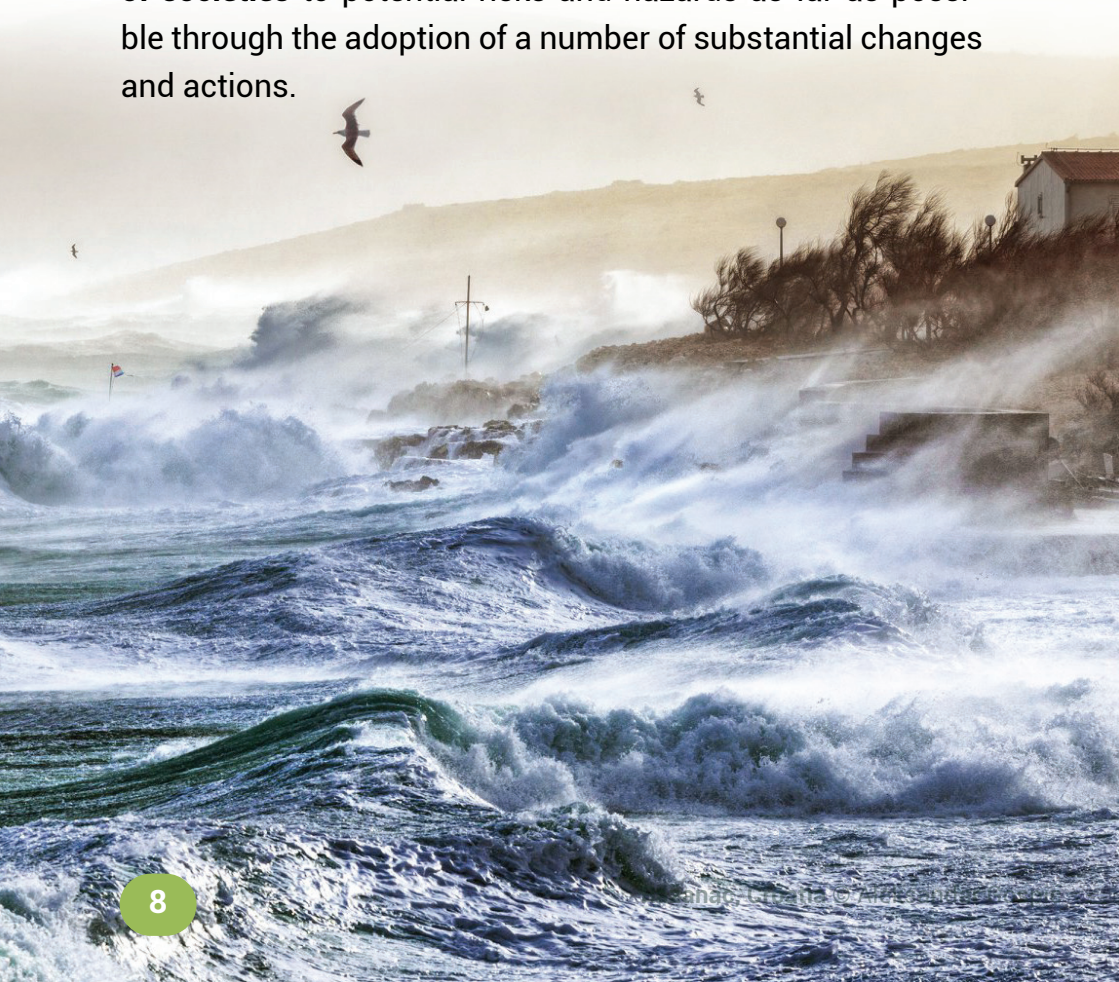
on the findings of the I-STORMS Guidelines and provides a link with the EU Civil Protection Mechanism and a consistency with the European legislative framework.

Climate change has created a new reality with more intense and destructive extreme weather conditions and the results are more catastrophic than ever. Hence, it is necessary that the cooperation mechanism be developed in order to be able to cope with the new challenges related to climate change effects. Current efforts shall be strengthened, while **new technologies will be used** in order for draft and implement effective strategies.

The **disaster management system** needs particular attention in the stage of 'Early Warning', in disaster prevention and in support of the decision-making processes at all levels of governance, so as to reduce the impact of possible disasters.

Furthermore, reduction in risks and in impacts can generate, amongst other factors, significant economic benefit to the countries due to it being less costly than reconstruction.

The level of prevention and preparedness reflects the degree to which a society is ready to face various disasters and hence, its level of resilience to a potential disaster. Therefore, it is of the utmost importance to **limit the vulnerability of societies** to potential risks and hazards as far as possible through the adoption of a number of substantial changes and actions.



2. THE RESPONSE: A STRATEGY FOR THE ADRION BASIN

Sea storms represent the main threat to coastal areas. In fact, they have a direct impact on the citizens' quality of life (especially in urban areas where sections of the inhabited areas are seldom inundated by water). Additionally, they cause damage to the important cultural heritage exposed to these phenomena and affect businesses as well (aquaculture, fisheries, tourism, beach facilities) as well as the environment at large (coastal erosion, floods). The potential future effects of global climate change emphasize the need for **strategies based on an anticipatory approach**, particularly in coastal areas at immediate and high risk.

Rising seas and greater storm surges could force hundreds of millions of people in coastal cities from their homes, with a total cost to coastal urban areas of more than $1 trillion annually by 2050[4].

Climate change is one of the greatest threats to humanity, with far-reaching and devastating impacts on the people, environment, and economy. Climate impacts affect all regions of the world and cut across all sectors of society.
Facing these new challenges of coastal risk, which directly involves a large number of people and infrastructures along the Adriatic-Ionian coasts, requires an **integrated approach between ADRION countries** but also **between the different**

4. https://cdn.gca.org/assets/2019-09/GlobalCommission_Report_FINAL.pdf

sectors that operate in each country in risk assessment and management.

Based on the findings of the Guidelines, I-STORMS Strategy takes into account the European context of risk assessment and flood risk management activities of the project partner regions, as well as the legislative references that represent the framework of the civil protection system. In particular, the EU Civil Protection Mechanism is considered the reference framework for cooperative emergency management across the EU, as well as in providing a joint approach that is more effective than separate national actions, and in reinforcing early warning tools encouraging the values necessary in promoting preparation, prevention and disaster resilience.

Regarding the specific risk of floods and sea storms, the Floods Directive (2007/60/EC) provides the common European framework for risk assessment and management and also contributes to the improvement of Early Warning Systems (EWS).

Early warning is a major element of Disaster Risk Reduction (DRR). It can prevent loss of life and reduce the economic and material impacts of hazardous events including disasters.
For this reason, the first objective of the strategy is to strengthen the Early Warning Systems beginning with the forecasting of models and the observing of networks, and continuing with the use of alert systems and intervention procedures in those cases of sea storms.

To be effective, Early Warning Systems need to actively involve the people and communities at risk from a range of hazards, whilst facilitating public education and the awareness of risks, disseminating messages and warnings efficiently and ensuring that there is a constant state of preparedness and that early action is enabled.

Early Warning will also contribute to sustainable development. The 2030 Agenda for Sustainable Development addresses Early Warning and gives it an important role across the Sustainable Development Goals, such as in food security, healthy lives, resilient cities, environmental management and climate change adaptation. The Paris Agreement stipulates Early Warning Systems as one of the major focus areas in enhancing adaptive capacity, strengthening resilience, reducing vulnerability and minimizing loss and damage associated with the adverse effects of climate change.

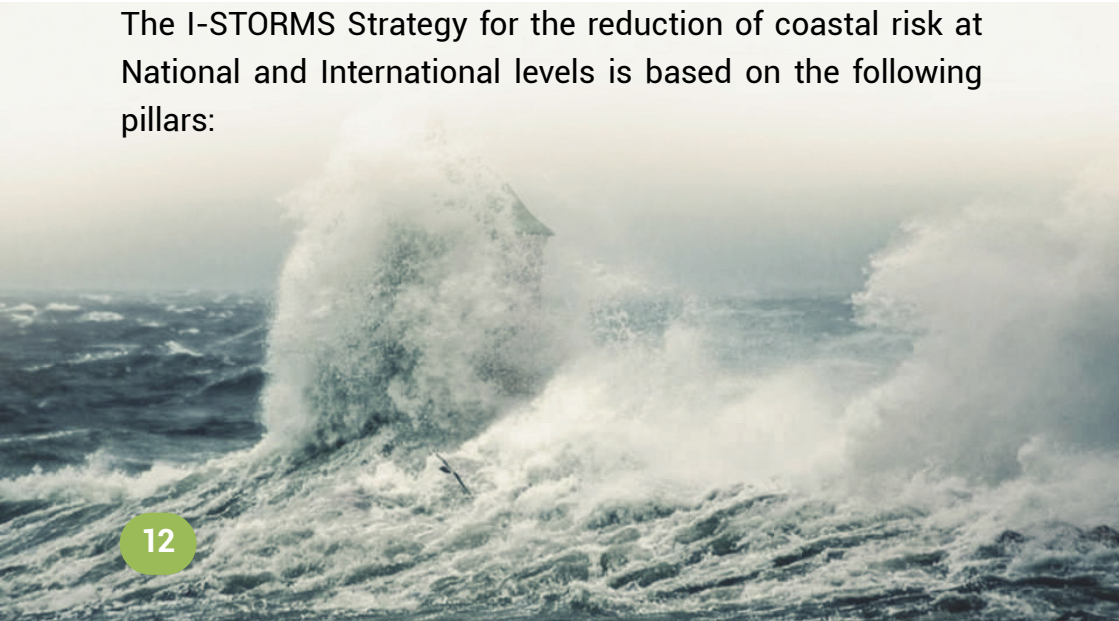
2.1 THE MAIN PRIORITIES AND THEMATIC PILLARS

An effective strategy to reduce the impacts of sea storms in the Adriatic-Ionian basin must work on two levels:

1. International level, which includes **transnational cooperation** for information and data exchange and integrated risk management

2. National level, which concerns the **development of legislation, plans and tools** for the managing of sea storms risk coordinated between the **state**, **regions** and **local authorities**. The partners must commit themselves to continuing the operation both at a trans- regional level, collaborating with the other ADRION countries, and in their own countries by regulating coastal risk management, something often not properly treated, and by building integrated governance systems.

The I-STORMS Strategy for the reduction of coastal risk at National and International levels is based on the following pillars:



Data & Information sharing for integrated tools

- Sharing of data, tools and information at all levels
- Rationalization, enhancement and re-use of tools already developed and financed to avoid duplication and loss of information

Cooperation & Coordination

- Construction of effective Governance structures, strengthening intra-regional and national coordination among stakeholders
- Creation of a permanent cooperation table, thematic networks and exchange of good practices

Communication & Stakeholder involvement

- Enhancement of communication through institutional channels, responding to users' information needs
- Reinforcement of stakeholder involvement in the management and communication of sea storm risk, in particular Civil Protection associations, schools, port authorities and all potential stakeholders in the tourism sector

Exercises & Volunteers

- Increase of exercises on coastal risk, that help to test the alerting and emergency management systems in a practical way
- Enhancement of volunteers which are a fundamental and important resource for event monitoring and emergency management everywhere

2.1.1 Data & Information sharing for integrated tools

To overcome the lack of integrated data and information, it is essential to establish **formats and tools** for collecting data, information, and damage reports that should be standardized and available before and during the events. Data sharing must be coordinated centrally and must cover all levels of the system (local, regional, national). It is essential to avoid the duplication of information and to create **standardized and integrated databases** (through data sharing and interoperable services) between the Adriatic-Ionian regions to expand on the analysis and comparison of coastal events at a basin level.

For effective Early Warning Systems in sea storms it is necessary to have online **weather, marine and coastal observation networks and share real time data** among those countries sharing coasts along the Adriatic-Ionian basin; also **available weather, marine and coastal forecasts** are required (also expressed in probability and forecast reliability) as well as high quality and reliable forecasts of sea level for citizens and protection services. Starting from these data and forecasts, early warning procedures should be based on thresholds that, in turn, must be connected with predefined risk scenarios. Risk scenarios must be modelled taking into account vulnerability and exposition of territories and cost/loss models.

As part of the I-STORMS project, the following **tools** were created with a view to allowing **the sharing of integrated data and forecasts** between the countries of the Adriatic-Ionian basin:

- The **I-STORMS Web Integrated System-IWS** is a shared and interoperable system allowing better exchange of information at basin level. In this way, available resources can be accessed simultaneously in an aggregated and standardized way.

- The **Open I-STORMS** is a dedicated web site (http://www.seastorms.eu/) to foster the data dissemination according to the community-based paradigm and to the Open Data principles allowing the public data, the forecast results and related statistics to be explored by non-experts over Internet through the use of shared maps, dashboards, graphics, tables and other interactive geo-visualization tools.

- The **Sea Storm Atlas** is an online tool for mapping data, forecast systems and current procedures for emergency responses to sea storm events as well as for gathering available information on coastal disasters caused by sea storms, in order to identify the most vulnerable areas to be focused on. The Atlas has developed a standardized way of collecting information on historical sea storm events.

RECOMMENDATIONS

It is very important to create **unified open-source interoperable and accessible databases** containing information and damage reports at every level (local-regional-national) in which all data converges and to ensure the maintenance of data flow (the supply and update of databases) and IT infrastructures, through the ordinary work of the institutions but also through the funding of other projects.

In order to avoid duplication and loss of information it is necessary to provide for the **rationalization, enhancement and re-use of tools already developed and financed.**

To feed the databases, as well as to develop and maintain forecasting and observation systems, it is essential to **guarantee the allocation of human resources** to these functions in every country and in every institution.

In each country, the bodies and services that provide data sharing must be identified and must also be recognized internationally. Where possible, an institution that coordinates the process should be identified.

2.1.2 Cooperation & Coordination

The I-STORMS project has been an opportunity for exchange and cooperation between partners and with network members and other stakeholders involved, and has represented an attempt to **coordinate data exchange in the ADRION basin**.

The work carried out within the project highlighted the need for effective Governance structures and for better coordination among stakeholders even at intra-regional and national level.

I-STORMS ensures cooperation even beyond the duration of the project through **a permanent discussion table** at the Adriatic-Ionian basin level to annually evaluate developments and tools in the coastal risk sector and to discuss and make available existing and new tools and implementations.

The cooperation table will also create the conditions for an effective, resource-sustainable cooperation in the ADRION area, thanks also to the collaborations activated through the I-STORMS network with other EU and Interreg projects and structures in the ADRION/EUSAIR area. The rules and functioning of the Permanent cooperation table will be agreed on by more than 50 participating institutions that will officially sign the Cooperation Agreement and it will be made available on the internet.

If in some countries alert systems on sea storms risk are already present which have been tested and effective, as well as procedures for risk management in the different phases, it is important that they be shared with all others as examples to refer to, always with a view to optimizing the EWSs and tools.

RECOMMENDATIONS

In order to continue addressing issues of interest in the area of coastal risk management, the **creation of thematic networks** at various levels is suggested in order to promote discussions and exchanges of good practice. All the results of the thematic work tables should converge in the permanent discussion table at ADRION basin level.

2.1.3 Communication & Stakeholder involvement

All ADRION partners have developed systems to disseminate general alerts to their populations in response to the specific hazards they face. Most of these systems follow nationally **standardized protocols** and use **redundant dissemination channels**, i.e. they combine sirens with TV spots or radio emissions. Several European Member States are testing new dissemination technologies such as cell-broadcasting. Issuing warnings is a competence of the national and/or local authorities. At European or international level, tools have been developed to exchange such warning information in case of transnational disaster risks.

One of the most dominant issues of the existing systems is the problematic communication witnessed between relevant public bodies and citizens. The **enhancement of communication through institutional channels**, and so responding to users' information needs, is an important step in increasing the effectiveness of warning systems and their results through the reduction of damage to people and property.

Public/Institutional bodies that issue the alerts must **increase public awareness** on forecasting and alerting systems and their associated uncertainty, strengthen their role as responsible for issuing alerts and communication. Institutional sources that are recognized and perceived as reliable, in particular those closest to local levels, should give all clear

and useful information to the citizens. These communication processes could be strengthened and improved by collecting feedback from the general public.

Information on these issues is essential and should start at **school level** with specific training.

Messages of alert to the public and **communication between all responsible players** belonging to the alert system must be, at the same time, **as quick as possible** (reaching the addressee in the fastest way and avoiding all bureaucratic and administrative obstacles) as well as being **"certified"** in order to have legal validity. Communication protocols have to be identified and used to satisfy these requirements.

The opportunity to **involve stakeholders** in the management and communication of sea storm risk is recognized as fundamental. In particular these include: Civil Protection associations, port authorities, beach manager cooperatives and other searelated activities, schools and all potential stakeholders in the tourism sector. Moreover, the involvement of stakeholders increases their awareness on specific risks.

Governments alone cannot address risk management. Every success story involves planning and implementation that gives importance to community or civil society involvement. Communities are a central player as they inhabit the territory,

whereas the involvement of practitioners and politicians is usually temporary. Engaged communities allow for priorities to be better defined and actions planned, responding to real (mostly local) needs and concerns and bringing about long-term change.

Good governance also entails improving accountability, **transparency and meaningful participation throughout the procedures and practices**. Negotiating, building consensus and reaching agreements comprise both formal and explicit mechanisms (legislation, policies, standards and administrative procedures) and informal and implicit agreements that mediate social, economic and political relations. In places where there is a proactive, responsive and accountable local government that works with local players, the possibilities of resilience are much higher.[5]

RECOMMENDATIONS

It is important to develop communication strategies coordinated between the different levels of governance (national, regional and local) and that take into account all the types of recipients to whom they are addressed.

Also, at international level it is essential that the communication codes and messages provided are coherent and standardized to allow for better understanding for those dealing with the different countries.

5. https://www.preventionweb.net/files/57399_57399localdrrandresiliencestrategie.pdf

2.1.4 Exercises & Volunteers

Timely and comprehensive warnings are only one element in an effective Early Warning System. Coastal communities have to be prepared through **appropriate education programs**. Even with near real-time warning systems, sea storm events and tsunamis require rapid reactions from potentially affected populations in order to prevent damage. It is therefore important that coastal communities be equipped with appropriate **emergency response plans**. These should include evacuation routes, regular drills and exercises to ensure that the population is aware of the risks and conduct themselves with the appropriate behavior. Appropriate educational programs may be integrated into school curricula and entertainment programs for guests and especially children in hotels.

Exercises on coastal risk are very useful since they help to test the alerting and emergency management system in a practical way.

Civil Protection volunteers are a fundamental and important resource for event monitoring and emergency management, hence they **must be supported, strengthened and enlarged**. Volunteers in general are an essential element of the civil protection systems, and without them the efficiency of the whole mechanism would be compromised.

RECOMMENDATIONS

It is fundamental to organize exercises on coastal risk on all occasions that provide funds for the improvement of EWS for sea storms.

In order to enhance monitoring and emergency management for sea storms, it is essential to promote legislation, procedures and mechanisms that extend the resources of civil protection volunteers.

2.2 CROSS-CUTTING ISSUES

In addition to the priorities and thematic pillars that are the focus of the I-STORMS Strategy, it is essential that work be conducted on other topics to ensure the effectiveness of the actions undertaken.

Specifically, it is key that activities be carried out in ADRION countries as well to act at both national and local level.

a. Promotion of national systems and directives in ADRION countries

Coastal risk, and in particular sea storms risk, has not been defined officially within national specific Directives in the same way as hydrogeological-hydraulic risks have been; and yet forecasts and responses to coastal events are different to continental storms and flood events, and so for this reason specialized and specific action plans for coastal areas are needed.

The risk management strategies and plans to reduce damage due to sea storms are issues that must be coordinated at a national level and managed at regional and local levels, because they contain locally-defined specific issues that must be studied in depth and addressed according to the various situations.

b. Enhancement of local plans and resilience strategy

Local strategies, while aligned with their national counterparts, are generally more specific. They reflect the local context and hazard profile and tend to concentrate on the planning and implementation phases, with clearly assigned roles and responsibilities at the subnational level.[6]

There is a shared understanding that governments alone cannot deal with Disaster Risk Reduction or any other complex development issue. All key players – from national to local governments, civil society organizations, academics, professional associations, the private sector, international donors and each and every citizen – have a role to play in the decision-making, planning and implementation process of DRR. With varying capacities and degrees of responsibility, they all need to engage in reducing disaster risks and contribute to building disaster resilience in their local areas. However, in order to do so, roles and responsibilities need to be clearly defined.

It is well recorded that those who do not have a voice and whose rights are not recognized are at a higher risk of death, injury and loss of property. Good disaster risk governance needs to promote participation and recognition to address the underlying risk drivers that result in differentiated disaster impacts according to age, ethnicity, religion, gender, labour conditions, land ownership, economic status and disabilities (physical, psychological and cognitive).

6. https://www.preventionweb.net/files/57399_57399localdrrandresiliencestrategie.pdf

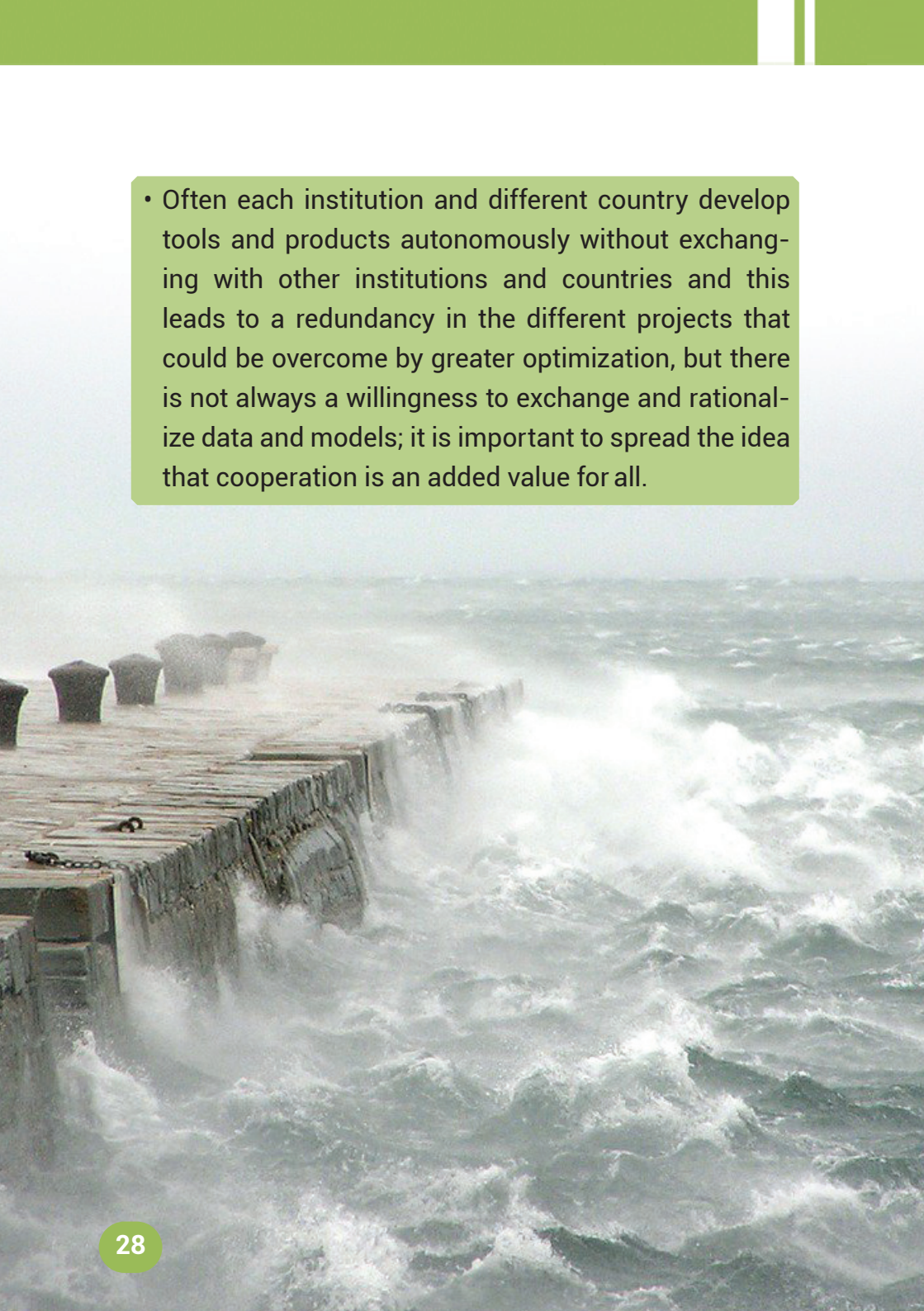
3. MISSING LINKS AND CRITICAL ISSUES TO BE OVERCOME

In the implementation of the strategy there could be difficulties that may concern technical, political and managerial aspects:

- The countries of the ADRION basin have a different scientific and technological level that could make it difficult to develop homogeneous and integrated tools, so it is important to make sure that the products developed meet the different requirements of the different countries involved (perhaps in a modular way) and are based on free and open source software.

- The partners of the ADRION basin must carry out the pillar activities both internally (at national and local level) and by collaborating with the outside (international level), but often it becomes difficult to carry out a complex process simultaneously; it is necessary to find governance structures that make this coordination possible.

- Often each institution and different country develop tools and products autonomously without exchanging with other institutions and countries and this leads to a redundancy in the different projects that could be overcome by greater optimization, but there is not always a willingness to exchange and rationalize data and models; it is important to spread the idea that cooperation is an added value for all.



4. CONCLUSIONS

The Sendai Framework for Disaster Risk Reduction 2015–2030[7] recognizes the benefits of multi-hazard early warning systems and enshrines them in one of its seven global targets. "In order to reduce disaster risk, there is a need to address existing challenges and prepare for future ones by focusing on monitoring, assessing and understanding disaster risks and sharing such information and on how it is created; strengthening disaster risk governance and coordination across relevant institutions and sectors and the full and meaningful participation of relevant stakeholders at appropriate levels".

Early warning will also contribute to sustainable development (the 2030 Agenda for Sustainable Development addresses early warning) and the Paris Agreement stipulates early warning systems as one of the major focus areas in enhancing adaptive capacity, strengthening resilience, reducing vulnerability and minimizing loss and damage associated with the adverse effects of climate change.

Without adequate warning systems and coordinated strategies, marine-coastal events, which are increasingly frequent and intense in the context of climate change, will cause major economic damage to an ever wider spectrum of coastal activities.

7. https://www.unisdr.org/we/coordinate/sendai-framework

Although the coasts of the ADRION basin are very exposed to storm events, Early Warning Systems are not widespread to deal with them and even civil protection procedures for managing the potential risk must be defined and improved. Sea storms coastal flooding emergency and response planning is a minor part of general "Flood emergency and response plans" and there is often no specific procedure for emergency responses to sea storms.

Facing new challenges of coastal risk, which involves a large number of people and infrastructures along the Adriatic-Ionian coasts, requires **an integrated approach between ADRION countries** but also between the different sectors that are involved in each country in risk assessment and management.

A strategic approach can help all ADRION countries in managing coastal risk through cooperation and the exchange of knowledge and good practices, working on two levels:

1. International level, which includes transnational cooperation for information and data exchange and integrated risk management

2. National level, which concerns the development of legislation, plans and tools for managing sea storms risk coordinated between the state, regions and local authorities.

I-STORMS Strategy for reducing coastal risk at a National and International level starts from **sharing data, tools and information at all levels** to meet the need for reliable forecasts, monitoring data and all the information useful in preventing and dealing with weather-marine phenomena. These data and forecasts, shared between the countries along the Adriatic-Ionian basin, must allow for the creation of **early warning procedures connected with predefined risk scenarios** taking into account vulnerability and exposition of territories and **cost/loss models**.

In addition to the integrated and interoperable databases, it is essential that those **human resources** that perform the activities required by the alert systems **are guaranteed.**

Currently Civil Protection **volunteers are a fundamental and important resource** for event monitoring and emergency management and without them the efficiency of the whole mechanism would be compromised. It is therefore important to promote **laws, procedures and mechanisms that strengthen those staff in charge and extend the resources of civil protection volunteers**.

Cooperation between ADRION partners are ensured even beyond the duration of the project through **a permanent co-operation table** at the Adriatic-Ionian basin level to evaluate annual developments and tools in the coastal risk sector and to discuss and make the existing and new tools available as well as their implementation. In order to strengthen intra-regional and national coordination among stakeholders it is important to build **effective Governance structures** and to create **thematic networks** for the **sharing of knowledge and good practices**.

Further still, **the enhancement of communication through institutional channels**, responding to users' information needs, is an important step in increasing the effectiveness of warning systems and their results in terms of reducing damage to people and property.

Institutional sources that are recognized and perceived as reliable, in particular those closest to local level, **should give all available and useful information clearly to citizens**. **Communication protocols** have to be identified and used to satisfy these requirements.

It is important to develop **communication strategies coordinated** between the different levels of governance (national, regional and local) and these must take into account all the types of recipients to whom they are addressed.

Also at international level it is essential that the communication codes and messages are coherent and standardized and so allowing for better understanding for those moving between the different countries.

Information on these issues is essential and should start from **schools** with specific **training**. Coastal communities have **to be prepared and this is possible through appropriate education programs**. Even with near real-time warning systems, sea storm events and tsunamis require rapid reactions from potentially affected populations in order to prevent damage. It is therefore important that **coastal communities be equipped with appropriate emergency response plans**.

Governments alone cannot address risk management. The opportunity to **involve stakeholders** in the management and communication of sea storm risk is recognized as fundamental, in particular Civil Protection associations, port authorities, beach manager cooperatives and other sea-related activities, schools and all potential stakeholders in the tourism sector. Engaged communities enable priorities to be better defined and actions planned, responding to real (mostly local) needs and concerns and bringing about long-term change.

Finally it is fundamental that **the alert systems and defined intervention models are tested** by the operators of the system, but also by stakeholders and coastal communities, in a practical way through **exercises** and so providing feedback on their effectiveness as well as critical issues encountered in order to improve the response to storm surge events.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