



## Deliverable DE.4

### Report on Policy and Business models for GI

Green infrastructures for disaster risk reduction protection: evidence,  
policy instruments and marketability (GREEN)

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## *Executive Summary*

The objectives of Work Package E are:

It is the central testing and demonstration facility for innovations in GI assessment, implementation and monitoring. The goal is to test and showcase beneficial effects of GI for DRR, CCA including wider benefits, to identify challenges and solutions for implementation and monitoring and to evaluate and improve the effectiveness of financing mechanisms. The cases allow for staged learning as they cover different development stages regarding current level of climate adaptation, present use of GI for DRR, hands-on experiences with applied solutions, policy measures taken or seriously considered, policy framework and private sector involvement in the implementation and maintenance of GI solutions.

Task E will include both past experiences in the case studies as well as results from testing innovative solution over the course of the project:

- Stock taking of achievements with respect to the three main innovation pillars
- Demonstrating and sharing within a large user community the whole range of innovations needed for large scale GI deployment
- Cross case learning and providing the basis for up-scaling and possible replication.

Case studies are rural and coastal cases, according to the task actions. Each case study partner will review existing monitoring schemes for GI solutions in the case studies. In particular, cases will assess how COPERNICUS services can be used to monitor GI in terms of managing risk and reduces future impacts from CC. This includes monitoring of physical indicators, socio-economic indicators as well as integrated indicators (e.g. risk assessments). To enable some case studies to act as examples for others to follow, a variety of GI solutions are offered at varying levels of maturity including: sand engines for natural elevation of beaches for storm protection; artificial beach nourishment for flood protection; dunes infiltration and aquifer management for artificial recharge and water purification, the use of (vegetated) foreshores for wave reduction. Among the partners involved different tools and methods for impact, risk and comparative assessment as well as monitoring are available from previous studies.

Description of deliverable DE.4:

In harmonization with deliverable DC5, this deliverable analyses the current policy processes with regard to GI, identify best practices and lessons learnt and formulate recommendations on how to improve stakeholder involvement in the decision making, implementation and monitoring processes. In addition, current policy framework for GI in the case study countries is analysed. Regulatory designs, economic and financial incentives, and business models are identified, which promote the implementation of favorable GI solutions.

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## **1 Introduction**

Policy framework and governance structures are necessary for widespread acceptance of GI.

GI solutions focus on opportunities and win-win solutions beyond limited problem perceptions and sector interests. This requires integrating alternatives across scales and sectors and time horizons, which raises complexity. This section deliverable aims to provide an overview of policy and business aspects of GI. The described policy and business aspects mainly include the following:

- Regulatory context,
- Knowledge context,
- Realization framework,
- Financing framework,
- Valuation framework.

The European Commission promotes the use and integration of GI in EU Member states through several policies. The adoption of GI strategies contributes to the successful achievement of the Environmental Impact Assessment (EIA) and into Strategic Environment Assessment (SEA) goals. Natura 2000 network is also a central part of the European green infrastructure. Most importantly the assessment of the value of GI in this case study will contribute to the implementation of the EU Green Infrastructure Strategy. The use and promotion of GI contributes to the EU Biodiversity Strategy aim to halt the loss of biodiversity and ecosystem services in the EU by 2020.

As an example, the importance of the protection against nitrate contamination is acknowledged by the European Union through the Nitrate Directive (1991). The Directive aims to protect water quality across Europe by promoting good farming practices as to prevent nitrates from agricultural sources to pollute ground and surface waters. Under the prescription of the Directive, member states design “Nitrate Vulnerable Zones” (NVZ).

In the Netherlands, the National policy for infrastructure and spatial planning was established by the Dutch Ministry of Infrastructure and the Environment (2011) emphasize the importance of having a good ecosystem and mentioned its components, such as green infrastructures, the benefits of ecosystem utilization, contributing to the livability and competitiveness of the nation. It is defined in this policy that the quality of the living environment is “a safe, healthy environment for both people and business requires good environmental quality, flood protection and reliable drinking water supply, protection of cultural heritage and unique natural values, and sites allocated to national defence”. This includes the priority actions for enhancing the environment, mitigate flood risks, strengthen water security, preserve the unique cultural heritage and natural values. Moreover, the wildlife habitats, flora and fauna preservation has undertaken international commitments in the form of the Biodiversity Convention and the European Birds and Habitats Directives (Natura 2000).

## **2 Policy and regulatory system**

The mapping of GI implementation enablers and constraints, or the identification of future trends requires policy documents. These policy documents may range from (adaptation-) policies and reports describing the economic sectors to reports on land use planning and GI efforts. Important examples of such documents are National Climate Change Adaptation Strategy and Action Plans, National Policy Strategy for Spatial Planning, or National Risk Analysis documents.

As a general rule GI alternatives should not only be appealing and effective, but also fit into existing policy and financial frameworks. In terms of policy regulations GI solutions usually meant to safeguard important values in society, for example, proprietary rights, biodiversity, human safety and so on. Therefore it is important to know how to scan regulations and deal with emerging regulatory barriers. This process includes the following steps:

1. General perspective on the structure of regulatory systems
2. Defining the role of perceptions of regulations in GI development processes.
3. Scanning of and dealing with regulatory barriers
4. Backward mapping from the required approvals and permits to provide a view on the legal procedures and assessments
5. Acquiring knowledge on how decision-making is framed with regard to authorities, procedures and applied standards
6. Make use of existing regulations, assess complexity and the challenges to be handled

### **2.1 Structure of regulatory systems**

Legislative and policy frameworks drive the juridical system of implementing GI solutions. In the context of applicable constitutional and administrative legislation, multiple primary and secondary legislations, informal regulations and sometimes case law can be relevant and need to be considered.

Regulations can be considered as the institutional materialisation of previous perspectives and discussions varying by sector and therefore fragmented. Coordination instruments should be applied to have some kind of cross-sector integration. The goal of GI principles, if effectively advocated, are to eventually influence the institutional context in which decision making takes place. GI designs are therefore confronted with a large number of regulations and standards at various levels.

There are certain factors that make scanning the regulatory context of GI solutions demanding:

1. Multi-level regulations apply to GI (local, regional, national, supra-national (e.g. EU wide)).
2. GI targets multiple interests, but primary and secondary regulations are often organized by specific sectors. Inter-sector coordination are often organized by procedural secondary regulations.
3. GI is relatively new concept, resulting in vague regulations
4. Conflicting and overlapping regulations exist
5. Plenty of gaps and unspecified regulations
6. Interpretation of regulations can be challenging
7. Static short-term perspectives often found in nature conservation regulations can contradict the dynamic long-term approach advocated by GI principles

It should be noted that policy and regulatory incentives can often be opportunities, not only barriers. In any case, some key points could be considered when facing regulatory barriers or opportunities:

- If current policy and regulations are barriers to GI implementation, potential lobbying could be done to have the current legislation revised according to GI principles. This is usually a long-term strategy and requires examples of successful GI solutions, as example cases, in the current regulatory setting.
- If current policy and regulations are opportunities, optimum use of these frameworks should be made, and a short-term strategy of working with the legislation in a pro-active manner has to be developed.

## 2.2 European policy framework

The European Green infrastructure Strategy recognized the need to incorporate GI into key policies, such as: (i) the EU Strategy on Adaptation to Climate Change; (ii) upgrading of the Natura 2000 Network, established under the Habitats and Birds Directives and 2020 Biodiversity Strategy (EC Communication, 2010); (iii) the EU Forests Strategy; (iv) the Common Agricultural Policy objectives; or (v) water-related policies such as Water Framework Directive or Floods Directive, among others.

On the other hand, the EU policy making process is well known for not imposing radical changes. EU policies and decision making (including Natura 2000) are usually gradually and incrementally developing in a slow pace. Initiating innovative plans and significant departures from the *status quo* cannot be expected especially as these have to be accepted by all member states without being.

The European Environmental Agency issued several comprehensive reports regarding green infrastructure. These EEA reports are the following, in descending chronological order:

- EEA 2017 - Green infrastructure and flood management
- EEA 2015 - Exploring nature-based solutions
- EEA 2014 - Spatial analysis of green infrastructure in Europe
- EEA 2011 - Green infrastructure and territorial cohesion

According to (EEA, 2015), many EU countries have prepared and included national guidance documents and/or strategies in their national plans to actively encourage investments in GI as an essential part of sustainable spatial planning. The following six strategies and programmes can be found in the EU policy domains:

1. Seventh ENvironment Action Programme (7EAP);
2. EU Biodiversity Strategy;
3. 2013 European Commission Strategy of Green Infrastructure;
4. Water Framework Directive, Nitrates Directive and the Floods Directive;
5. EU Strategy on Adaptation on Climate Change;
6. Regional Policy 2014-2020.

It was also noted that an integral part of the EU policy on disaster risk management are GI measures that boost disaster resilience. Green infrastructure development can contribute to make disaster-prone areas less vulnerable to extreme weather events and natural disasters such as floods, storms and wave surges that cause loss of life and result in billions of euros of damage and insurance costs each year in the EU.

Moreover, (EEA, 2015) states that there are several policy examples that can be supported by the defining and implementing a European wide GI network:

- integration of GI into the EU Forest Strategy;
- development and implementation of all targets of the Biodiversity Strategy;
- reporting under different directives, such as the Habitats Directive or the Water Framework Directive;
- promotion of soil protection and climate change mitigation;
- promotion of GI as inter-territorial tool;
- use of GI for integrated spatial planning;
- use of GI for ecosystem-based disaster risk reduction;
- contribution to current discussions on options for territorial cohesion policy after 2014, and later discussions on measuring Member States' performance;
- promotion of the EU-wide policy framework to deliver sustainable development fostered in EC communications from 2001 and 2005.

The EEA has also identified the types of mechanisms that could be used to integrate green infrastructure into other policies (EEA, 2011/18). The mechanisms include:

- existing or new European and national environmental legislation;
- existing or new European and national legislation on green infrastructure;
- European and Member State guidance/ management plans on green infrastructure;
- direct support through targeted European funding and non-EU funding;
- indirect support through European funding in other sector areas (e.g. agriculture);
- national and regional green infrastructural strategies;
- spatial planning and building control;
- strengthening the use of assessment, e.g. Impact Assessment, the SEA and EIA;
- communication and capacity building.

(EEA, 2011/18) also found key opportunities for the wide spread social acceptance of green infrastructure:

- promoting the concept of green infrastructure to support both environmental policy goals and certain non-environmental policy goals,
- seeking opportunities to mainstream green infrastructure into other policies to realise the potential synergies;
- linking green infrastructure to ecosystem services
- encouraging the use of existing legislation to promote green infrastructure (e.g. the White Paper Adapting to Climate Change, the Habitats and Birds Directives, the Water Framework Directive, the Floods Directive, the Marine Strategy Framework Directive, and the EIA and SEA directives);
- emphasising the role of spatial planning in facilitating and delivering green infrastructure,
- use of European and national legislation, guidance/management plans, direct and indirect European funding and non-EU funding, national and regional green infrastructural strategies, building control, strengthening the use of assessment and communication,
- capacity building.

**Birds and Habitats Directives: barrier or opportunity?**

The application of the EU Environmental Directives by the member states, regional authorities and project developers has not always been successful. In particular, the Birds and Habitats Directives have created many negative feelings when they were called upon in national courts. Due to the Birds and Habitats Directives several projects were delayed or cancelled. For this reason, in many cases the Birds and Habitats Directives is perceived as a barrier for GI implementation in the EU.

On the other hand, the Birds and Habitats Directives can also be considered as opportunity for GI solutions as outside protected areas GI implementation is more difficult to realize, as there is no necessity to take the ecological system into account as much as in protected habitat areas. In cases where funding for ecological project-components is limited, environmental regulations could serve to 'push' for a GI solution as a means to adhere to environmental obligations (e.g. the goals of Natura 2000).

Moreover, initial lack of attention, knowledge and awareness of the requirements of the Birds and Habitats Directives has been overcome as practical experience and case law increased. Recent guidance documents published by the European Commission encourage GI development in estuaries and coastal zones, port development and inland navigation and existing GI pilot projects show that these type developments are possible within the existing regulatory framework.

**GI and Marine Strategy Framework Directive**

It has been proven now, that the pressure on natural marine resources and the demand for marine ecological service are often too high (The European Commission, 2008). That is why the Marine Strategy Framework Directive (MSFD), was established in 2008 by the European Commission, as a framework for community action in the field of marine environmental policy and an effort to reduce the impact on marine ecosystem regardless of where their effects occur. Moreover, the framework proposes that the state members of the European Union must take actions quickly and set a goal to achieve a good quality of marine waters by 2020. The quality of marine waters can be described by the Good Environmental Status (GES), which is defined in Article 3, the MSFD, as "the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive" (The European Commission, 2008).

Each of the GES descriptors helps to orientate for preserving the elements of the ecosystem at the state that constitute a healthy and productive environment. This process is facilitated by GI implementation. One aspect required in order to achieve a productive ecosystem is having abundant and balanced fundamental food sources in the system. Therefore, it is important to maintain a natural harmony between the species population and nutrient availability in the ecosystem. This target is well addressed throughout eleven descriptors of GES. For example, for keeping the population of under-populated species maintained as in current state or being improved is mentioned in Descriptor 3. The abundance of the food source is mentioned in Descriptor 4: Elements of food webs ensure long-term abundance and reproduction. The effort to manage the overgrowth of the population of species is mentioned in Descriptor 2, regarding non-indigenous species, or of what could even cause pollution as in Descriptor 5: Eutrophication is minimized. By

studying these descriptors and the corresponding measures, an ecosystem which is healthy and rich in biodiversity will be closer to achieving.

### 2.3 GI related policy framework in the Wadden Sea

This section provides an overview of relevant policies in the Wadden Sea area that should be considered when developing GI solutions. There has been quite many legislation and protection programme operating for reducing anthropogenic causes nutrients to the area of from the neighboring rivers, such as the International Commission for the Protection of the Rhine, the Birds Directive, the Habitats Directive (Natura 2000) and the Water Framework Directive. The management measures have shown good effect on reducing some nutrients sources, especially phosphorus and nitrate, and the eutrophication has been improving.

As a cross-boundary property, the Wadden Sea protection is the common concern of the trilateral conservation policy and management between Denmark, Germany and the Netherland (Reise et al., 2010). Due to the vulnerability of the ecosystem, the sea is under strict protection. The essential principle is that "unreasonable impairments of the interests of the local population and of traditional human uses of the Wadden Sea Area have to be avoided" (Trilateral Cooperation on the Protection of the Wadden Sea (TCWS)). For common management objective, there are six types of habitat identified in the Wadden Sea as well as in the Dutch Wadden Sea: the offshore zone, the beaches and dunes, the tidal area, the salt marshes, the estuaries and the rural area. Each of those habitats needs a different level of quality and can be achieved by proper management of the area. (Marencic and de Vlas, 2009)

Important policy documents and initiatives were defined by stakeholders during the GREEN Stakeholder interviews and questionnaires. The table below shows the most important policy documents and/or policy initiatives that take into account the risk of climate change for the Wadden Sea area.

Table 1. Policy documents/initiatives taking into account the risk of climate change for the Wadden Sea area, based on input from stakeholders

<b>Policy documents/initiatives taking into account the risk of climate change for the Wadden Sea area (stakeholder input)</b>
<b>Deltares sea level rise reports</b>
<b>Delta Commission policy documents</b> The Delta Commission, a special government committee, is in charge of the Delta Programme, which is in place to protect the Netherlands from flooding and to ensure a sufficient supply of fresh water.
<b>Natura2000</b> Natura 2000 is a network of nature protection areas in the European Union, made up of Special Areas of Conservation and Special Protection Areas.
<b>Dutch National Coastal protection policy</b>
<b>Intergovernmental Panel on Climate Change reports/scenarios</b> IPCC is an intergovernmental body of the United Nations, dedicated to providing an objective, scientific view of climate change, and its impacts (natural, political and economic), risks, and possible response options.
<b>Royal Netherlands Meteorological Institute (KNMI) reports/scenarios</b> KNMI is responsible for weather forecasting, climate change monitoring, and

monitoring seismic activity.

**Dutch Nationaal Waterplan**

Government plan for water policy in the Netherlands.

**Structuurvisie Infrastructuur en Ruimte**

The national government outlines ambitions of the spatial and mobility policy for the Netherlands in 2040.

**Delta programme (Waddengebied)**

Preferential Strategy regarding flood protection of the Wadden Region by the Dutch Delta Commission.

**Provincial plans**

**Waddensea Plan 2010**

Common framework for the protection and sustainable management of the Wadden Sea as an ecological entity. It is prepared by the Common Wadden Sea Secretariat.

**EU Habitat & Bird directives**

These directives are built around two pillars: the Natura 2000 Network of protected sites and the strict system of species protection.

**Water Framework Directive**

EU directive which commits European Union member states to achieve good qualitative and quantitative status of all water bodies.

**Beheerplan rijkswateren**

Management and Development Plan for the National Waters by the Directorate - General for Public Works and Water Management.

**Integral management plans**

(e.g. Eems Dollard)

**No clear policy on this point yet, only studies**

According to the stakeholder most policies are for shorter terms and aim to maintain present values instead of anticipating on future developments and threats.

The stakeholders were also questioned on the most important policy objectives of their organization, or related to their organization, that could be affected by climate change effects (see table below). It can be seen that many GI related policy objectives are influenced by climate change:

- Conservation and Habitats for birds
- Water safety
- Restore natural processes on landscape level (natural sedimentation and societal non-risky erosion)
- Coastal defence (sand nourishment)
- Biodiversity preservation (ecology) (sea level rise and higher temperatures of both water and air)
- Limiting human impacts (fishery, N-deposition, growing pressure of tourism)

Table 2. policy objectives of the interviewed stakeholders that could be affected by climate change effects

**Most important policy objectives of the interviewed stakeholders that could be affected by climate change effects**

Conservation

Habitats for birds

Water safety

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Restore natural processes on landscape level (natural sedimentation and societal non-risky erosion)
Coastal defence (sand nourishment)
Dredging
Biodiversity preservation (ecology) (sea level rise and higher temperatures of both water and air)
Data provision (high quality data, information and knowledge on the Wadden Sea Region)
Limiting human impacts (fishery, N-deposition, growing pressure of tourism)

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### **2.3.1 Barriers to GI implementation in the Wadden Sea**

According to the questioned stakeholders the main barriers to implement GI measures in in the Wadden Sea are the following:

- wrong planning,
- lack of knowledge base,
- institutional and regulatory barriers,
- lack of long term strategy,
- lack of local support,
- finance

Therefore, institutional and regulatory barriers are only one of the many other barriers. During an interview Natura 2000 (which should be in the core of EU GI strategy) was also named as a barrier as current nature conservation strategy does not allow introducing “new” nature. Another named barrier was inadequate planning of GI measures. An example for this was a sand nourishment solution implemented in a predominantly muddy environment, which does not respect building with nature principles. The full list of barriers is listed in the table below.

Table 3. Barriers to GI implementation in the Wadden Sea

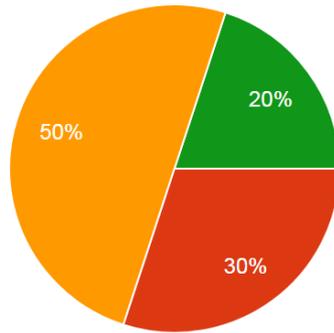
<b>Main barriers to the implementation of green infrastructure in the Wadden Sea area</b>
Projects are not planned at the right location (effective solutions have to be planned at the right site)
Lack of necessity
Knowledge base on usefulness for ecological values
Very complex policy structures on all levels
Institutional barriers (complexity of governants/organizations)
Too rigid nature protection regulations (e.g. Natura200 - reference situation cannot be changed)
Local support
Finance
Lack of ecosystem based long term strategy
Nature is often seen as an obstacle for economic development
Regulation of flood protections system (strong requirements)

Some of the above mentioned barriers were further investigated and stakeholders were questioned on how important are the following elements for the implementation of green infrastructure measures among the user community. While all listed elements were considered important, clear

regulations and accountability, as well as community experience, were the two most important enablers for GI implementation, according to the stakeholders (see figure 1).

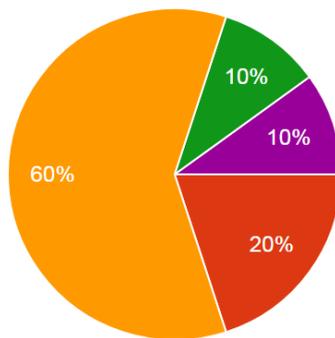
Apart from the enabler factors, stakeholders were also questioned on how important are elements in limiting the implementation of green infrastructures among the user community. The responses suggest that lack of government staff and capacity is not seen as a main limiting factor, in contrast with the conflicting codes and ordinances, which are connected to policy framework, and which was labelled as a very important limiting factor (see figure 2).

**Economic incentives**



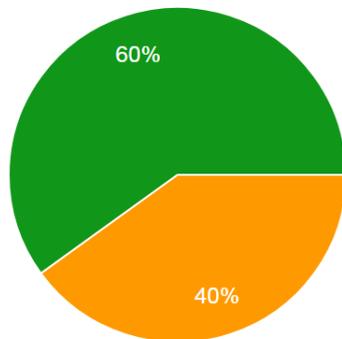
- Not important
- Somewhat important
- Important
- Very important
- Essential

**Education**



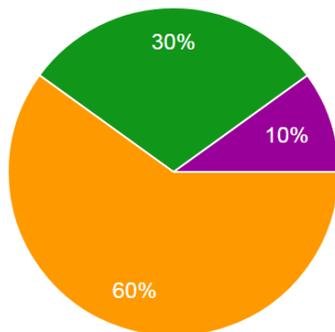
- Not important
- Somewhat important
- Important
- Very important
- Essential

**Community experience**



- Not important
- Somewhat important
- Important
- Very important
- Essential

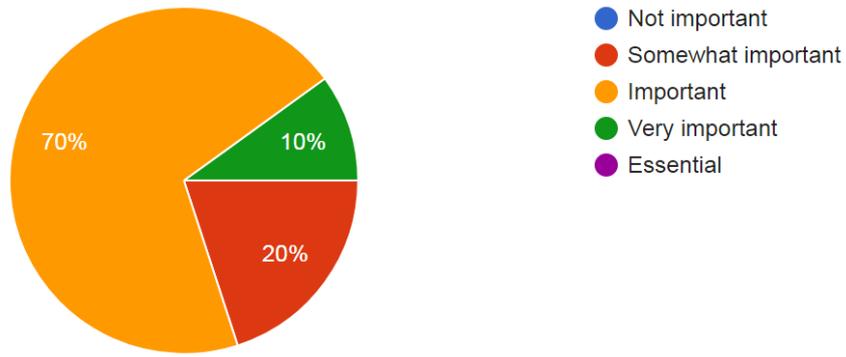
**Clear regulations and accountability**



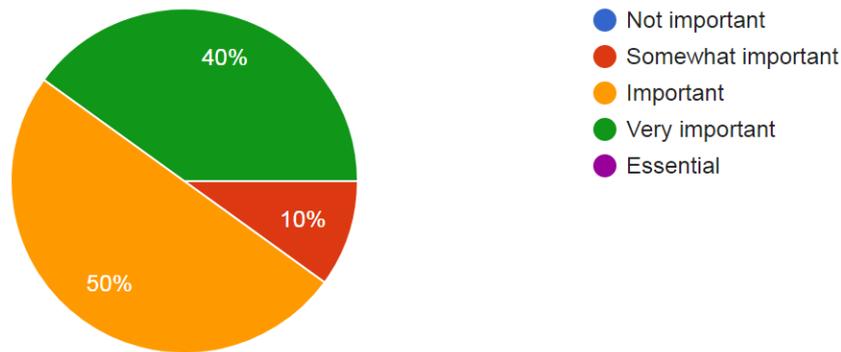
- Not important
- Somewhat important
- Important
- Very important
- Essential

Figure 1. Elements enabling the implementation of green infrastructure

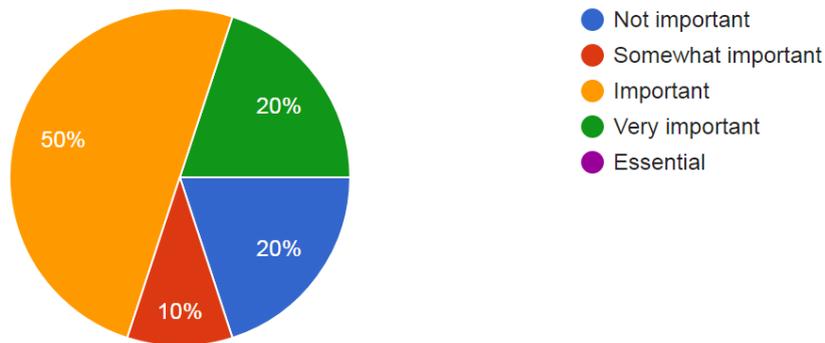
**Lack of knowledge regarding maintenance requirements and cost**



**Conflicting codes and ordinances**



**Lack of government staff capacity and resources**



**Scepticism about long-term performance**

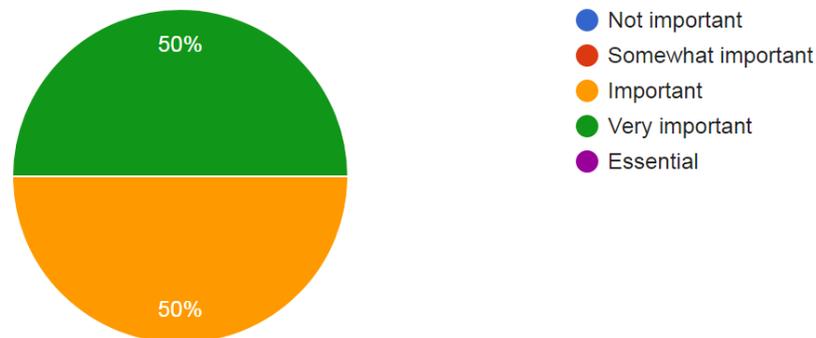


Figure 2. Elements limiting the implementation of green infrastructure

### 3 Business models for GI

The basic economic rationale of green infrastructure is that given the spatial scale (house, neighbourhood, city, region, country) and time horizon (the value of costs and benefits varies over time), the green adaptation measures should achieve a lower hazard risk (expected damage/losses) through either reduction in exposure or reduction in vulnerability. Moreover, the costs of achieving the reduction need to be lower than the benefits.

In line with this basic economic rationale the following main financial determinants should be considered:

#### Value



- What kind of value is being generated? (Economic, social, environmental)
- Who are the main beneficiaries?
- Does the value being generated justify an investment?

#### Return



- What kind of goods are produced?
- What kind of income can be generated?
- Which financing mechanism fits the type of return?

#### Risk



- Financial risk, environmental risk
- What is needed to mitigate risks and enable investment?

By optimizing these financial determinants one can draw up sustainable business models for GI solutions.

#### 3.1 Financing framework for water security approach

Possible financial and institutional arrangements for implementing the identified GI measures for the selected case studies can be identified by applying the Financing Framework for Water Security (Altamirano, 2017). This framework is a decision Support tool for local governments to find an implementation arrangement choosing from a wide range of project delivery and finance options that vary from purely public governance options up to the creation of markets for private initiatives.



The financing framework for water security approach takes several features into account:

- **transaction** (e.g. type of good & measure; project characteristics: financial and technical),
- **level of service** required over time,
- **institutional setting** (linked to Section 2): stakeholders, strengths of local government, private sector and community and the incentives created by formal and informal institutions.

For the governance and financing of a GI project, and securing its financial sustainability, it is important to link the above features to (i) distribution of costs and benefits over time, space and actors, (ii) distribution of risks over time, space and actors, in relation to the expected value to be generated; (iii) shortlist the most effective implementation arrangements (funding, financing,

procurement); and (iv) ensure the financial and institutional sustainability of the service being introduced by the solution or measure that is being implemented.

The approach starts with an overview of potential funding sources for DRR in the case study regions, taking into account:

- **Climate Finance instruments** (Climate Funds –for Climate adaptation projects, Payments for Watershed Services, Water funds),
- **Public Finance:** National Public Investment System, Disaster Risk Management – within SNIP procedures, EU Funds and Disaster Risk Financing strategy (part of DRR strategy)
- **Private Finance:** PPP and private initiative modalities – Private financing of Infrastructure, Capital Markets & Project Finance. Such as Innovative SDG’s financing instruments for water, e.g. Water Funds (Latin America) and Payment for Ecosystem Services schemes.



Secondly, the available sources would be linked to potential business models such as:

- Emission of water and climate bonds to finance development of resilient natural infrastructure;
- Creation of a Water Credits market where natural infrastructure act as water bank for groundwater and runoff filtration (insurance of water quality and quantity –through groundwater recharge);
- Natural resource banking;
- Payment for Ecosystem Services (PES) and Payment for Adaptation Services (PAS).

Thirdly, the business model and financing source can be combined in a possible financing arrangement. Particular attention can be paid to blending different financing sources. This can also include: structuring and financing of green adaptation projects, risk matrices and risk allocation, social community-based business models, expected ‘cash profile”, institutional and tax arrangements for revenue collection and innovative project finance arrangements for green climate adaptation, as well as insurance and re-insurance industry models for ecosystem services.

In funding strategies the main objective is that the financing gap is decreased by raising tariffs, taxes, and by other transfers, as illustrated in the figure below.

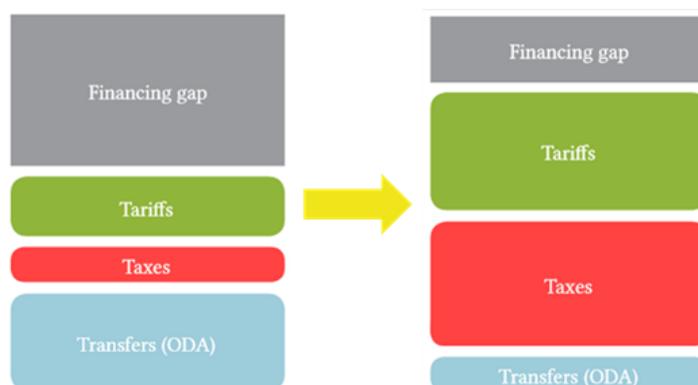


Figure 3. Changing financial strategies to close the financing gap. Source: (Altamirano, 2017)

Appropriate financing mechanisms should be identified in form of tax swaps, institutional investors, bonds financing, concessional loans, capital markets, project finance (PPP's), and others. The financing mechanisms can be grouped as grants, loans, equity, guarantee, see figure below.

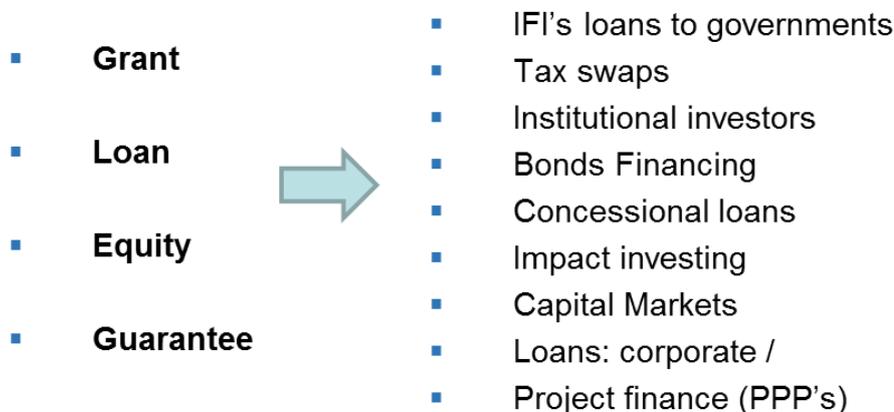


Figure 4. Financial mechanisms

The financing framework for water security approach in practice links environmental effects with economic and social variables for **risk estimation**. It **values effects** correctly based on social, economic and ecological values and links risk mitigation and the distribution of benefits to the appropriate financing and funding structure.

Example financing mechanisms:

- *Storm barrier* is a measure for the public good and has a lot of beneficiaries and therefore **public funding, tax scheme** is appropriate.
- *Irrigation scheme* benefiting several agricultural businesses: **tariffs based on additional revenue** is appropriate
- *Water treatment plant* that benefits businesses, people and the environment: **PPP, tax scheme** is appropriate
- *Private investment* that is uncertain to be profitable due to hydrological risks but also benefits public: **public guarantee, insurance, subsidies are appropriate**

**Bankability**

It should be noted that the above mentioned economic rationale often does not translate into the bankability of GI projects. This is due to the fact that climate adaptation projects are:

- Capital-intensive;
- Unique;
- Have delayed & dispersed benefits;
- Isolation of benefits is difficult (free-rider issues)
- Non-guaranteed and non-cash benefits;
- There is limited autonomous earning power;
- Have high risk profile

Other intrinsic characteristics of green infrastructure projects that make them less financially attractive (World Bank, 2012) are:

- Elevated perceived risks
- Capital market and information gaps - “newness” of technology & perception of excessive risk
- Risk-reward profile of green infrastructure not financially attractive (absolute or in comparison)

### **3.2 GI Valuation**

In order to provide evidence of the potentiality of GI projects both economic and non-economic valuation, is indispensable. In certain cases GI designs might be cheaper or more durable due to the fact that they make use of natural dynamics or materials. In other cases GI solutions are more expensive, however, they can be favourable as they yield added values (co-benefits). Therefore it is crucial to consider the possible co-benefits of GI projects. In traditional projects for grey infrastructure alternatives are chosen first and subsequently their effects. In GI projects the process is the opposite. Based on valuation, potential benefits and co-benefits are quantified for the different system components and for the system as a whole. Finally, after comparative assessment of solutions, alternatives can be identified (see Deliverable DE3).

Valuating nature aspects can be done through the assessment of policy alternatives by awarding points to areas of nature, depending on the quality of the nature area. Such nature valuation tool helps in valuating non-financial benefits of nature in order to include them in a Socio-economic Cost Benefit Analysis (SCBA), as explained below.

#### **Socio-economic Cost Benefit analysis (SCBA) for GI Valuation**

With a Socio-economic Cost Benefit analysis (SCBA) the balance between costs (investment, maintenance, etc.) and benefits (primary and co-benefits) can be determined. The SCBA tool does not only include direct costs and benefits but also indirect public goods such as nature benefits, public health and recreation aspects. A SCBA gives evidence and motivation to initiate GI projects when the GI benefits (and co-benefits) for society exceed the GI costs. Often improved ecosystem services are only mentioned as unquantified side benefits in SCBA as pricing ecosystem services is challenging. However, pricing ecosystem services can be done by Contingent Valuation. Contingent valuation is a survey-based economic technique for the valuation of non-market resources, such as environmental conservation or the impact of pollution events. In this methodology the willingness to pay is determined based on hypothetical market mechanisms.

#### **Nature valuation**

In short, the economic value of ecosystems is defined as the amount of welfare (both material, e.g. resources, and immaterial, e.g. aesthetic or cultural) that nature generates for society. This implies that the economic value of nature is larger than the direct cash flows (financial value) derived from nature benefits, e.g. expenditures in restaurants in recreation areas. Such financial value (or cash flow) can be quite limited for non-exploited pristine nature areas, while the economic value also comprises other types of ecosystem services such as contribution to clean water, carbon sequestration, coastal protection, recreation, among others. The definition of welfare definition implies that the economic value is an anthropocentric measurement (benefits to human societies

through use and non-use of goods and services), similarly economic value results strictly in human welfare. This definition does not capture other intrinsic values, such as welfare for other organisms, plants and animals (Nieuwkamer, 2008).

In order to fully capture the value of GI measures, all values of nature should be considered: the economic, the financial and the intrinsic value of ecosystems (see figure below). Contrary to the intrinsic value, the economic value of ecosystems can be more easily expressed in monetary terms and quantified by means of economic valuation techniques, after which it can be included in socio-economic cost benefit analyses.

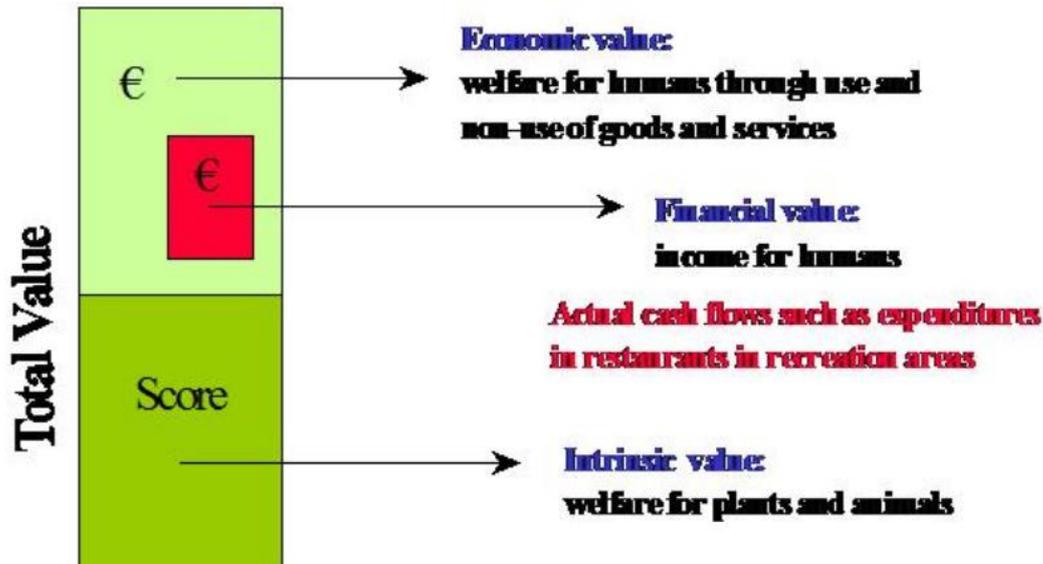


Figure 5. Economic, financial, and intrinsic values of nature (source: Ruijgrok et.al., 2004)

### **Economic and financial value of tourism in the Wadden Sea**

One important feature of GI solutions is the aesthetic value which can be monetarized by studying the value of tourism and monetary benefits.

The Wadden Sea World Heritage Destination is one of the most popular tourism destinations in Northern Europe, and tourism is a major economic pillar for this rural region. While foreign tourists account for almost 70 % of all overnights in the Danish Wadden Sea region, they account for less than 4 % in the German Wadden Sea region and about 20 % in the Dutch region. Due to different administrative regulations and laws in the three neighbouring countries, transnational statistics on tourism lack a common, uniform data basis, although Eurostat has developed methodological guidelines.

Overall, the Destination recorded almost 53 million overnight stays in 2013, of which 24 million in the Dutch, 23 million in the German, and 6.2 million in the Danish regions. However, when including overnight stays in smaller accommodation establishment and private accommodation, the volume could be considerably higher. Domestic tourists account for the bulk of the overnight stays, particularly in the German region (95 %), and the Dutch region (80 %). Only in the Danish region do foreign tourists account for the majority of overnight stays with 68.5 %. The average length of stay varies between 4 and 5.5 days in the German and Dutch regions and is not measured in Denmark.

More than nine million visitor arrivals are recorded in the Wadden Sea Region, generating more than 53 million overnight stays. Further, sporadic information about the number of day visitors indicates that the region generates some 40-60 million day visits.

The total tourism revenue in the Wadden Sea World Heritage Destination is estimated at EUR 6.7 billion, of which EUR 3.9 billion (58 %) in the German region, EUR 2.2 billion (32.5 %) in the Dutch region and EUR 640 million (10%) in the Danish region. Average daily spending varied between EUR 75 in the Danish region, EUR 87-96 in the German regions and EUR 40-100 in the Dutch region. The economic importance of tourism for the overall World Heritage Destination and the three individual regions has steadily increased since the QSR 2004 and QSR 2009, and is now estimated at EUR 6.7 billion, an increase of 17% since the QSR 2009. Tourism supports about 58,000 full-time jobs, corresponding to 6.3 % of the Region's total employment, the Dutch region accounting for 66 %, the German region for 25 % and the Danish region for about 9 % of the total. The World Heritage status of the Wadden Sea has the potential for affecting tourism development in the Region positively in respect of increasing visitor numbers and tourism revenue.

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