Chapter 9
Closing the Implementation Gap of NBS for Water Security: Developing an Implementation Strategy for Natural Assurance Schemes

Mónica A. Altamirano, Hugo de Rijke, Begoña Arellano, Florentina Nanu, Marice Angulo, Camilo Benítez Ávila, Kieran Dartée, Karina Peña, Beatriz Mayor, Polona Pengal, and Albert Scrieciu

9.1 Introduction and Conceptual Frame

Evidence recorded over the last decade indicates that we are about to reach or have already reached a tipping point related to climate change. The Global Commission on Adaptation (GCA) (2019) report stated: "Climate change is one of the greatest threats facing humanity, with far-reaching and devastating impacts on people, the environment and the economy". The frequency of extreme events keeps increasing. In terms of overall losses, 2017 was the second-costliest year ever for natural disasters. Overall losses in 2017 (US$ 330 bn) were far greater even than those in the extreme years of 2005 and 2008. Only in 2011 higher loss figs. (US$ 350bn) have been recorded and they were related to the Tohoku earthquake and floods in Thailand. The share of insured losses (US$ 135 bn) is the highest figure in the period from 1980 to 2017.

M. A. Altamirano (✉)
Deltares, Delft, The Netherlands

Faculty of Technology, Policy and Management, Delft University of Technology, Delft, The Netherlands
e-mail: monica.altamirano.dejong@gmail.com

H. de Rijke · B. Arellano · F. Nanu · M. Angulo · C. Benítez Ávila
Deltares, Delft, The Netherlands

K. Dartée · K. Peña
Field Factors, Rotterdam, The Netherlands

B. Mayor
Icatalist, Madrid, Spain

P. Pengal
Institute for Ichthyological and Ecological Research (REVIVO), Dob, Slovenia

A. Scrieciu
REVIVO, Institute for Ichthyological and Ecological Research, Ljubljana, Slovenia

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Munich Re NatCatSERVICE recorded 710 relevant loss events, which is above the average of 605 events per year of the last decade and much higher than the average of 490 events over the last 30 years (Munich Re 2018). According to the GCA, rising seas and greater storm surges could force hundreds of millions of people in coastal cities from their homes and generate losses of more than USD 1 trillion yearly by 2050 in coastal urban areas. Meanwhile, a 2016 World Bank report indicates that the impacts of Climate Change will be channelled primarily through the water cycle and that water scarcity could cost some regions up to 6% of their GDP.

In the context of a climate and water crisis, and intensified by the Covid19 crisis awareness about the need to rethink our economic development paradigm has increased. Against this context the potential of Ecosystems and Nature-based Solutions (NbS) as important pieces of a new regenerative economic model and as important allies to mitigate water risks is being more and more recognised.

This approach is understood as the enriching of the traditional infrastructure planning process with green and hybrid (green and grey) solutions along with traditional grey infrastructure. Green infrastructure is defined by the World Bank (2019) as a subset of nature-based solutions (NbS) that intently and strategically preserves, enhances, or restores elements of a natural system to help produce higher-quality, more resilient and lower-cost infrastructure services. Green infrastructures are multifunctional and adaptive, making them a promising and robust long-term solution. Due to their characteristics, they can contribute to climate adaptation as well as to climate mitigation. They can provide a cost-effective approach to address deep uncertainty related to climate change by avoiding or delaying lock-in to capital-intensive infrastructure, allowing for flexibility to adapt to changing circumstances (OECD 2013).

The challenge is that, while the potential NBS and green infrastructure is increasingly acknowledged, and it is well positioned in the political agenda of the European Commission, Multilateral Development Banks and governments, the reality is that in many regions the implementation of these solutions at watershed scale remains latent. In most cases green infrastructure is still implemented solely as pilot projects removed from mainstream procurement strategies. Even in countries at the forefront, like Peru, where funds are being collected to invest in watershed protection and ecosystem conservation for water supply, the implementation of projects at scale is still an operational and procurement challenge.

In order to close this implementation gap this chapter presents guidelines to develop an implementation and financing strategy for natural assurance schemes, and for the implementation of Nature-based Solutions for Water Security in general (Altamirano et al. 2021). Following the Financing Framework for Water Security (Altamirano 2017, 2019) these principles have been further tailored and developed with additional elements to fit the innovative nature of NBS projects for which important evidence and information gaps remain, e.g. the expected and typical cashflow and risk profiles of green and hybrid (green-grey) projects and the levels of service they can guarantee over time.

Summarising, our aim has been to develop a methodology that supports and enables the proponents of green infrastructure to structure and shape their project proposals as investable propositions, in a way and a language that appeal to either public or private investors. Our approach offers an interface between the project

delivery and finance community and the water resources planning and watershed conservation communities.

In this chapter we present the basic methodological elements of our approach and the process it involves, as well as an illustration for one of the three demonstration cases we have supported to develop an implementation strategy. This is one of the three EU case studies where the framework was appplied to develop an implementation strategy. The three EU case studies are micro-wetlands in Rotterdam in the Netherlands, Medina del Campo Groundwater body (GWB) in Spain and Potelu wetland in the lower Danube in Romania which are presented in Chaps. 11 and 16 (this volume). To finalize conclusions and recommendations about what is needed to move ahead towards implementation at scale of NBS for water security in Europe are presented.

9.2 Financing Framework for Water Security

An important goal in relation to natural assurance schemes was also to enable the step from adaptive planning towards investment planning. For plans and projects of any type to be able to access funding and financing, it is essential to justify why the proposed investment optimises the use of scarce public and/or private funds. It is also very important to provide evidence that shows that the proposed investment(s) in NBS and the way these NBS will be procured will optimise Value for Money (VfM). In other words, the case for investment needs to be made.

The Financing Framework for Water Security supports the aforementioned objective by setting in motion a process that bridge the existing gap between adaptive planning and investment planning phases. In the adaptive planning phase both the strategic case – the need for change- and the economic case- on why the preferred strategy – NAS- will optimise the use of scarce public funds (see Chap. 6 Le Coent et al., this volume) are made. The framework then guide within the investment planning phase the further definition of the commercial case: how to organise the program so as to make its implementation achievable and attractive for market players (large companies as well as SME's); the financial case: is the program affordable for the local and national economy? And the management case: how could these concepts and the entire program be delivered successfully and by whom? (Public, Private, and civil society actors).

A crucial element towards the development of the five business cases: strategic, economic, as well as commercial, financial and management business case (see Fig. 9.1), is the development of a suitable implementation arrangement per measure. The FFWS guides the stakeholder involved in a planning process in designing an implementation arrangement for water security projects and natural assurance schemes including the development of a governance structure, a funding strategy, a financing and procurement strategy. This means considering a number of elements, namely: (a) the transaction (e.g. type of good and financial as well as physical project characteristics), (b) the level of service required over time and (c) the institutional setting (stakeholders, strengths of local government, private sector and community, the incentives created by formal and informal institutions and the

Fig. 9.1 The five business cases for public investments. (Source: UK HM Treasury 2018. More information available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/749086/Project_Business_Case_2018.pdf)

insurance and re-insurance schemes that apply) – and considering lessons learned from best practices worldwide, they can choose from a wide range of project delivery and finance options that vary from purely public governance options up to the creation public governance options up to the creation of regulated markets for private initiatives and innovative business models to emerge. The implementation arrangement(s) with the highest potential to ensure sustainability in service delivery in the long term are then considered as base for a further process of design and project structuring.

The four main stages of analysis to design an implementation arrangement to follow are presented in Fig. 9.2 and Box 9.1. For more detailed guidance on the process to gradually advance the five business cases through the process of strategic planning for water security, please check the Handbook for the Implementation of NBS for water security (Altamirano et al. 2021).

It is important to clarify that while on the one hand the input to this first phase is expected to be a preferred strategy for water security, for which there is a clear strategic and economic case; on the other hand the further specification of a hierarchy of services to be provided by the strategy and/or specific green infrastructure

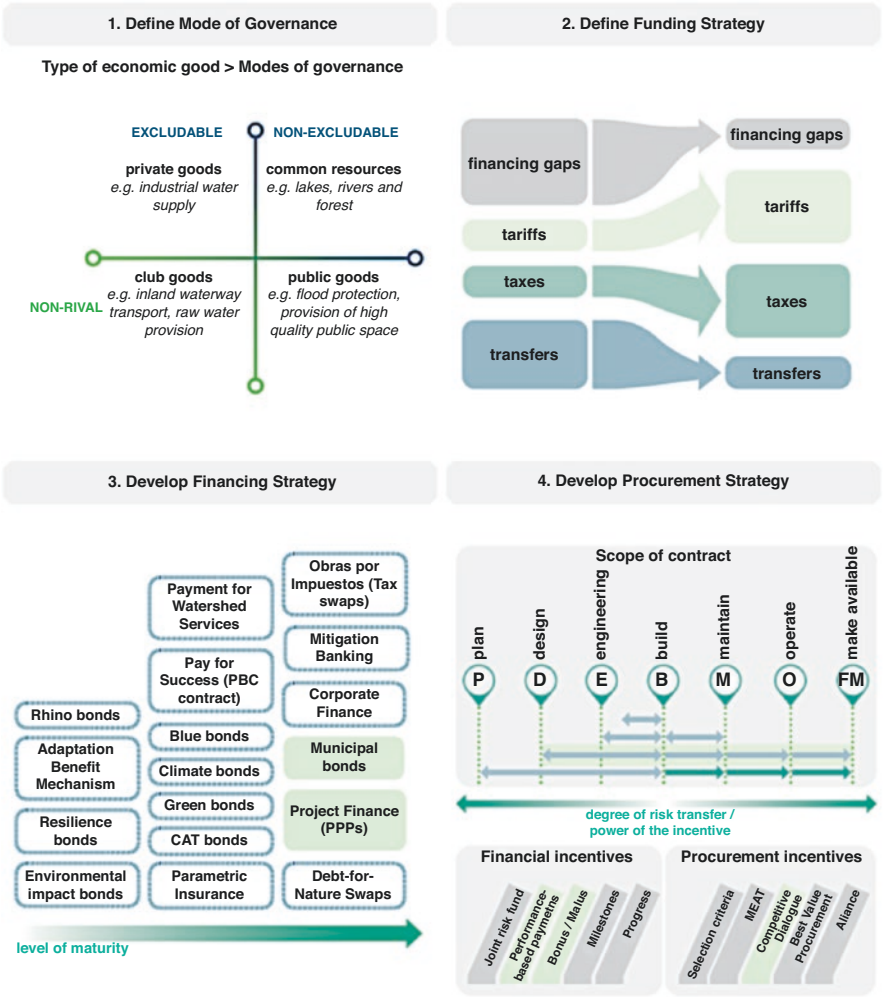

Fig. 9.2 Main components of the implementation arrangement. (Source: Altamirano et al. 2021, p. 23)

investments and the potential sources of revenue helps to further shape the strategic case of the investment programme being considered and may even lead to significant changes in the solutions being thought as part of this preferred strategy. Box 9.1 presents the four more important steps considered in this process of designing an implementation arrangement.

Making use of system analysis, group model building and other collaborative techniques along with principles of New Institutional Economics, the FFWS enables a process of transdisciplinary collaboration to design fit for purpose implementation mechanism for water security projects and strategies. This process involves all

relevant public, private and community actors key for implementation and enables the translation of strategic water security plans into clearly phased hybrid infrastructure clusters that can be absorbed by formal public investment planning processes and then translated into several financially viable or even bankable deals making use of a blended finance approach (Altamirano 2019, p. 7).

Blended finance is defined as the strategic use of development finance and philanthropic funds to mobilise private capital flows to emerging and frontier markets by the OECD and the World Economic Forum (OECD and WEF 2015; OECD 2018).

Box 9.1 Steps to Design an Implementation Arrangement According to the Financing Framework for Water Security

Step 1: define the main services the project will create and categorize this in types of economic goods*. It is important here to bear in mind that we categorize the services the asset created by the project delivers, not necessarily the asset itself. For example, a forest may provide services that can be considered private (such as reduction of sedimentation rate of hydropower plants), yet the forest itself may be a public good. This categorization enables the identification of which types of funding could be appropriate to ensure cost recovery.*

Step 2: Funding strategy*: the funding of a project could be either public or private. In general terms, the main sources of funding are what the OECD called the 3 T's: Taxes, Tariffs or Transfers. Once the sources of funding – who ultimately pay for the project- are determined the mechanisms to arrange capital upfront (financing) and how to place the project on the market (procurement) are selected.*

Step 3: Financing strategy*: depending on the type of project and whether the project sponsor is public or private, a variety of financing instruments could be used. In the graph below we show for example a variety of innovative financing instruments for Climate Adaptation and DRR* (Altamirano 2019).

Step 4: Procurement strategy*: which refers to how the government agency or private project sponsor responsible for the project can choose to make use of or to purchase the project. The graph shown here applies mainly to public infrastructures, while other sectors or types of transactions may need a different approach, such as the design of regulated markets or bottom-up community-based initiatives. At is shown in this graph in case of public procurement of infrastructures the government may choose to tender it as a fully integrated contract (e.g. involving the private sector from planning up to Operation and Maintenance) or choose for more traditional separate ones.*

(Source: Altamirano 2019, p. 13)

9.3 Green Versus Grey Infrastructure Projects: Structuring Investable NBS Propositions

Multiple factors slow down the rate of adoption of NbS for water security. Some of the more often cited are uncertain performance, higher (real and perceived) risk and an unattractive cash profile of NbS projects. However, the most fundamental challenge is that most public and private investment planning processes are geared towards grey infrastructure "projects" as investment units and do not fit the characteristics of natural infrastructure investments. This section presents how natural infrastructure is seen through the lens of the proponents of this approach versus the lens used by investors. The way hybrid infrastructure strategies are seen by eco-engineers and proponents in general versus financers and project developers create an important divide in language and interests. The criteria they both apply to judge the potential of green and hybrid versus grey-only infrastructure strategies are fundamentally different.

It is important to clarify that whether the project developer could be public or private, does not make a significant change in this divide; the only difference could be the capacity of the public project developer to carry more risks and financial losses than the private one. Our objective with the FFWS is to enable NbS proponents to engage in strategic planning and investment planning processes and work more effectively together with project developers, project sponsors and financiers.

9.3.1 Cost-Effectiveness of NBS Versus Grey Infrastructure

Here an important aspect to consider is context specificity. That is for the calculation of life cycle costs and comparison of NBS versus grey solutions and strategies "green infrastructure design and performance is generally more context-specific than grey infrastructure. NBS solutions for DRR need to be designed and built to fit the soil, terrain and hydrological conditions of each individual site" (American Rivers 2012, p. 9). For NBS projects this difference means, on the one hand, greater complexity and uncertainty in ex-ante cost estimations and cash profiles, and in the other hand often a greater value from addressing wider local concerns and values (Altamirano and de Rijke 2017), i.e. a wider set of co-benefits (see Chap. 6 Le Coent et al., this volume).

9.3.2 Cash Profiles of Green Versus Grey Infrastructure

Cost-benefits comparisons made of NBS solutions versus grey infrastructure for example for stormwater management; have found the following advantages of NBS versus grey infrastructure projects in terms of Total Costs of Ownership (American Rivers 2012, p. 9):

- Reduced built capital (equipment, installation) costs
- Reduced operation costs (e.g. energy costs)
- Reduced land acquisition costs
- Reduced repair and maintenance costs
- Reduced external costs (off-site costs imposed on others)
- Reduced infrastructure replacement costs (potential for longer life of investment)

Nonetheless, NBS have unique financing challenges inherent to their cashflow and risk profiles. Benefits are often unique, delayed, dispersed, non-guaranteed and non-financial, complicating the estimation of an internal rate of return (IRR). With respect to costs, capital expenditure is often spread over a longer-term, in comparison to grey solutions as construction time or time to reach functionality is often longer for green versus grey infrastructure.

While Total Costs of Ownership (TCO) are expected to be lower for NBS versus grey infrastructure in the long term, it is also important to consider the differences in the perceived risk profiles of green versus grey and the impact that will have on the cost of capital and on the "risk premium" to be charged by implementing parties to the procurement agency when opting for green versus grey. This will be especially the case in the earlier years of transition towards a hybrid infrastructure market, when risk perception will remain high and companies that engage in providing these NBS solutions will not have the required track record to prove to financiers that these companies have full overall control of construction and performance risks.

The multi-functional and innovative nature of green versus grey makes the financing of NBS solutions at scale significantly more challenging. Nevertheless, the specific characteristics of NBS also result in a net positive impact for on-site aesthetics and other co-benefits has often proven beneficial to generate new funding sources since these positive impacts and other co-benefits increase the willingness to pay from people in the immediate vicinity of these solutions. For example, in Portland, Oregon, residents were more willing to invest for on-site stormwater projects that brought scenic and other direct additional benefits (American Rivers 2012).

Our approach proposes a structure process to shape NbS projects and design fit for purpose implementation arrangements that improve the cashflow and risk profiles of NBS projects, enable the conversion of co-benefits into additional revenue sources and keep transactions costs and implementation risks inherent to multi-functional projects at a minimum.

9.3.3 Specifying Multiple Levels of Service: A Hierarchy of Functions to Guide Trade-Offs

A main advantage of NBS is that they can fulfil multiple functions. This also means that when NBS strategies are structured as investment projects, these may translate into projects that are contracted by multiple principals (public and/or private). As trade-offs between the functions provided by the NBS strategies may be expected,

this could easily translate into significant contractual risks, during both the construction and operation of these projects.

To reduce these eventual contractual risks while increasing the possibility to monetize more co-benefits of NbS we propose a number of collaborative modelling protocols that help clarify:

- **Hierarchy of functions:** specifying which combinations of measures (green, grey and non-structural) ensure together 2–4 main functions; and then make clear how to prioritize in case of trade-offs between them. The final prioritization is a function not only of the physical processes, but ultimately a social construct that is influenced by how active different problem owners are and which function is valued more by public and/or private beneficiaries
- **Function curves, Life Cycle Costs (LCC), cashflow and risk profiles of natural infrastructure measures:** the function curves, risk matrixes and LCC of grey infrastructures are often well known, however that is not the case for green infrastructure. A wide variety of technical expertise (e.g. ecology, morphology, civil engineering, and so forth) and simulation models need to be considered to arrive to the definition of these variables which ultimately shape the cash and risk profile of these hybrid investment projects.

These two elements set basis for further in-depth analyses and will lead to the identification of alternative revenue generation strategies (funding strategy) and the choice of a family of implementation arrangements. Depending on whether the services provided – not the assets- can be considered public, toll, common resources or private goods different sources of funding would apply; tariffs can be applied to private and toll goods and taxes or transfers would be required to fund public services. Then depending whether taxes, tariffs or transfers are identified as the most important source of revenue as well as whether the public or the private sector will be the main project sponsor, different types of implementation arrangements will be considered for further development of the full business case.

More specifically investment in NbS for water security and watershed conservation could take any of the following four forms:

1. Public procurement contracts, which includes traditional Design-Bid-Build contracts but also Public-Private Partnerships and even unsolicited proposals made by the private sector but that require concession rights from the government authorities
2. Privately driven water stewardship investments,
3. Collective investment vehicles, and
4. Environmental and/or ecosystem markets

Although the design process will vary for different types of implementation arrangements, in most cases, investments will lead to investment projects and/or the delegation of operation and maintenance activities to third parties. Whenever a public or private entity needs to implement the envisioned activities, these entities will need to decide whether to implement themselves or to delegate implementation to another party: public, private or community. In that sense, independent of whether the choice for implementation arrangements is 1,3 or 4 (as above); the project sponsor

will have to make financing and procurement choices. For doing so, this chapter presents the process to guide them in selecting the project delivery and finance mechanism that reduce transaction costs and ensure the right incentives are created for sustained service delivery (Altamirano 2019).

9.4 Spain, Medina Del Campo Aquifer Recovery as Illustration

The illustration presented here is a summarised version of the case presented in the Handbook for Implementation of NBS for Water Security (Altamirano et al. 2021). The NAS in question is the Medina del Campo aquifer, a groundwater body in Central Spain extending beneath Southern Valladolid and Northern Avila provinces. The area covering 3700 km^2 is highly impacted by droughts, groundwater exploitation, and degradation of the surface riverine ecosystems along the Zapardiel river. Climate projections indicate that these conditions will worsen in the future and probably threaten the economic wellbeing of the region, which is highly dependent on agriculture. A collaborative process with water users and related stakeholders has resulted in the identification and planning of 5 measures: aquifer recharge, technological transformation of fields, alternating crops, water abstractions control and other governance measures including the constitution of WUAs (water user associations). While the technological transformation of fields was not considered originally as part of the strategy within the NAIAD project, the analysis undertaken by Deltares, including the results of the first stakeholder engagement workshop found out this to be a critical component for the overall success of the NbS programme. Therefore, it was decided to include this measure as part of the preferred strategy in the design of the project preparation process.

The FFWS for the Medina del Campo case was implemented during the process of building commitment with water users, and during the later stage of strategy building for complying with the Water Framework Directive targets for groundwater. The assessment of existing data was a collaborative process between different NAIAD demo partners, the Duero River Basin Authority (CDH) and the research institute Deltares. Additionally, the findings from the NAIAD project and the FFWS application could be of use for the further design of the LIFE Integrated Project lead by the CHD. This LIFE-IP RBMP-Duero project aims to implement a river basin management plan in the central-south part of the Duero river basin, including the Medina del Campo area.

The most crucial success factor for successful implementation in the Medina del Campo case relates to behavioural change by agricultural water users, and how to effectively incentivize them to make significant changes in their agricultural practices. Existing traditional practices have compromised the sustainability of water resources in the long term. Given this key implementation challenge in this application of the FFWS relatively more attention was paid to the non-structural measures or soft components of the NbS strategy and the process included an in-depth institutional analysis.

9.4.1 *Strategic Case: Theory of Change and Enabling Environment*

Spain has been exposed to significant simultaneous changes, which have challenged water management efforts nationwide. On the one hand, European regulation requires from member parties the compliance with more demanding environmental goals. On the other hand, the lack of demographic retention in the rural areas and an aged farming sector affect this and other regions in Spain and set an important constraint for the implementation of the proposed measures.

Main drivers for implementation of an NbS strategy are to reduce water consumption by 25%, to restore ground-water-related ecosystem services, to improve water supply quality now affected by arsenic contamination, and to reduce flood and drought risk and other related risks such as landslide. The initiative stems from the strategic goals and responsibilities of the CHD to comply with European regulations and national water planning. The enabling environment is given by the structure of water rights, and the Water Framework Directive. Accordingly, the problem owner is the Duero River Basin Authority (CHD), as the authority in charge of water planning and the enforcement of the Water Framework Directive (FD).

In previous decades, the CHD granted water rights over the aquifer in a time when the knowledge on aquifer dynamics was rather scarce. Therefore, there was an overprovision of water rights on the aquifer. The situation as is now is presented in a Causal Loop Diagram (Fig. 9.3).[1]

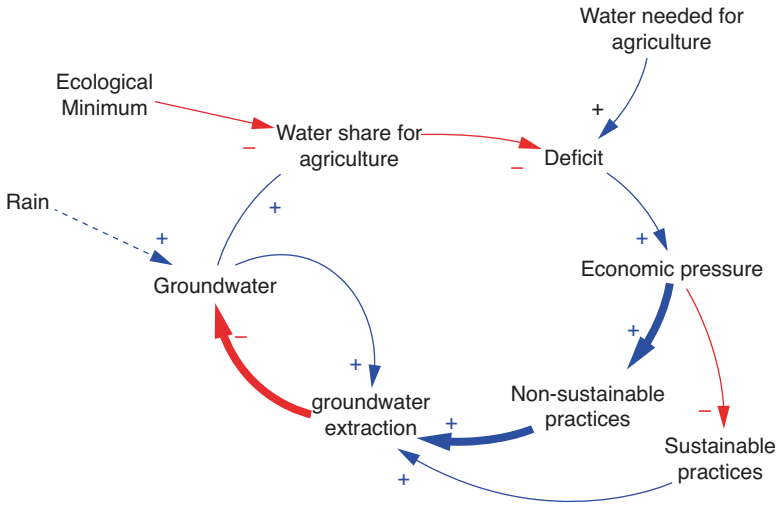

Fig. 9.3 Business as Usual situation in Medina del Campo

[1] See Lane 2008 for getting familiarity with CLD representation of complex systems.

There is a balancing loop between water availability, the higher levels of groundwater the higher water extraction reducing the existing levels of water in the GWB. Water extraction is driven by agricultural production. A share of this production is the result of unsustainable water use practices, which is driven by economic pressure faced by farmers due to extremely low prices. Non-sustainable practices imply higher rates of water extraction, and consequently, it is represented with a thicker arrow. The economic pressure increases as there is a perception of the water deficit between water needs and availability, competing with the ecological minimum. As the positive contribution of rain to water levels is rather insufficient to balance water extractions, it is represented with a dotted line.

The NAS strategy proposed.

to introduce a change in the way water is managed towards a more sustainable water use regime includes:

1. Aquifer recharge (structural measure).
2. Formation of Water Users Association (non-structural, governance measure);
3. Control of abstractions; (non-structural measure to increase enforcement).
4. Transformation of the fields and.
5. Introducing alternating crops.

As presented in Fig. 9.4, these interventions aims at reinforcing sustainable practices, reducing the needs of water and physically contributing to water stock in the GWB.

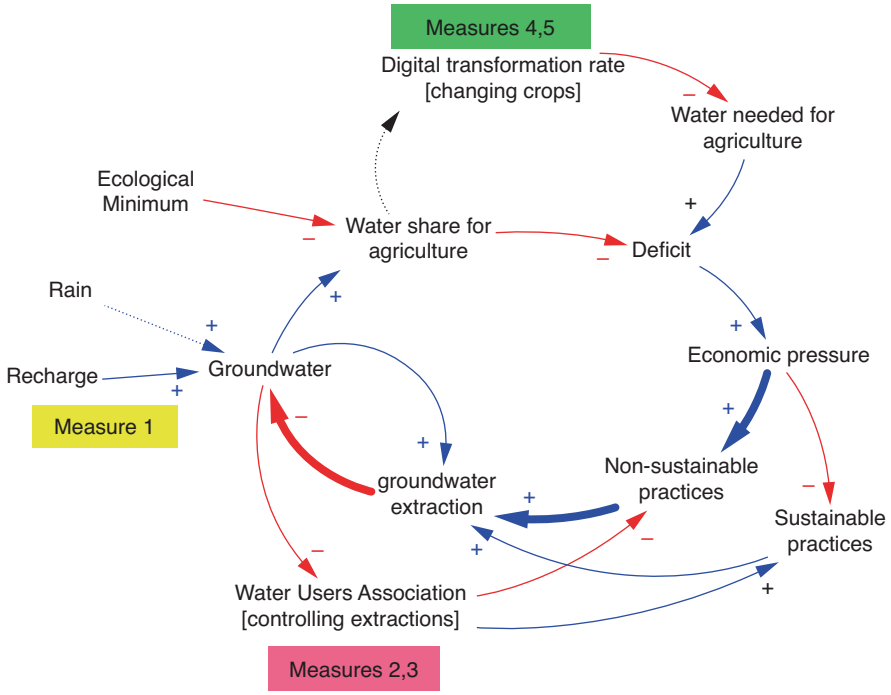

Fig. 9.4 NAS strategy to achieve sustainable water use in Medina del Campo

9.4.2 Economic Case: Winners and Losers

The most important and direct benefit that results from the implementation of the NbS strategy in Medina del Campo is the reduction of drought risk and associated impacts for the agricultural sector. As agriculture is one of the main economic activities in the region, a reduction of this risk impacts directly economic resilience.

As previously explained the NbS strategy aims to reduce in the long-term water stress by conserving aquatic ecosystems, terrestrial ecosystems and wetlands protected under Natura 2000 policy. By balancing environmental and economic goals, the NbS investment programme is expected to contribute to the region goal of retaining youth and may also contribute to more young people becoming active in a new modern agricultural sector. In the medium to long term the program aims to avoid a potential future social conflict that could be triggered if aquifer condition worsens and is declared over-exploited.

The sector most impacted by the implementation of the measures in the short term is the agriculture sector, particularly the farmers, although it will also affect the whole agroindustry value chain. The paradox is that this is also the sector that will benefit the most in the long term with a more reliable and sustainable water provision model. Other interested groups include the environmentalist organisations, as well as business owners linked to the agriculture sector. The identification of pains and gains for different actors (see Table 9.1) was established upon the interpretation of interviews made to CHD officers, a representative of farmers and a representative of the Castilla y Leon Autonomous Community.

9.4.3 Commercial, Financial and Management Cases

Given the future scenarios of water scarcity, the focus service is reducing water consumption. Funding and governance have two main sources. The first one through centralized procurement and using the budget available from the Duero River Basin Authority. Another important source of funding emanates from the European Union level, where the environmental goals reached by the measures are the priority. This budget is also managed in a centralized manner and will be driven by the fulfilment of performance indicators in the aquifer, and effectiveness of the governance goals implementation, e.g. degree of parcels encompassed in a WUAS. Being that the service and benefits constitute a public good, the possibility of putting a tax scheme in effect is considered feasible and desirable. Some income has already been inputted by the water rights and their subsequent responsibilities. Figure 9.5 summarises the service hierarchy, funding and governance structures related to each of the three main functions the NAS strategy includes.

The implementation arrangement was structured according to the procurement practices of public commissioners: Medina de Campo municipality and the CHD. The delivery and proper operation of the aquifer recharge system is a responsibility of the Municipality, as such they will act as commissioner for this part of the NbS strategy. The **governance modes** that will be used for the implementation of

Table 9.1 Pains and gains of existing value chains due to the implementation of NbS in Medina del Campo

Sector	Target group	Winner/ loser	BAU-2050		Solution-2050	
			Pain	Benefits	Pain	Benefits
Farming	Farmers	Loser short-term Winner long-term	Yes	No	Yes (short term)	Yes (long term)
				No extra costs or changes to their current exploitation schemes. Unrestricted exploitation in the short term.	Reduction of water consumption and compliance with regulations	Sustainable and reliable provision of water- avoiding abrupt discontinuation due aquifer overexploitation
Environmental	Environmental groups	Winner	Yes	No	No	Yes
			Acquire and ecosystems exploitation and loss			Avoid ecosystems degradation and recovery of the aquifer
Commerce	Local business owners	Neutral	Yes	No	Yes (partially)	Yes

Source: Altamirano et al. 2021 p. 199

this is part of the NbS strategy is therefore **public procurement contract**. Taking this into account, the CHD and the Municipality can develop further with support from EU innovation partners the specifics of the procurement strategy, including the **scope of contract**, financial incentives to consider in the payment mechanism as well as **procurement incentives** built in the awarding procedure (Fig. 9.5).

Given the innovative character of the solution, it is expected that the municipality will keep control over design and then delegate the responsibility for building the solution and possibly operate it to the winning private company or consortium.

Finally, both the municipality and the CHD oversee the management of water-related disaster risks such as droughts. Table 9.2 gives an overview of possible implementation arrangements for Medina del Campo NbS programme.

9.5 The Way Forward

As we advanced in the implementation of the FFWS and it further development to respond to the needs of our demonstration cases in NAIAD, we have observed that the demo leaders and the proposers of green infrastructure in at least half of our demonstration cases and therefore also the NbS they propose were not yet part of the formal public planning and investment programming process. In many cases the proponents of NbS are organisations active in advocacy and/or academic work and often with little familiarity with public and private investment planning processes. As a result, there is an implicit bias to shape these projects towards the creation of awareness, and less towards demonstration of their revenue generation potential. Our methodology has therefore supported demo leaders in considering how to move forward towards implementation and scale and restructure demonstration cases to create the investment case for public and private sectors alike.

9.5.1 The Missing Link: A Full Business Case

For plans and projects to access funding and financing is necessary to prepare a full business case for the entire investment programme and each of the projects that make part of it. Unfortunately, in most cases the proponents of NbS are organisations with an advocacy and/ or scientific background with limited involvement in public and private investment planning processes. As a result, often NbS pilots and demonstration projects are shaped more as awareness raising projects than as "investment projects" that could attract funds from either public authority aiming at reducing a risk, or private impact investors willing to accept lower returns in exchange for social and environmental impacts.

The criteria and level of detailing regarding implementation costs and risks differ greatly between the project descriptions of NbS proponents and the requirements for allocation of public funding or granting of loans by impact investors. In simple

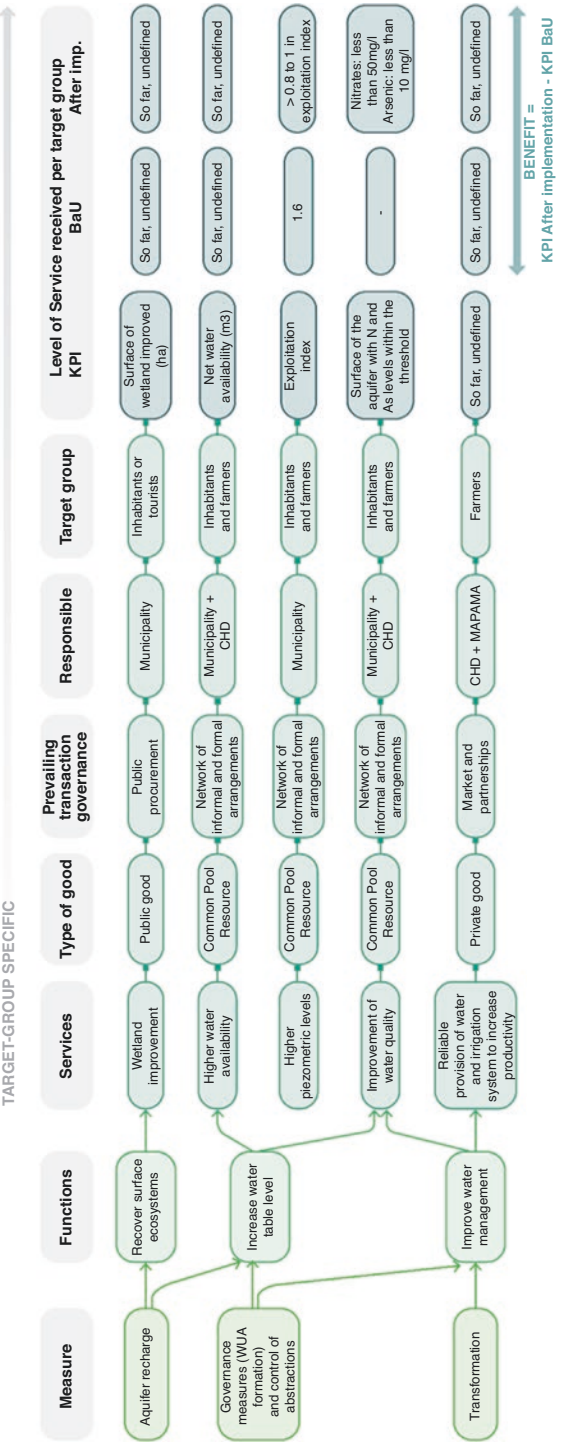

Fig. 9.5 Service hierarchy, funding and governance structure for Medina del Campo. (Source: Altamirano et al. 2021 p. 200)

Table 9.2 Implementation arrangement for NbS strategy in Medina del Campo

Measure	Commissioner	Main tasks associated	Public-in-house/procure in the market/assumed by the market/ assumed by a network	Degrees of private managerial freedom
Assessment of water quality (service: water quality)	CHD	Collection of information and inventory of water capture points	Assumed by a network	N/A
		Geological mapping and survey, Piezometric -flow measurement and hydro-geochemical studies.	Procured in market	Low
		Study of infrastructures and devices available for artificial recharge.	Public in-house	High
		Tests of recharge devices and complementary construction works.	Assumed by a network	N/A
	CHD	Extraction inventory and checking correspondence between the authorized volumes and collected data	Public in-house	N/A
	CHD	Locate parcels whose crops are suspiciously been irrigated with groundwater extractions	Assumed by a network	N/A
Water recovery and resource efficiency (service: water availability and quality)	CHD	Creation of a recreational area near the Medina del Campo town	Procured in market	High
Artificial recharge of the groundwater body Medina del Campo (measure: Aquifer recharge)	CHD	Design: Civil engineering consulting company	Procured in market	Low
		Construction works [CW] removing of waterproofing layer (soil and infiltration works)	Procured in market	High

(continued)

Table 9.2 (continued)

Measure	Commissioner	Main tasks associated	Public-in-house/procure in the market/assumed by the market/ assumed by a network	Degrees of private managerial freedom
Compensation payments for environmental services and climate change mitigation and adaptation services (measure: CUAs + governance measures)	CHD	Agroforestry programme: creation and management of new forested areas in currently cultivated plots	Assumed by a network	N/A
		Assessing NbS impacts on reducing water risk for agriculture (minimal compensation, maximum compensation, assessment of damages)	Procured in market	N/A

Source: Altamirano et al. 2021 p. 202

terms, what in the scientific and advocacy world could be considered a project, within investment cycles is considered a project idea. For this project idea to become an investment project that can be assessed for bankability and/or investability, many much more details and evidence needs to be gathered and more clarity needs to be achieved regarding the way NbS proposed will be implemented.

9.5.2 New Partnerships and Expertise Required

In order to ensure a successful implementation of NbS as well as to guarantee stable levels of service over time; it is key to consider not only lifecycle costs and their distribution over time but even more the skills and expertise required to undertake the activities. Based on an identification of key implementation resources hold by different actors, activities and risks can be assigned in such a way that the project can be delivered at the lowest costs, the highest quality while minimizing risks. By considering these aspects, the implementing agencies can be guided in their choices of who should take care of which life cycle phases of the project. In other words, this understanding of cost elements and cost drivers can guide the process of allocation of risks, responsibilities and rewards between the key implementing actors that could be either from the public sector, the private sector or the community.

An in-depth analysis of the strengths of Public, Private, People actors' is required to guide these allocations Given the differences in implementation arrangements and actors between NbS and grey infrastructure solutions up until recently, to find suitable implementing parties for large scale NbS projects may prove challenging.

Until recently NbS projects have been often undertaken by community volunteers coached by NGO's and/or environmental government authorities; and more often than not these projects have a piloting function and are of limited scale. In these projects often social objectives are equally important as those related to biophysical conditions or risk reduction; which influences significantly the design of NbS measures, the methods for their construction and the emphasis given to monitoring and data collection systems. This means all in all a very different project management style than the one normally applicable to grey infrastructure projects.

Meanwhile the provision and procurement of regular grey infrastructure is a relatively more formalized process where (large) construction companies and public infrastructure agencies are key players. In this sector risk-based asset management along the entire useful life of the asset is the new norm. Additionally, due to public procurement rules in this sector; risk allocation and the related liabilities carried per implementing party need to be clarified and agreed upon way in advance before project implementation.

9.5.3 Mosaic and the Need for Innovative Contracting Practices

The future is in mosaic projects, and their implementation requires innovative contracting practices, as concluded during the recent Environmental Market and Finance Summit.[2] Over and over, asset managers and market service providers told us that they redesigning projects that can responsively serve multiple markets, depending on where the demand is. This allows them to stack funding from multiple sources: carbon offsets, sustainable forestry, water quality credits, recreational use payments, wetland and habitat mitigation, and other revenue streams.[3] Additionally, in a recent market sounding research process undertaken by Deltares in Peru, in cooperation with the Natural Infrastructure for Water Security (NIWS)[4] project it was found that hybrid (green-grey) infrastructure projects are seen as more attractive to project developers than green infrastructure projects alone. According to the methodology proposed, a central building block is hybrid infrastructure clusters. These are after organised into hybrid and multipurpose infrastructure projects and formal performance-based contracts that can be funded by different revenue streams; depending on local institutional conditions and context specific preferences and the willingness to pay of beneficiaries"(Altamirano 2019, p. 5). However the contracting of multiple services by different authorities and blending of funds from the public and the private sector that benefit from these services requires the development of new public procurement and contracting practices that can deal with this complexity. In first instance this requires the clarification and agreement on a hierarchy of functions and associated levels of services that enable the making of trade-offs during the whole life cycle of green infrastructure: design, construction, operation and maintenance.

9.5.4 Policy Recommendations

Research and climate funds aim at the mainstreaming of NbS need to require a different mix of expertise and roles that ensure the applicability of the knowledge and evidence developed and increase their ability to influence public and private investment decisions.

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[2] The summit was hosted by Forest Trends and AEMI. The summit main conclusions are summarized in the blog titled "Five Things We Can Do in the Next 24 Months to Mobilize Major Investments in Ecosystem Restoration and Climate Resilience, November 13, 2019. https://www.forest-trends.org/blog/five-things-we-can-do-in-the-next-24-months-to-mobilize-major-investments-in-ecosystem-restoration-and-climate-resilience/

[3] Idem 11.

[4] More information on the NIWS project lead by Forest Trends available here: https://www.forest-trends.org/who-we-are/initiatives/water-initiative/natural-infrastructure-for-water-security-in-peru/

Along with a different mix of expertise in the consortia, it is important that the right type of coaching is given to demonstration cases leaders to ensure they are able to achieve not only benefits in terms of awareness raising but also serve as pilots to demonstrate the investability and bankability of NbS projects.

Finally, a new type of mission-driven research programmes aimed at implementation of NbS at scale to deal with climate and water risks; needs to include additional mechanisms to increase accountability and impact of research efforts. These mechanisms could include the setting up of advisory boards or users board for clusters of projects where key representatives from public procurement authorities, banks, impact investors and companies are represented and have the opportunity to give feedback about the knowledge and evidence being developed from early on in the project.

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