Federal Ministry
of Education
and Research

FONA
Research for Sustainable Development
BMBF

Funding priority
„Sustainable Water Management“ (NaWaM)

within the framework programme on “Research for Sustainable Development”





NaWaM
Nachhaltiges Wassermanagement

RESEARCH

Igniting ideas!

Published by
Bundesministerium für Bildung und Forschung /
Federal Ministry of Education and Research (BMBF)
Unit 724 – Resources and Sustainability
53170 Bonn

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Fax: +49 (0) 18 05 - 26 23 03
(0.14 Euro/min. from the German fixed network)
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Printed by
Print Production M. Wolff GmbH, Aachen

Bonn, Berlin 2012

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Helmholtz Centre for Environmental Research

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Contents

1. Introduction **2**

2. Status **4**

3. Challenges **6**

4. Subject areas **8**

4.1 Water and energy 10

4.2 Water and food 11

4.3 Water and health 12

4.4 Water and environment 13

4.5 Water in urban areas 14

5. Implementation **15**

1. Introduction

Water is the most important resource for humankind – there would be no life without water! Unlike other resources (such as sources of energy), water cannot be replaced – supply is limited and demand is rising. Although water cannot be "used up", pollution can render it unusable for humans.

Water is a global resource, but solutions need to be regional in nature. As a result, there are a wide range of different perspectives, whose common aim is to implement sustainable water management in order to balance water supply and demand while protecting water as a resource.

The current challenges facing society – the consequences of climate change, demographic change, and efforts to use energy more efficiently – are placing increasing demands on sustainable water management. In just a few years, sustainable water management will be as important as sustainable energy management is today.

With the help of research, political concepts and guidelines need to be provided at an early stage so that suitable adaptation strategies can be developed. The uneven distribution of water resources will continue to get worse, particularly as a result of the rise in extreme weather events.

To overcome these challenges and do justice to the political importance of water as a resource, the Federal Ministry of Education and Research (BMBF) has included this topic in its framework programme on "Research for Sustainable Development" (FONA). The "Sustainable Water Management" (NaWaM) funding priority is an important initiative within the field of action dedicated to "Sustainable management and resources".

The aim is to conduct cross-cutting research into different key technologies and management concepts and strengthen Germany's leading position in the "water management" lead market. The global market for the extraction, treatment, distribution and purification of water is expected to rise to €800 billion over the next ten years, an annual increase of six per cent.

This concept describes the framework for the BMBF's funding activities in the area of water research in the next few years. Future NaWaM funding measures are intended to support innovative research within this thematically broad funding priority.

The following sections will describe the status, challenges and the five subject areas currently being addressed in water research.

Facts about water

Resources

- Water covers 70% of the earth's surface
- 2.5% of the world's water is freshwater
- 1% can be used by ecosystems and humans

Use

- Agriculture accounts for 70% of global water use
- Industry accounts for 22% of global water use
- Households account for 8% of global water use

Economy

- 250,000 employees in the German water industry
- €200 spent on water supply and disposal every year for each German citizen
- €500 billion annual turnover worldwide in the water industry

Infrastructure

- Public sewage/water supply system in Germany: about 500,000 km pipes each
- Investment requirements in the global water industry: €450 billion p.a.
- Investment requirements in the German water industry: €8 billion p.a.

Health

- 5 million people die of waterborne diseases every year
- 900 million people have no access to clean drinking water
- 2.6 billion people have no access to sanitation

Policy

- At least 250 river catchments worldwide cross national borders
- Universal right to clean drinking water since 2010
- By 2030, 47% of the world population will live in regions with water stress

Environment

- About 180,000 km of flowing waters and more than 12,000 km of stagnant waters in Germany
- 60% of the largest rivers strongly affected by dams
- 16,000 litres of water used to produce one kilo of beef

Risks

- The 2002 Elbe river flood caused damages of about €10 billion
- Damage caused by droughts in Europe approx. €3 billion p.a.
- 2 million tons of waste disposed of in water bodies every day across the world

2. Status

Against the background described in the introduction, water research and the water industry play a key role in preserving the natural environment and using dwindling water resources in a sustainable way. Numerous national and international activities are being carried out in the field of water research. Some of them will be presented in this brochure, but there are many more.

In Germany, a significant amount of water research is publicly financed via the basic funding of universities and non-university research institutions, such as the Helmholtz Association (HGF), the Leibniz Association (WGL), and the Fraunhofer-Gesellschaft (FhG); about a third is financed through project funding from the Federal Ministry of Education and Research (BMBF), the Deutsche Forschungsgemeinschaft (DFG), the European Union (EU) and the German Länder. German academic research is internationally acclaimed in many subject areas, particularly thanks to its orientation towards practical application.

The DFG provides project funding for basic research according to the bottom-up principle. Its Senate Commission on Water Research (KoWa) is an advisory body that addresses the latest developments in scientific research and exchanges information with other disciplines and funding institutions.

A "Water Science Alliance" is currently being prepared on the initiative of KoWa and the Helmholtz Centre for Environmental Research (UFZ). Its aim will be to network different stakeholders within the HGF and beyond in a number of thematic clusters.

The activities of fourteen Fraunhofer Institutes to turn the latest technologies in the field of water research into practical applications are to be strengthened through the Fraunhofer Alliance "SysWater".

With its support of collaborative projects with partners from science, administration, associations and businesses, the BMBF is working to build a bridge between basic and application-oriented water research. The projects place a strong focus on innovations and system solutions to strengthen water research and overcome global challenges. The research framework programme FONA, implemented through the funding priority NaWaM, is the political basis for future project funding in this area.

Other important stakeholders in Germany include the two large associations – the German Association for Water, Wastewater and Waste (DWA) in the areas of water and waste water, and the German Technical and Scientific Association for Gas and Water (DVGW) in the area of drinking water. Both exchange information with the relevant ministries, thus helping to take current developments in the water industry and in water research into account, and both also finance their own research programmes.

German water research and the German water sector do not just have to contend with global challenges, but also with international competition. This is reflected in the NaWaM funding priority, in line with the BMBF's internationalization strategy.

On the European level, the ERA-Net projects have been a key part of efforts to promote cooperation between national research funding organizations since the 6th EU Research Framework Programme. Important ERA-Nets in the field of water research in which the BMBF was or is involved include CRUE (flood risk management) and IWRM.Net (integrated

water resources management). A Joint Programming Initiative (JPI) on the subject of "Water Challenges for a Changing World" complements and adds to the ERA-Nets.

Alongside the project funding provided under the EU's 7th Research Framework Programme, a further European initiative is the Water Supply and Sanitation Platform (WssTP), an industry-driven stakeholder network which has, among other things, identified the research needed to realize the joint vision for an innovative water industry by drawing up a strategic research agenda. The EUREKA Cluster "ACQUEAU" is closely linked to this. Its aim is to enable cross-border research projects in strategically important fields of technology in the European water sector.

Here are just a few examples of the many international activities in the area of water research: UN-Water, a collaboration of 26 UN organizations working on the subject of water; UNW-DPC, the UN's Water Decade Programme on capacity development, which is based in Bonn; and the International Water Association (IWA), a global network of experts from science and practical application.

The topics defined in the funding priority NaWaM take into account the most important contributions of national and international activities and stakeholders. The funding measures within NaWaM will support collaborative projects that make an innovative and internationally visible contribution to solving the challenges described in the following section.

3. Challenges

Global water use has more or less tripled since 1950. It is set to triple again by the middle of the 21st century, given that the world population is expected to rise to about 9 billion by then. In many countries, the available water resources are becoming critically scarce. On the one hand, these developments cause significant humanitarian problems; on the other hand, they offer great opportunities 'for the German water industry to help solve these problems, for example by exporting efficient systems for water supply and waste water disposal.

Up to 90% of the population increase expected until 2050 will take place in developing and emerging countries, where there is already a shortage of clean water. The incidence of droughts and floods will rise in certain regions as a result of climate change. The globalization of economic systems, demographic developments, and structural change processes will put greater pressure on water resources, particularly in cities, but also in the surrounding areas. In many areas, rising levels of pollution and eutrophication in conjunction with water shortages are leading to a critical increase in the vulnerability of aquatic ecosystems.

For these reasons, the water industry and water research are facing enormous challenges, both nationally and internationally. Varying demands, different forms of utilization and geopolitical problems need to be addressed in this context. Questions of water quality and water quantity are equally important, but their significance varies depending on the region. That is why we need cross-cutting solutions for sustainable water management.

In other words, there are a wide range of challenges that affect the social, ecological and economic dimensions. Essentially, the top priority is to achieve sustainable development in water management.

The most important challenges are:

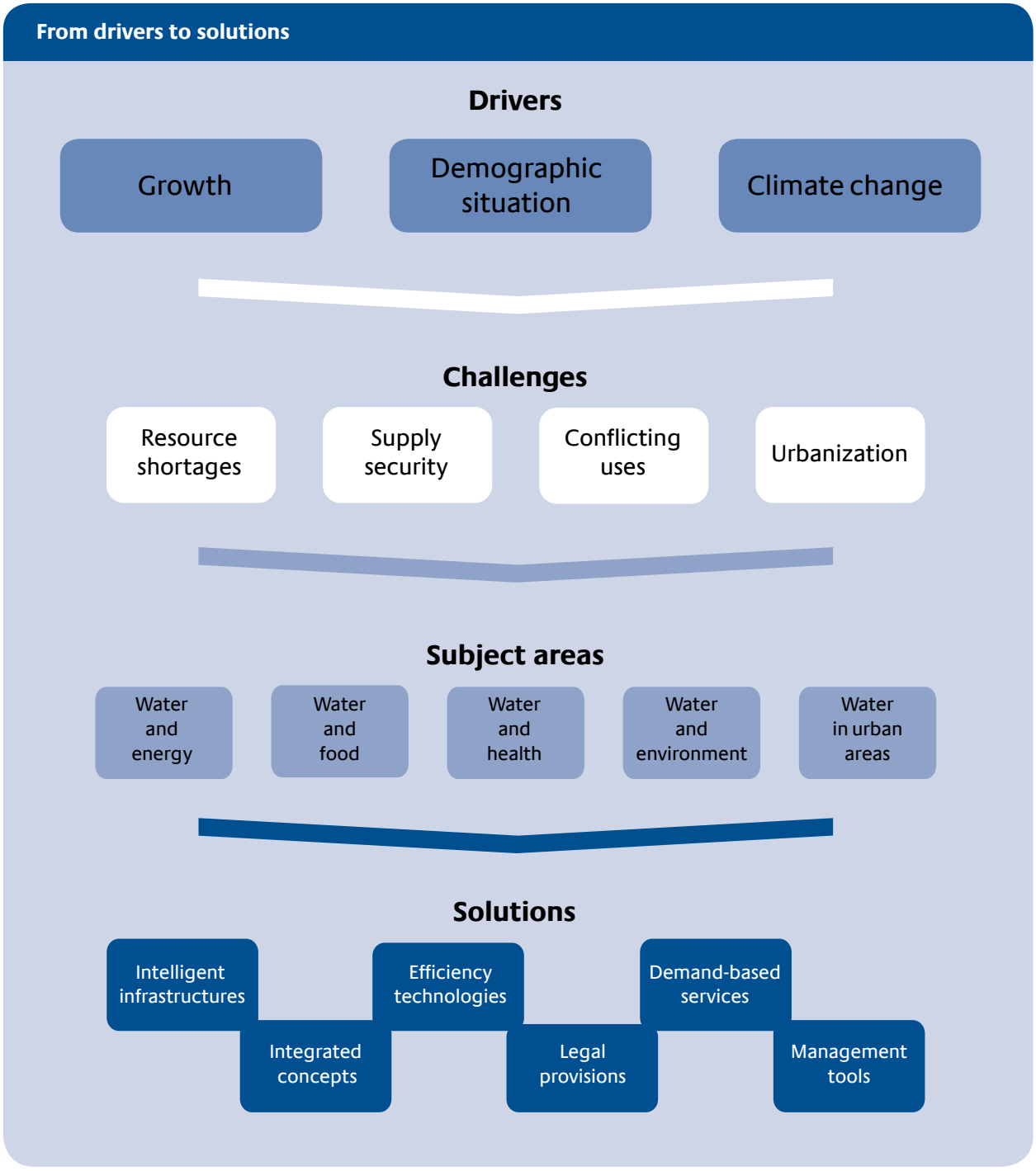
- **Promoting a more efficient way of dealing with water resources against the background of dwindling water supplies and resources**
- **Enhancing security in water supply and disposal and enabling a sustainable water cycle**
- **Striking a balance between different uses while applying the principle of sustainability**
- **Adapting water infrastructures to demographic developments and the process of urbanization**

As well as the challenges described above, international agreements on water and environmental policy also need to be taken into account. They include the European Union's Water Framework Directive and the UN's initiative to make clean water a basic right. Water is much more than a drink – it is a commodity, a legal issue, an asset to be protected, an ecosystem and a resource.

Further research is needed to meet the challenges. There are a wide range of areas of action related to sustainable water management, and they require a great deal of interdisciplinary and transdisciplinary cooperation. Water research focuses on the following areas:

- **Creating innovative water infrastructures to adapt to changing conditions and use waste water-related resources**
- **Protecting rivers as special living environments through sustainable land management**
- **Developing overarching management and governance concepts for water management at regional level**
- **Dealing with extreme events in various natural environments and settlement areas**
- **Finding ways of meeting legal requirements when developing water management**
- **Protecting aquatic biodiversity when using water resources**

The subjects of the BMBF's NaWaM funding priority systematically address the challenges in this area, and its innovative research projects are making a significant contribution to solving them.


From drivers to solutions
Drivers
Growth
Demographic situation
Climate change
Challenges
Resource shortages
Supply security
Conflicting uses
Urbanization
Subject areas
Water and energy
Water and food
Water and health
Water and environment
Water in urban areas
Solutions
Intelligent infrastructures
Integrated concepts
Efficiency technologies
Legal provisions
Demand-based services
Management tools

4. Subject areas

The NaWaM funding priority focuses on five subject areas:

- **Water and energy**
- **Water and food**
- **Water and health**
- **Water and environment**
- **Water in urban areas**

They provide a framework in which specific funding measures will be carried out in coming years, with the aim of positioning the German water sector and water research for the future. The funding measures are to be planned and coordinated together with the relevant interest groups. The funding measures can fall within more than one subject area – this reflects the integrative and transdisciplinary approach of the funding priority.

One of the aims of the NaWaM funding measures is to accelerate the transfer of basic findings from academic research into competitive services or processes in the water sector ("from knowledge to product").

This requires significant participation on the part of industry development partners in the research projects. The most important factors are a focus on innovation as well as high potential for commercialization. Small and medium-sized

enterprises (SMEs) play an important role in the area of technological and economic innovation. The existing funding measure “KMU-innovativ: Resource and Energy Efficiency” already provides faster support for SMEs and is open to different topics, now also including “sustainable water management”.

Innovative solutions are the key to meeting future challenges in the area of water management. More than ever before, stakeholders in research and development are called upon to enable significant systems innovations and leaps in technology. The increasing complexity of global changes requires cross-sectoral approaches.

In addition to the development of new technologies, services and concepts, we need supplementary measures in initial and further training (capacity development), communication, and decision-making support in order to establish sustainable water use across regions and countries. These factors will form part of the internationally visible research projects.

4.1 Water and energy

Challenge

Managing water resources helps to secure the supply of drinking water, the disposal of waste water, and the supply of energy. Higher efficiency can significantly improve the energy balance in all these areas. Waste water treatment facilities currently account for 20% of energy consumption, making them the biggest municipal energy consumers.

Waste water, sewage sludge, and sewage gas have a great deal of untapped potential as sources of energy and materials – they could be used for the self-powered operation of treatment plants or as sources of heat, electricity or hydrogen. Drinking water treatment and distribution processes can also be optimized in order to save energy. The use of water in the context of energy production and the rising importance of renewable energy sources open up new opportunities, but also cause utilization conflicts and involve certain risks for groundwater supplies and aquatic ecosystems.

Need for research

There is a need for further research on the following topics within this area:

- **Tapping efficiency potential in municipal supply and disposal processes and concepts**
- **Increasing efficiency in industrial energy generation through the provision of cooling water from water ecosystems, including measures for adaptation to climate changes**
- **System analysis on the role of water as a resource in regional energy supply and climate protection concepts**
- **Balancing the various utilization interests between the protection of aquatic resources and the utilization of renewable energy**

Implementation

The following priority fields are to be addressed within the funding priority:

- **Viable technologies and concepts for energy-efficient and resource-saving water management**
- **Increasing energy efficiency in processes for drinking water treatment and provision**
- **Concepts and technologies at the interface between energy generation and water ecosystems**

4.2 Water and food

Challenge

Securing the global food supply is the central challenge in this subject area. Population growth, migration, and demographic developments make this difficult in several respects. Soil and water are limiting production factors that are subject to overexploitation and pollution throughout the world.

The aim is to secure the productivity of agriculture, which currently accounts for 70% of global water use, by establishing efficient, sustainable water management. Rural and semi-natural regions are particularly affected; they need integrated water/soil/land management. The development of innovative groundwater protection concepts and technologies is a special priority, and the various water users should be included in this process. It is particularly important to involve the food industry in research and development efforts in order to enable regionally, nationally and internationally sustainable water-related value added networks.

Need for research

There is a need for further research on the following topics within this area:

- **Sustainable groundwater management through regional land management concepts**
- **Assessing the real and virtual flow of materials, water and energy in land use**
- **Innovative water technologies in agricultural production processes**
- **Managing natural environments to maintain diversity and functionality**
- **Intelligent storage and information technologies for water management**
- **Regionally integrated water utilization and efficiency in rural regions**
- **Ensuring that water technologies and aquacultures are sustainable**

Implementation

The following priority fields are to be addressed within the funding priority:

- **Optimization of water-related value added networks in the food industry in order to boost efficiency**
- **New concepts and technologies for the sustainable management of groundwater and surface water**
- **Efficient irrigation strategies for sustainable agriculture**

4.3 Water and health

Challenge

The health of the world's population is directly linked to the quality and quantity of usable freshwater. According to the World Health Organization (WHO), avoiding the spread of pathogens (bacteria, viruses and parasites) that are transmitted through contaminated drinking water represents the biggest global health challenge. More than 2,500 children in developing and emerging countries, most of them under the age of 5, die every day as a result of poor hygienic conditions, the absence of sanitation facilities, and contaminated drinking water.

Increasingly, water shortages are exacerbating the situation in many developing countries. Unlike in developing and emerging countries, the main risks in Germany and other industrialized countries are posed by various new chemical substances, but also pathogens that are transmitted via the water systems.

Need for research

There is a need for further research on the following topics within this area:

- **Health risks arising from the reuse of water and of materials from waste water treatment**
- **Monitoring of different water quality levels for different uses, with a special focus on hygiene**
- **Health risks arising from water quality losses in the network, household installations, and influences in the catchment area**
- **Educational measures in the area of „Water – Sanitation – Health" to accompany environmental technology development**
- **Hygiene issues related to water management in tropical and subtropical countries**

Implementation

The following priority fields are to be addressed within the funding priority:

- **Risk management for new pollutants and pathogens in the hydrological cycle**
- **Development and implementation of integrated concepts and technologies for sustainable sanitation**

4.4 Water and environment

Challenge

The central challenge is to resolve utilization conflicts in water management while securing the ecological balance and productivity of water systems. The various biotic and abiotic resources are equally affected, as natural resources are scarce, precious and often water-bound.

The aim is to enable a sustainable management of natural and man-made water ecosystems from a spatial, temporal, socio-economic and resource-related perspective. This applies to rural, peri-urban and urban regions, where water supply and demand need to be balanced. At the same time, water as a resource needs to be protected and aquatic biodiversity maintained so that the diversity and productivity of the various water ecosystems are preserved in the long term.

Need for research

There is a need for further research on the following topics within this area:

- **Research on complex water networks and future landscape water balance**
- **Dealing with extreme weather events in the context of water management**
- **Model-based links between coastal and water research**
- **Protecting habitats and natural environments through intelligent utilization concepts**
- **Land use and material flow-specific water management**
- **Optimization and functionalization of regional hydrological cycles**
- **Integration of different technologies and services into water management**

Implementation

The following priority fields are to be addressed within the funding priority:

- **Changes in regional water resource management**
- **Cross-border water resource management in coastal and river areas in Europe**
- **Water resource management under extreme weather conditions with a special focus on low water**

4.5 Water in urban areas

Challenge

The number of people living in cities surpassed the rural population for the first time in 2007. According to UN predictions, more than 60% of the global population – almost 6 billion people – will live in urban environments by 2030, most of them in regions and countries where urban infrastructures are already deficient. Against this background, we need new approaches for urban supply and disposal as well as for the protection of natural resources.

As a result of demographic change, structural change and climate change, Germany is facing enormous challenges in urban supply and disposal. The effective use of raw materials, water, energy and information is a particularly important area of action when it comes to developing strong, flexible and viable supply and disposal solutions. In line with the demands of sustainable system management, these should be designed for application across different sectors.

Need for research

There is a need for further research on the following topics within this area:

- **Securing water quantity, quality and availability to supply cities, taking sustainability criteria into account**
- **Solutions for resource- and energy-efficient operation of water management facilities**
- **Linking natural, semi-natural and man-made infrastructures to improve the management of urban water systems**
- **Decision-making support and management systems to assess adaptation measures**
- **Linking landscape water balance and urban water balance, with a special focus on groundwater resources and ecosystems**

Implementation

The following priority fields are to be addressed within the funding priority:

- **Intelligent and multifunctional infrastructure systems for sustainable water supply and waste water disposal**
- **Concepts and technologies to link urban material flows in industrial and municipal environments**
- **“Innovative water infrastructures” – model regions to establish internationally visible reference projects**

5. Implementation

The funding priority is to run for five years. The following activities are currently being implemented or prepared:

- **A call for proposals entitled "Risk management for new pollutants and pathogens in the hydrological cycle" (RiSKWa) was published within the subject area "Water and health". Twelve projects have been selected and receive funding from BMBF for three years.**

- **A call for proposals entitled "Intelligent and multifunctional infrastructure systems for sustainable water supply and waste water disposal" (INIS) has been published within the subject area "Water in urban areas".**

- **A call for proposals entitled "Viable technologies and concepts for energy-efficient and resource-saving water management" (ERWas) has been published within the subject area "Water and energy".**

- **A call for proposals within the subject area of "Water and environment" with the working title "Changes in regional water resource management" (ReWaM) is currently being developed in cooperation with experts from science and business, DVGW, DWA and the working group on water of the Federal Government and the Länder (LAWA).**

- **A further call for proposals with the working title "Enhancing the availability of water resources" is being prepared for publication in cooperation with the DWA and other experts.**

- **As a cross-cutting activity, research and innovation projects on a wide range of different topics in the area of sustainable water management are being supported within the funding measure "KMU-innovativ: Resource and Energy Efficiency".**

- **The funding measure "International partnerships for sustainable climate change mitigation and environmental technologies and services" (CLIENT), including the subject of "water management", was also published as a cross-cutting activity with the aim of supporting definition and research projects.**

- **As an important cross-cutting activity in the area of capacity development a scholarship programme of the German Academic Exchange Service (DAAD), entitled "International Scholarships for Sustainable Water Management" (SuWaM) is financed by BMBF.**

Further funding initiatives are to be launched in coming years.

Notes

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