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# CAPACITY BUILDING ON SUSTAINABLE FLOOD RISK AND WATER MANAGEMENT - TRANSNATIONAL AND TRANSDISICLIPNARY ACTIVITIES IN THE NORTHSEA REGION

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## 1 INTRODUCTION

Since 1998, floods in Europe have resulted in 700 deaths, the displacement of about half a million people, and at least €25 billion in insured economic losses (MunichRe 2006). Furthermore, 40% of the surface water bodies in the EU are at risk of failing to meet good ecological status (defined by WFD) (EC 2007) and there has been a 50% reduction in Europe's wetlands over the last 100 years (IUCN 2005). These points highlight the need for a strategic integrated approach to sustainable flood risk and integrated water management which compliments both the implementation of the water framework and flood risk management directives.

The most important barriers to achieving this goal are silo thinking, poor or difficulties in communication and the lack of a strategic approach to capacity building in integrated and coherent planning and management. In order to overcome these challenges and to enhance society's ability to cope with we propose a concept for enhancing the capacity and capacity building in sustainable flood risk and water management (SFRWM). Within this context we characterize capacity building as follows: The term Capacity Building (CB) has in the past largely been used with reference to developing countries. It describes the fostering and educational aid to raise "a society's ability to identify and solve [a certain type of] problems (Weidner et al, 2002) and it is an ongoing process in which all stakeholders participate (CRS 2009; UNDP 2004). The continual nature of capacity building challenges any project-like approach which expects tangible or even pre-defined outcomes within pre-determined time spans (Eade 1997).

The aim is to strengthen individuals, groups, organizations and societies, enhance their ability to identify and meet […] challenges (CRS 2009) and – as central goal – build independence: as a process of promoting individual activity and participation, it is in itself truly democratic, asking for and aiming at integrating the individual perspective. Capcity building needs and relies upon independence (cf. Eade 1997:17-18). Accordingly, Weidner et al. (2002) find democratic rules and institutions the most important background for capacity building, the enabling administration being a precondition for success (cf. Eade 1997).

A characterisation of capacity building in SFRWM naturally includes a description of capacity in flood management:

*Capacity in flood management is the capability of individuals, groups, institutions, authorities and of local societies as a whole, to live with and adapt to a locally specific exposure to waters and flood hazard in a sustainable way. Thus, capacity*

*building must comprise tasks, strategies and methods that enable societies and their individuals to develop this capability.*

Due to every individual or group being part of the society as background, frame and network, "capacity building involves the whole network of relationships in society" (Eade 1997:22). A holistic perspective is mandatory, thus capacity building is far more than training individuals (GDRC 2009), but includes

- development of human resources;
- development of organisations; and,
- development of institutional and legal framework.

It must be understood and conducted as an approach to development, transforming [local] societies but at the same time value every learner and their very own experiences, respect and integrate it (cf. Eade 1997): Equality between parties involved appears of overall importance as "…inequality never built capacity!" (Manji 1997).

## 2 PRINCIPLES IN CAPACITY BUILDING IN SFRWM

The development of our CB concept is based on research in flood risk management together with physiological and didactic insights. In this paper we discuss our approach mainly against the background of (1) the principles educational scheme of United Nations Decade of Education for Sustainable Development (DESD), and (2) learning theories especially in risk awareness.

Sustainable flood and water management is part of the broader approach of sustainable development. Therefore the DESD principles will be discussed here in the context of developing a didactic concept for SFRWM. Flood risk management is very much related to general insights into risk management and learning processes.

### 2.1 Decade of Education for Sustainable Development

In 2002 the United Nations General Assembly put in place a United Nations Decade of Education for Sustainable Development (DESD), spanning from 2005 to 2014, and designated UNESCO to lead the Decade (UNESCO 2009).

The DESD breaks down the traditional educational scheme and promotes:

- interdisciplinary and holistic learning rather than subject-based learning;
- values-based learning;
- critical thinking rather than memorizing;
- multi-method approaches: word, art, drama, debate, etc;
- participatory decision-making; and
- locally relevant information, rather than national.

Four key objectives of the Decade are:

1. facilitating networking, and collaboration among stakeholders in ESD;
2. fostering greater quality of teaching and learning of environmental topics;
3. supporting countries in achieving their millennium development goals through ESD efforts; and,
4. providing countries with new opportunities and tools to reform education.

In the context of an ongoing European project on Strategic Alliance of water Management Actions (SAWA), several activities are being undertaken in order to build capacity for SFRWM. The SAWA approach focuses primarily on the first two DESD objectives: By establishing Centres for Sustainability Education in flood risk and integrated water management we foster the collaboration amongst stakeholders and support the developing and facilitation of networks for knowledge exchange and collaborative learning processes. Greater quality of teaching and education of environmental topics such as the SAWA focus we try to support by the special educational programmes in Higher Education at several European Universities.

### 2.2 Learning theory in risk awareness

As the past has shown, experience bears some importance for the way people react to and handle flood hazard. Thus, education was mainly based upon objective encounter, alias experience. The experiential learning theory (Kolb 1984) has been applied to the problem in an educational attempt (cf. Kappe et al. 2006), trying to approximate experience. In the same direction constructivism can be integrated into respective educational approaches, especially as it is perceived as supportive of sustainability education (Khourey-Bowers 2009). But these tracks can not account for the vital difficulty in cognition of seldom hazards: A simplified constructivist approach – construing reality from perception – leads right to the point, where most people find themselves, arguing that "flooding never happened here": the perceived reality of seldom events contains no flood! If behaviour is based upon this conclusion, the constructivist approach leads right back to a more often than not misconceived behaviourist concept (Musahl 1997), the negative reinforcement (Skinner, 1974), which Musahl calls one of the strongest paradigms in learning: no matter what the existing information, if experience tells us otherwise and appears supportive to a certain (comfortable) behaviour, this is what becomes subjective perceived reality (cf. Harré et al. 2005; Deery 1999).

To compile educational approaches and didactics in consideration of this effect, it is necessary to understand how perception forms subjective reality and how on the other hand – referring to the influence of experience – "objective reality" can form perception: The accessibility of what is encountered and the wide field of judgemental and heuristic biases and their conditions for cognition and behaviour concerning seldom hazards (Musahl 1997, Musahl 2009, Kahneman 2003).

All this defines the scope for the educational and didactic approach: aiming at experienceable reality and guided by the conditions of intuitive judgement, its "filtering" effects and the levers for its adapted enhancement.

## 3. THE DIDACTIC CONCEPT FOR CAPACITY BUILDING IN SFRWM

Based on the DESD principles, didactics and findings in learning theory in risk awareness we figured out that following elements are crucial to be included and be respected for CB in SFRWM: Information, Internationality, Interdisciplinary, Interactivity, Identification, Interconnection, and Internalising. In the following a brief description of these elements will be given.

I. Information & knowledge

As a basis for learning processes, valid and relevant information is needed. Particularly in the field of flood risk awareness and management, target specific-information which is understandable and reliable is considered as crucial. As well as expert knowledge, local knowledge from residents and stakeholders should be included in the information and knowledge pool.

II. Internationality

Floods and (transboundary) waters are global and international issues. Therefore, the scope of thinking must be global and international – however, the frame for action is local. An international exchange can "broaden the mind". If we look at other countries and regions we should regard different intercultural worldviews, practises and knowledge systems.

III. Interdisciplinary

Water management is an integrated issue which has to consider inter alia river basin approach, natural sciences, governance, social context, economics. Therefore, an interdisciplinary approach with transectoral work and collaboration is needed. This is relevant for all fields such as inter-, multi- and trans-disciplinary and applied research but also for daily life work processes in administration and elsewhere.

IV. Interactivity

Interactivity has to be regarded with both didactics and processes. Concerning didactics, interactive learning is better than one-way learning. The process of learning and learning methods are very much important for effective learning (e.g. Webler 1991). This includes active learning, case studies, action research and so forth. Possible methods can be role play, blended learning, multi-media-tools, case studies, student-centred-learning, problem-based-learning etc. Interactive processes in flood risk and water management are immanent. Especially (learning) methods for participation and collaborative decision-making are crucial for social learning and capacity building (Pahl-Wostl 2006). This approach helps to prepare citizens to engage in participatory democracy.

V. Identification

For effective learning, it is crucial to apply the new knowledge and to identify that a given issue, such as flooding, is or can be a relevant theme to the learner (Webler 2002). Our reactions and actions are mainly based on intuitive judgements. By a process of identification, the lexical knowledge can lead towards action capacity. Identification processes are a first step towards internalising (see point VII). It is therefore important to reveal practical relevance to local and community needs.

VI. Interconnection

SFRWM is a "wicked" problem (Lazarus 2009). It has to be identified the interconnections between different systems such as natural and social systems (defining what how flood effect risk awareness and social implications such as fear, traumatic experiences or the flood probability and insurance systems and so on and so forth). However, different working and management systems such as water management, nature conversation, spatial planning also play an important role in capacity building. In order to enhance the enabling environment for interdisciplinary

problem solving capacity, we should enhance the understanding and respect each other to see thematic and structural linkages.

VII. Internalising

Without internalising information it does not become knowledge and no action capacity (Webler 1991, 2002). Internalising has to be realised:

- at the individual or group levels (covering skills and knowledge requirements);
- at the institutional or organizational levels (covering operational and administrative aspects); and,
- at the strategic or systemic level (covering legal political, economic frameworks).

We cannot change legal structures and institutions, but we can change the minds of those involved.

## 4 APPROACHES IN THE PROJECT SAWA

It is within the context of *SFRWM* that the SAWA-project was formed. SAWA (**S**trategic **A**lliance for **W**ater management **A**ctions) is a pan-European INTERREG project which involves 23 partners in five countries: Norway, Sweden, the Netherlands, Germany and the United Kingdom. The overarching goal is to investigate "adaptive" flood risk management within the context of the EC Floods Directive and the WFD. This work will focus on the engineering, social and capacity issues associated with flood risk management plans.

The aim of capacity activities within SAWA is to pave the way for a sustainable approach to the multi-level management and use of flood risk areas and river basins – from the local residents to planning, and administration. This approach will therefore facilitate flood risk reduction in line with the ecological requirements of the Water Framework Directive and enable the optimal implementation and lasting operational capability of the Flood Directive.

In the following we will describe two types of activities in the SAWA project that aim to capacity building in SFRWM: (1) Sustainability Education Centres (SEC) and (2) programmes in Higher education at Universities in the Northsea region.

### 4.1 Sustainability Education Centers (SEC)

The SAWA project's approach is thus a vertical societal integration between all levels and parties involved; where school pupils can participate in local tasks of flood management, students provide local activities and project work for school classes and residents and Sustainability Educations Centres (SEC). These SECs, set in strategic locations within the partner countries, will serve as hubs in this network for education and capacity building. SECs are aimed to be places of exchange, cooperation and social learning processes.

*Table 1: Sustainability Education Centres (SEC) planned in SAWA project*

| Insti-tution | University of Karlstad | Waterboard of Delfland | Agency for roads, bridges and waters | Leuphana University of Lüneburg |
|---|---|---|---|---|
| Country | Sweden | Netherland | Germany | Germany |
| Name/ Type | Centre for Climate and Safety (CCS) | Kehringhuis | Dike protection centre (DPC) | Virtual centre for integrated water management (vIWa) |
| Target groups | - Professionals<br>- Students<br>- Scientific society | - Pupils<br>- General public | - Professionals<br>- Pupils<br>- (General public) | - Professionals<br>- Students |

## 4.2 Programmes in Higher education at Universities in the Northsea region

Universities which are involved in the SAWA project offer different bachelor and master courses which are related to SFRWM. In the following three examples will be described to illustrate the implementation of the 7-I elements of CB concept. Table 2 gives an overview of elements and related measures, respectively.

a) Course University of Karlstad/Sweden

*Using a university course for capacity building at the local and regional scales – Climate change consequences and flood risk management for Lake Vänern, Sweden*

To support capacity building in municipalities and counties around Lake Vänern, Sweden, a university course was started in autumn 2008 at Karlstad University. One objective of the course is to increase the knowledge about climate change consequences on ecosystems, and the effects for different societal sectors or interests that use or are dependent upon the water system. Another important objective is to build networks among students, local and national experts, decision-makers and academics. A series of day-long educational meetings in cities located around the lake create arenas for capacity building, including elements of social learning, trust-building and stakeholder participation. The group of students is dominated by persons with a present occupation within planning, environment protection, safety management, teaching, NGOs, etc, at local or regional level. The part-time pace (25% during a year) and distance course mode open up the course for participation of persons with an employment.

The topic for the course is a large water system in south-western Sweden – Lake Vänern and the Göta älv River. Lake Vänern with its area of 5,500 $km^2$ is the largest lake in Sweden and also in the European Union. The Göta älv River runs from the lake outlet, 90 km down to the sea at Gothenburg. Vänern and Göta älv are used for hydropower production, shipping, tourism, fishing, drinking water supply, as waste water recipient, etc. Each of these sectors is addressed during at least half a day during the course, including adaptation and risk management aspects. The entire risk system is complex with flood risks in the lake and in Gothenburg, which are connected to landslide risks and industrial risks in the river valley. The drinking water supply for 700,000 persons in the Gothenburg region is also at stake. Substantial increases in precipitation during the 21$^{st}$ century, according to IPCC, will give a corresponding increase in flood risks.

b) Environmental project study at Leuphana University of Lüneburg/Germany

Another activity is the development and implementation of an Environmental project study which is implemented in the Bachelor programme "Environmental sciences" at Leuphana University of Lüneburg in Germany. This project study implies eight modules in a period of 4 semesters (40 ECTS). The subject is on sustainable flood risk management. The concept is based on a transdisciplinary teaching approach and inter- and transnational perspective and implementation.

In the first and second semester basics of integrated water resources management (IWRM), flood risk management, sustainable regional development, GIS analysis modelling, remote sensing and regional excursions are the main subjects. In the third and fourth semester students will do international excursion to SAWA partner universities with the focus on sustainable flood risk management. Furthermore they will develop flood risk scenarios, build up a collaborative modelling platform and will do collaborative modelling with the partner student group in Netherlands, Sweden, Norway or United Kingdom via a web-platform. By doing so they can develop adaptive measures, discuss these concerning sustainability and effectiveness and other aspects and will trade off possible measures for certain test-sites online or in direct discourses.

c) Heriot-Watt University/Scotland

*Formal MSc Education in Sustainable River Catchment Flood Management*

Internationally, the need for graduates in this field is likely to increase as the Floods Directive is implemented in the EU. What makes this course unique is the holistic view it takes of Sustainable Flood Management. It considers everything from how the planning process should work in areas with potential flood risk, to catchment hydrology, flood hazard, environmental protection and the conceptual design of flood protection schemes. Key subject areas include: (1) Planning Process, (2) Catchment Hydrology, (3) Urban Drainage System Performance, (4) Urban Drainage System Performance, (5) River Flood Flow Routing, (6) Flood Inundation Modelling (2D), (7) Coastal and Estuary Flood Risk management, (8) River Processes, and (9) River Processes.

*One of the activities in this course is developing the interactive exhibition "In deep water: urban flooding in the 21$^{st}$ century".*

Building of the didactic concept, the main aim of the project is to develop an interactive exhibition to help understand how best to explain to stakeholders how stormwater is managed within urban environments, with particular reference to the adaptations that are necessary to mitigate against the effects of climate change and urban creep and the integrated interdisciplinary nature of the problem. The project methodology is based on the principle that you learn more by doing rather than by listening and watching (Kolb 1984); hence, interactive physical models form the centrepiece for transferring information and knowledge. As an example, the main elements of one of the three models are shown in Figure 1 and include:

- A realistic section of urban landscape drained by a sewer system and a river.
- A rainfall generator to introduce water into the model.

- Interchangeable system elements (both traditional and SuDS).

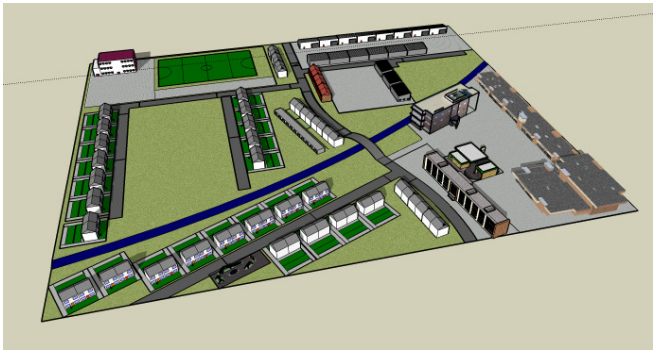

*Figure 1: Schematic of a model (1.8m x 1.5m built at 1:220 'Z-gauge')*

Target audiences include: the general public at science centres/festivals, school children at organised internal/external events and relevant professional organisations (e.g. the planning community). Conservative estimates show a projected audience of almost 9000 people for the first year of the exhibition, which is the proposed period for project evaluation purposes; over the estimated working life of 5 years, this figure is expected to increase to at least 16000. The process of project evaluation will be significantly more involved than that of monitoring, and will seek to gauge what participants have learnt.

*Table 2: Activity matrix for elements of CB in SFRWM in programmes for Higher Education (exemplified)*

| **Element of CB concept** | **Course Vänern Karlstad University/Sweden** | **Bachelors course Leuphana University Lüneburg/Germany** | **Joint Master thesis and research / Heriot-Watt University/Scotland** |
|---|---|---|---|
| Information & knowledge | Experts from local, regional and national levels contribute during each education day. On-site information on flood risks are integrated via excursions. | Detailed and valid information and data, recent research results are integrated. Data validation, interviews with experts and residents/stakeholders will be conducted. | Students will learn how to communicate complex model output to stakeholders using simple graphics and simple models. |
| International | The case study of Lake Vänern is integrated in courses for international students. | Exchange with students in Sweden and the Netherlands, evaluation of case studies from different places in Europe will be realised. | Students will have the option of undertaking the research component of their MSc overseas at one of the SAWA SECs. |

| | | | |
|---|---|---|---|
| Interdisciplinary & Integration | A holistic perspective is chosen regarding societal and ecological consequences of climate change, disciplines involved in teaching and represented stakeholders | Analysis of different sectors such as natural sciences, spatial planning and nature conservation, discourse with different experts is integrated. | Interdisciplinary approaches will be fostered by recruiting students from a wide range of backgrounds (e.g. engineering & geography) and including modules such as urban planning as core course content. |
| Interactivity | Participation among students and involved experts causes an active and interactive learning environment. | Excursions, discussions experts, interactive web-based platform, development of scenarios are didactic elements. | Interactivity is key to the deployment of the physical model. |
| Identification | Geographically distributed educational meetings around the lake connect the participants to local knowledge and local experts. | Identification of local relevance, analysis of regional/local impacts of events or measures, scenario building is included. | This will be supported by designing a series of relevant real-world case studies. |
| Interconnection | A series of educational meetings in different cities promote the creation of a network of professionals, stakeholders and students | Cooperation of local, regional, national and international bodies and societal groups, thematic interconnection (flood risk and risk awareness, risk discourse) is planned. | To help understand the "wicked" nature of SFRWM students and those using the physical model will undertake role-playing exercises. |
| Internalising | Common learning situations among students and local stakeholders put information and knowledge into a local context and stimulates reflexions. | Role games, web scenarios, presentation and discussion of students results with regional experts and stakeholders foster the internalisation process. | Role-playing exercises will also be used to help students internalise information and help transform it into knowledge. |

## 5 SUMMARY

This paper has defined and demonstrated the need for capacity building in the EU and further afield. By understanding the need in a holistic sense, a didactic concept for capacity building has been developed based on ongoing research. To implement the concept across the North Sea Region of the EU, a flexible 7i (Information, Internationality, Interdisciplinary, Interactivity, Identification, Interconnection, and Internalising) framework is being used to link together the first phase of high profile activities; primarily masters level education.

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