Curriculum Outline WEC

Curriculum outline of the 'Strengthening the Water and Environment Center' Project (NPT/YEM/036)

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Introduction

WEC started the 'Strengthening the Water and Environment Center' project in 2004 to develop a graduate course (MSc) on Integrated Water Resources Management. It is a 4-year program (2004-2008) to support the development of a sustainable water education curriculum and training approach in Yemen. WEC's MSc program is contributing to the capacity building of the Yemeni water sector. The MSc program is based on the IWRM concept.

This paper defines the concept of IWRM which will be used in WEC's MSc program and it clarifies the programs vision on education. By identifying which competencies are expected for graduated students this paper gives a guideline for the program and its courses.

Our vision on IWRM

Optimal problem analyses and solutions are not reached by disciplinary approaches, but by comprehensive analyses from different points of view within different levels of scale. IWRM includes a full spectrum of items related to water management, including social, legal and economical aspects. This approach is a reaction on the conventional 'command and control' approach which used to dominate traditional water management. The Government of Yemen uses IWRM as their water management framework and international donors are requesting activities to fit within this framework.

Integrated water resources management is generally seen as a solution to water management problems. In the water-scarce Republic of Yemen, IWRM is used as a method to improve water use and thus to better balance water supply and demand (e.g. NWSSIP, 2005-2009). IWRM should, however, not be seen as a magic solution that creates more water.

IWRM can have multiple interpretations, depending on the level of implementation. To come to a universal support on the concept of IWRM the Dublin principles are formulated. These are:

- Fresh water is a finite and vulnerable resource, essential to sustain life, development and environment.
- Water development and management should be based on a participatory approach, involving users, planners and policy makers at all levels.
- Women play a central part in the provision, management and safeguarding of water.
- Water has an economic value and all its competing uses should be recognized as an economic good.

Those principals include both horizontal and vertical integration. Different disciplines as well as different policy scales are included and approached from a broad perspective. Because of the broadness of the Dublin principles and the vagueness of definitions on IWRM it is necessary to define the important elements in IWRM better. Here, we will discuss each of the interacting components related to IWRM alone in order to get a clearer understanding of the IWRM concept.

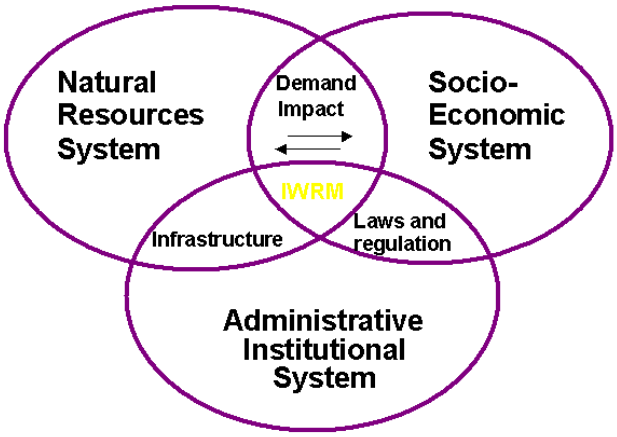

Figure developed by Leo Santbergen.

Administrative-Institutional System

IWRM can be implemented at a vertical as well as at a horizontal level. Vertical implementation of IWRM is integration in the "chain of command". This includes international conventions, national ministries, but also governance at the field level (e.g. water user associations). An example of vertical integration is when policy makers at the ministry communicate their thoughts on how integrated water resources management should be implemented to the field level. The horizontal implementation of IWRM is between different disciplines at the same level, for example technical engineering water manager who thinks of the implementation of a drinking water pump with a technology that allows everyone to use this pump, avoiding traditional or religious barriers that could exclude one specific group of the population.

The integrated approach aims at a polycentric, horizontal governance structure. At the higher level this means the breaking down of some of the traditional barriers between different ministries. In Yemen, this has resulted in the formation of a new ministry of Water and Environment, covering all water related issues except irrigation in agriculture, which remains under the Ministry of Agriculture and Irrigation. Another implementation of IWRM currently in the planning phase is expressed through a National Water Sector Strategy and Investment Plan (NWSSIP, 2005), which aims at streamlining the strategies and investments in all water related issues in the Republic of Yemen.

Going down to the field level, IWRM is more an awareness activity that aims to make water users realize how water is used and what can be done at the user level to conserve both water quantity and water quality. On this level, IWRM stresses the need of stakeholder participation. Common tools for reaching participation of users are multi-stakeholder platforms and water users associations. Stakeholders are all who use the resource, and all who will be affected by the implementation of interventions. Horizontal, cross-sectoral analysis identifies emergent problems and integrates policy implementation from different disciplines.

The intersphere of the Legal Administrative System and the Socio-Economic System

Water development initiatives (policies, programs, projects) often depend on forms of legal regulation as a major instrument to achieve a certain goal.

Attention to the role of law and norms in development policies and interventions has been rapidly increasing. This is especially the case with regard to the social-legal dimensions of natural resource use and management. Natural resource management strategies often entail the introduction of new laws, principles and procedures in contexts generally characterized by legal complexity. Some difficulties resulting from this complexity is the translation of the generic complex law into actions, as well as the need for capacity to enforce the laws. The IWRM perspective shows that those laws can not be implemented without concerning the different functions that water can accomplish, and the impact that the legal administrative system will have on different actors. Public participation could be a tool to ensure the applicability of the rules and regulations on the socio-economic system. In Yemen, the National Water Resources Authority (NWRA) is the main institute to implement the water law into actions and enforcement.

Socio-economic System

Public participation in water management creates commitments and willingness to act among different players and it brings new viewpoint and ideas, which enable policy makers to think out of the(ir) box. The fundamental rationale for undertaking public participation is to ensure the effective implementation of the water management plans and achievement of their environmental objectives, as well as to increase local awareness and involvement in water quality and quantity savings. Approaches to public participation for groundwater management in Yemen can be found in the community water management project (CWMP).

A gender sensitive approach to water management should not be limited to an understanding of the different of roles of men and women. The IWRM scope is broader; it tries to mainstream gender concerns by developing replicable strategies for enhancing gender sensitive approaches and empowering women.

A comprehensive understanding of all stakeholders and their relations can be achieved by open, shared information sources that fill gaps and facilitate integration. This can concern information management between different sectors or scales, as well as the information transfer from institutions to users. CARE-Yemen is one of the institutes that focus on this part of the IWRM sphere.

The intersphere of the Socio-Economic System and the Natural Resources System

The socio-economic system and the natural resource system interact in relation to water management. Water users demand a certain quality and quantity of water from the natural resource system, and at the other hand, the natural resource system can limit users in their practices. A clear understanding of the demand of all actors concerned in water issues is needed in order to implement successful and sustainable interventions.

These interventions can have impacts on the natural resources system which might easily be overlooked, either because the impact is far from the location of the impact in space or in time. As in many water resources development projects the broader spectrum of environmental impacts are not fully considered, environmental impact assessments are not conducted on a regular basis. As a result, some water resources development projects have suffered from unexpected negative environmental impacts. To minimize possible negative impacts of future water resources projects, the need for an effective management tool exists by which ancillary impacts on environment might be included in the project planning process.

The Natural Resources System

The water cycle is basic knowledge, needed to understand the effects and interactions between actors and systems. The IWRM approach aims at an understanding of interactions between resources on a basin level. This basin management concept enables a look at the whole water chain and the possibility to reuse water for different functions.

The impact of social activities on the natural resources system is obvious. Drinking water has become greatly affected as well as our ability to use water for recreational purposes. In Yemen, most regions are dependent on "old" groundwater, thus mining reservoirs filled in the past. In order to combat water pollution, we must understand the problems and become part of the solution. Natural resources must also be considered as a water user. Coastal zone ecosystems are often fragile systems balancing between salt water and fresh water availability.

The intersphere of the Natural Resources System and the Legal Administrative System

The overall objectives of the Yemen government are to focus on the traditional water harvesting system in the mountain terraces and to increase public awareness to optimum benefit from rainy water seasons. Planners and engineers need a clear understanding of the dynamics in the natural resources system and a comprehension of the demands of the end-users to design water allocation infrastructure at an appropriate scale. IWRM promotes a decentralized governance system for the infrastructure. Preferably, the end design comes from diverse sources.

When users pay for water and its infrastructure, they are ought to be more concerned with the operation and the maintenance. Diversifying financial resources, using a broad set of private and public instruments, enables to spread risks and finance integrated projects which include different scales and sectors.

Many issues in IWRM do not easily fit in one of the systems; they rather slightly touch upon different elements. This IWRM framework should only be seen as a method to enable us to clarify the concept. It helps to check whether no important IWRM elements are overlooked, and it helps in defining important topics to teach in the Msc-curriculum.

Our vision on education

The interrelationship between education and work should be constructive. To obtain this competency-based education is a prerequisite as otherwise there is the risk that the world of work and the educational system do not interact, and both parties do not listen to each other (Hughes, 1997). Competency-based education is concentrated on the usefulness of the content of education, the process of learning and the outcome of the total study curriculum instead of the traditional education system which is mainly based on teaching activities (Farstad, 2004).

The world of work has changed in the past years towards a world of work in which people have many careers in which several competencies are needed.

Skills such as entrepreneurship, teamwork and the like start to become increasingly important in education (Interlaken congress, 2001).

Competencies offered at the university should match to the needs of the society in which the student will find his/her profession in order to build a sustainable system in which education forms a base for development of a country. In this context, competencies are the set of abilities of the student to make use of knowledge, skills and attitudes expected of them in the everyday work in the Yemeni water sector.
For this reason the WEC study curriculum is developed with a strong focus on the demands in the current Yemeni water sector in which the IWRM framework plays a central role. Students will be guided to acquaint knowledge which is applicable in the Arabic regions. Though the curriculum does not only consist of gaining knowledge on important water issues. It uses the broad definition of learning; the scope is on all the competences that students need in their profession. The development of skills such as report writing and basic computer skills will be facilitated, as well as the ability to work in teams and to have a problem solving attitude.
The main objective of the MSc education in IWRM is to obtain an approach of thinking, analyzing and solving problems in stead of repeating text book approaches to non-text book problems. To allow this "problem oriented learning" to develop in a student group of different backgrounds, basic text book knowledge on a variety of topics is needed to allow the students to understand the language of the different disciplines.

Expectations for graduates

WEC wants to contribute to the highly required practical solutions to water security. It wants to accelerate and broaden the flow of workable ideas and solid knowledge in water management in Yemen. As such it wants to make the work of the University relevant to one of the major challenges in the country and beyond. WEC thus provides a linkage based on IWRM principles between academic knowledge and skills at Sana'a University and the agencies responsible for water development and management in Yemen.
Students start with a BSc-level diploma, mostly from a technical discipline. They have work experience in the water sector and are selected on motivation.
When graduated from the IWRM study curriculum, students should have developed competencies which are in line with those objectives of WEC. Graduated students are expected to be able to contribute practical solutions to water security issues in the Yemen. They will find employment opportunities in research, consultancy and policy agencies, and therefore they need a solid, interdisciplinary knowledge on water management. At the same time, the label "MSc" requires an academic approach to problems, allowing students with the skills and motivation to continue for PhD research.

Related to the program
Graduates are expected to have knowledge on IWRM related concepts. They need a basic understanding of technical disciplines such as hydrology and engineering, and should be able to identify aspects related to these. An insight in social aspects is required, including the institutional structure, public participation and gender issues. This knowledge is needed to form the basics towards thinking in a wider context.

Graduates have to apply the basic concepts to integrated disciplinary fields: integrated watershed management; integrated coastal zone management; integrated groundwater management and the water chain. Since these are "fields" of water management, specific problems will differ by region, time, and type of users. The problem oriented approach should prepare the students for the analysis of real life problems in a wide context.

During the MSc program students improve the basic skills needed for the course work, case studies and MSc research. They have to be able to work in small groups, and present their own findings. Students will develop skills needed in research, consulting and policy jobs, for which they have to be able to plan research and write research papers as well as research proposals.
During disciplinary courses students will get acquainted with disciplinary knowledge. They have to develop skills and knowledge to see linkages between those disciplines in order to comprehend the IWRM principle. The knowledge obtained during the fist semester should be applicable on actual water resource management problems.

Students should be able to mention social, technological, economic and institutional management options and instruments to solve interdisciplinary water issues and identify ecosystem functions and related goods and services in the watersheds and coastal zones in Yemen.
Students get involved in project planning. They should be able to design management options, identify project alternatives and their impacts on other functions or users, as for example upstream actions and downstream effects.

Related to courses
Students develop a basic knowledge on the disciplines hydrology, environment, agriculture, sanitation and waste water treatment, water use in rural and urban areas, economics, water policy and rights, public participation and gender.

Before the disciplinary courses students start with an introduction to IWRM, in which students are introduced to the important issues related to the development, use and management of the world's water resources. They are explained what the differences are between traditional ways of water management and integrated water resources management, and they are able to mention and explain which factors play a role in IWRM.

The course Water issues in Arab region follows with an overview on water resources situation in the Arab Region, the major issues and problems and case studies from representative countries of the region.

The discipline of hydrology is spit up in two courses; Introduction to Hydrology and Hydrology of Yemen. The introduction course has as goal to provide an understanding of the principles of hydrology and the main processes in the water cycle. After this course, students have a comprehension of hydrometeorology, water balances, groundwater aquifers and groundwater flow principles which they apply on the Yemeni situation in the course Hydrology of Yemen.

The Water and Environment course consists of two parts. In the first part a short introduction is given about water quality parameters. Furthermore, an overview

is given of water quality parameters of different water uses and water quality requirements for different water uses.
In the second part specific information is provided on the Water and Environment topic. Main issues are water pollution and effects on the environment. Effects of water quality and quantity on the environment in Yemen are dealt with through case studies about desertification, groundwater and coastal zone in the Yemen region.

Water Use in Agriculture gives participants insight in the relationship between irrigation and (food) production on global, regional, field and farm level. It explains the relationship between irrigation technologies and its social and institutional context and different forms of water use. Students learn to make determinations of crop water requirements and irrigation water demands and relate these to different field irrigation methods.

At the end of the subject Sanitation and Wastewater Treatment the participants should know about the source and nature of wastewater constituents; about sewerage systems, waste water treatment technologies and selection criteria of suitable wastewater treatment technology based on local circumstances.

The course Water Use in Urban and Rural areas also discusses water treatment and looks both at quantity and quality of urban and rural use. Participants get an understanding of production and distribution systems, both for conventional and non conventional water resources.

An understanding of the basic concepts of economics scarcity, efficiency, equity and sustainability will be developed in the course Water Value and Economics. Students will get an understanding of market failures and different types of costs. After completing the course students will be able to calculate the total cost of water for specific case studies.

During the course Water Policies and Rights students gain an insight in the institutional structure and dynamics of water rights in Yemen. They gain knowledge of Yemen water policy and problems of implementation and develop a capacity to interpret plural water rights and institutions as well as to analyze, design and evaluate water policy /governance strategies. These skills are combined to execute case studies on solving problems of water governance in the field.

For the course Public Participation students should be able to explain why public participation is important for solving IWRM issues in Yemen. The should be able to mention and explain governance styles and related roles of stakeholder groups; to distinguish different techniques for participation; to mention and describe subsequent stages and steps in developing community action plans. Students have to develop the capacity to interpret plural water rights and institutions, and to analyze, design and evaluate water policy and governance strategies.

In the first module of the course Gender and Water gender awareness exercises will be done to explain the concept of gender, and its relation to IWRM will be explained. The second module of this course focuses on the importance of

women and water, and their role in water user associations. It will be assessed how gender in water interventions can be mainstreamed.

In the second semester students develop skills to integrate these different disciplines. The courses in which this is done are Environmental Impact Assessment; Water Chain Management, Integrated Groundwater Management; Integrated Watershed Management and Integrated Coastal Zone Management. Those courses are more practice-oriented, and knowledge from the first semester will be used.

---- Skills related to diploma project and thesis work? No learning goals given for these activities yet.----

Organization

From the beginning onwards, the project has concerned the financial and institutional sustainability of the WEC as an important issue. Besides the WEC core staff and lecture staff, support lecturers from Egypt and the Netherlands were involved with the development of the curriculum outline. During the first year of teaching, the external support lecturers have given a one-week input to the Yemeni lecturers on topics in which they were less skilled. In the second and the third year, this external support was limited to fewer courses. Yemeni lecturers have the possibility to follow additional workshops in Yemen and abroad on specific IWRM topics.

The individual courses are given by groups of topic experts. These groups of topic experts, which consist both of Yemeni and support lecturers, have presented the course contents to each other to avoid overlap between the individual courses.

Within the project management the focus lies on remaining the ownership of the project with the WEC. The project coordinator visits the WEC frequently but does not stay for long visits. WEC daily business remains in the hands of the WEC staff.

This institutional support, which is approached interactively, leads to a sustainable program of the WEC.

Quality Control

To control the quality of the program the curriculum will be continuously evaluated. The curriculum and the institutions will be assessed of their merit.
The evaluation serves as a quality assurance, and it has a steering function. Suggestions can be derived from the evaluation for options and modalities which the WEC could use to adapt to changing university by-laws, evolving degrees or changes in the water sector.

The quality control includes a support of education, research and the Water and Environment Centre itself. Evaluations focus on academic quality, the content of the curriculum and the execution of courses. As there are no graduates of the program yet, there can not be an evaluation of the impact of the MSc-program on the water sector, or the functioning of graduates in the field of activity.

The WEC Management staff and the course coordinator continuously evaluate the overall curriculum. WEC staff and external staff together form a supporting curriculum committee. This committee evaluates the curriculum and the project and may make suggestions when new issues should be added. To make this assessment, the supporting curriculum committee uses the method of student evaluations for every course. Feed-back from the lecturers themselves is also valued highly.

Three external professors, who form the academic advisory committee, assess the quality of the program and its education. Its function is not determinative but the academic advisory committee may give suggestions.

Proposed changes in the program must be submitted to the WEC Council, which functions as final approval for modifications. It should be seen as a steering committee and its members are representatives of donors, departments and other actors. The international university network, in which Wageningen University (the Netherlands), Delft University (Netherlands) and Cairo University (Egypt) are involved, assures the quality of the project.

To be discussed (lacking in other documents):

- Which standards and criteria are used?
- Which activities are carried out?

References

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