The role of Practitioners
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KNOWLEDGE TRANSFER FOR ENVIRONMENT-WATER

INTRODUCTION

One of the focuses of the present ETNET 21 colloquium on "Knowledge Transfer for Environment-Water" is the role of the practitioners in the learning process:

The gap between education, research and practice in the water-field is recognised by many. Bridging the gap can only be achieved by involving the practitioners in education and training and more particularly in the long-life learning processes.

It is amazing how many water professionals mention this "gap", and since long. In 1995, the theme of the 26th I.A.H.R. Congress in London was the "Integration of Research Approaches and Applications". Four years later, in 1999, the I.A.H.R. added the word "Engineering" in its name to become the "International Association of Hydraulic Engineering and Research.
The I.A.H.R. membership was losing - and still not regaining - quite a number of practitioners. We did not succeed yet to regain them and something should be done about it.

Also in 1999, I.A.H.R. set up its European (regional) Division and asked me to chair the ad-hoc committee. I guess that one reason was my position as a practitioner, and living in Brussels. Water had to be put high on the agenda of the European Commission.

The water-field is vast and I will restrict this discussion to the role of the practitioner in hydraulics, more specifically in fluvial hydraulics, my preferred field of expertise. Nonetheless, I guess most conclusions could be applicable to other water-fields.

THE GAP BETWEEN EDUCATION, RESEARCH AND PRACTICE

Before discussing the role he could play in the learning process, let us try to define the practitioner. According to the Webster dictionary, a practitioner is:

"One that exercises an art, science or profession (as law, medicine, or engineering)".

How can these practitioners to be made to help bridging the gap?
By integrating rather than segregating them. We need them to check if the output - the tools and the engineers - from our research institutions and education system fits the needs of the end-users.
We have therefore to consider the interaction between the various players, the actors in the water field: the clients, the funding agencies, the researchers, the educators and the practitioners. We have to face a fact: the practitioner is not very much involved in research and education, less than before. Yesterday, John Davies said that only a small number of experts are available for advanced courses for short periods. He said also that there is a lot of Distance Learning material for basics, not so much for specific matters.

Let us see how the relationship between these actors evolved in the past and what has changed in recent times.

Research
At the 22nd biennial I.A.H.R. Congress, Jean Cunge (1987) stated in his keynote lecture about numerical hydraulics modelling that the "golden age" of experimental hydraulic research from the thirties to the early sixties - the era of the laboratories - benefited from the experience of their leaders who often were simultaneously engineers involved in engineering practices (the practitioners), fluid dynamics specialists and experimenters (the researchers). Many of them were also involved in education, teaching in their respective domains (the educators).

At that time, most research in the water sector in Europe was conducted in state-owned or university institutes, but also in private research laboratories that were benefiting from research under contract funds. Engineering studies, especially using models were highly appreciated. Being innovative, they were highly remunerated, so much that the remuneration provided research funds for private and public laboratories. Hydraulic research based on "physical" or "scale" modelling reached its culmination point in the sixties. In the seventies, scale models were progressively replaced by mathematical models and the advent of the microcomputer produced a revolution in the eighties, making the tools more widely distributed and user-friendly. Today, hydroinformatics is the new fashion. Scale modelling became a routine activity and at the same time too costly to perform in Europe or North America and has been progressively, whenever possible replaced by numerical modelling, leaving physical modelling only for specific domains. European Laboratories have set up hydraulic laboratories in the Third World so they can run scale models at lower cost.

Privatisation of state-owned research institutes was successful for some, not for other. For all, it was the beginning of difficult times, with the search for contracts taking a large share of the engineer’s time. Operational costs - at least the visible ones - grew and fierce competition replaced the former collaboration between the researchers belonging to different laboratories. It is all business now. University research institutes underwent a parallel evolution, as funding of research in the water-field declined, first in the USA in the seventies, later in Europe. University researchers had to find projects so as to keep sufficient personnel, with contract money. Some research institutes have become truly

commercial, what does not benefit to the customer of research results, i.e. a practitioner.

Clients (i.e. investors, contractors, etc.) and practitioners believe sometimes blindly in modern tools such as numerical models. How often do I hear that the numerical tool for solving a particular engineering problem exists, while the limitations are not told, especially in fluvial hydraulics. Many researchers developing models have insufficient knowledge of real-life situations. Researchers need to publish for their professional career. The quantity of research papers is high, not always the quality, and there are too many papers in my view. The topics are often chosen because of personal interest, or because of the present fashion, rather than because of an end user's need.

Education

When I was studying at university, the majority of our professors in engineering had no PhD. Today, it is impossible to become a university professor in Belgium without a doctorate. Today, many of our university professors have a neat career, straight from good graduate to post-graduate student, to assistant and then professor, without any practical working experience. I noticed in the report presented yesterday by BEST the following opinions about study curricula:

Very theoretical-oriented teaching. Research oriented-training. Link with real world? (Comment made about one of two kinds of systems reported in France).

Learn people a way of thinking, problem solving, adapting to new situations.

Faculties (to) ask their employees (teachers) to work 1-2 years in research - practice is not mentioned - and then work 1-2 years in teaching. In this way, teaching should be better appreciated.

Many interesting issues and thoughts are presented in the BEST document. The survey reveals also how different are the situations in the various European countries.

Today, graduate and post-graduate students are confronted with modern tools such as numerical models, but they often do not get - or keep - sufficient insight in the physics. In fluvial hydraulics, to take again this example, the physical environment is most of the time not discussed; in an exercise on floods, water flows with a set of equations, but the importance of the geomorphic setting is most often not, or not well considered.

Today, we still miss good equations for simulating sediment transport, but worse, we still do not understand its mechanisms. The behaviour of rivers is handled with primitive concepts, based on poor understanding of how rivers really function. This is why in my daily work I am confronted with so many failures in hydraulic engineering, for which the hydraulic engineer is blamed, giving a negative impression to the profession.

Training courses are mushrooming, a source of income for university departments, but not all have the right level and content. Some of these courses are given by university professors who are lacking sufficient real-life experience.

Consultancy

Previously, we had the research institutes, the education institutes, the consultancy (firms and independent experts). Each one was complementary to the other. The research institutes were working to develop knowledge, so that the tools could be built. These tools were taught in the education institutes to students who would be oriented to research, education or consultancy careers.

Today, we have the research institutes, the education institutes and the consultancy firms or individuals competing for the same jobs. How many consultants have faced unfair competition, when a university professor is bidding on the same project, obviously with lower salaries, with biased costs?

In consultancy, a comment frequently heard is that students are not well prepared and that they lack physical insight. In their education, a lot of attention is paid to basics, but young engineers do not remember the basics if they were taught in a too theoretical way. When confronted with difficult engineering problems, they often lack the capacity to think in physical terms and start to use tools such as numerical models in an inappropriate way.

HOW TO BRIDGE THE GAP

About Research

Practitioners should be more involved in the research domain, by providing the field experience and knowledge needed to build tools such as mathematical models. Though field observations are scarce, there are project data of good quality that were never used to understand the physics of the processes to be modelled. Examples are flow resistance in alluvial rivers, or sediment transport mechanisms, or morphological behaviour of rivers. Researchers tend to rely on their own observations, which are usually collected in laboratory conditions, not in the field. The physical understanding is now most often with the expert practitioner but his experience and knowledge are badly used in the development of models.

The real-life experiences are poorly documented. We need to organise the feedback from practice to research. We need papers and teaching courses included in curricula on the successes and failures of engineering projects. Where do we find them today? Please, have a look at the Journal of Hydraulic Research: few papers with real-life information. I.A.H.R. has recently started agreements with engineering journals, but these are mainly dealing with the construction aspect of hydraulic engineering. This will not attract more practitioners to the association unless new class of papers linking construction aspects to hydraulic/hydrology/hydroinformatics will appear.

The practitioners form a small group within the I.A.H.R. membership. We need attract more them by offering the kind of information they are looking for. All over Europe, engineers in the public and private sector have difficulties to find the right information, to identify study programmes, to set up terms of references of projects, to organise data acquisition campaigns, etc.

Last but not least, the national and European research budgets are too low for developing the tools we need to handle, even for the most urgent needs, like for flood problems. One of the results is an unfortunate behaviour of some consultants hired for project's development and implementation in the Third World. I have worked for almost nine years in Bangladesh as project adviser in the Flood Action Plan project, called the River Survey Project, funded by the DG 1 of the European Commission. We have in Bangladesh the best examples of how development money is used to develop tools that would be used later for other studies. I always felt this unacceptable, because the money has been spent not to the direct benefit of the country but to have European consultancy firms building up their own capacity. Everybody agrees today that we need good models to study floods in Europe, but I can not understand why we need to rely on development money to set up these models, and the survey techniques. It should be done with our own national or European budgets. It is also striking to compare the significant budgets for developing modelling tools, with those, in comparison rather insignificant, allocated to the field observations and data collection.

Somebody mentioned yesterday the lack of communication and co-ordination between the D.G.'s in the European Commission. Some time ago, I suggested having research projects funded by the EC DG Research linked with development projects funded by the EC DG International Relations.

About Education

Our education is more and more dominated by theory. I have already mentioned for Belgium the requirement of a PhD to become a university professor. The distance learning and the virtual laboratories might be opportunities to get the input of those having real-life experience, provided that they are also practitioner-oriented, not limited to the universities, and that they are interactive both directions. Doing this, we could have at least two professors for one course: one proficient in theoretical aspects, the other in real-life situations. However, I am afraid that the implementation of the Bologna declaration will make things more difficult. Practitioners could have a significant input in education by making available real-life experiences. Case studies could help illustrating the variety of situations, to show why a given model works in one particular river and why not in another. Al this may help the students to become more critical, more aware of the limitations.

Practitioners should be more involved in training courses and in life-long learning, especially for ensuring the continuity in expertise, as in some domain experts formed a long time ago are progressively retiring one after the other, as is the case in fluvial hydraulics.

About Consultancy

In the consultancy world, time is money and money is scarce because the fierce competition brings the budgets for studies and project down. I feel it is a good idea to have a practitioner participating in training, writing down his personal experience, so that it would be available for future research and education. But who will pay for his time?

In my opinion, we need at this stage to involve other actors: the international water-related associations, European Institutions and organisations (especially the European Commission), and the funding agencies. Why not to include an item for follow-up and assessment in the budget of engineering projects?

About the Funding Agencies

The funding agencies are many: the banks, the development agencies, the national or regional governments, the European Commission etc. How many projects have ended without real follow up, because of many reasons among which the inadequate institutional setting in the recipient countries, also because the inappropriateness of the tools transferred. About the International Organisations

Scientific organisations are involved in the dissemination of information, with the help of practitioners. One example is WMO, publishing manuals. However, improvements are possible, even needed. Practitioners should be involved in establishing guidelines for the use of manuals under the sometimes very different situations found around the world.

CONCLUDING REMARKS

Some members of the European Division of I.A.H.R. had developed the idea to build a Centre of Professional Interest (CPI). I will not give now details about this idea, just to say that it would be a system by which professionals could be helped in their search for information as individuals, independently of their administrations, firms, etc. Latest News and Keywater, the tools developed under TECHWARE and now operating under ETNET 21, could be used in the CPI, which should be financially self-supporting and open to the practitioners.

I have tried in my presentation to set the scene, so that we could assess the chances to see the practitioners helping to reduce the gap between education, research and practice. For me, it is clear that this gap is currently growing even more.

The tools discussed in the workshop are developed under the impulse of your world. We, the practitioners, look at this with both amazement and scepticism. For me, who tried to assist André Van der Beken in all his initiatives, this ETNET 21 is another of his attempts to have things changing, improving. I can only hope some outcome that could be proven to be sustainable.

REFERENCE

Cunge J.A. 1987, "Numerical Hydraulics Modelling; Late '80s context and cross-roads," Proceedings Technical Session, XXII IAHR Congress, Lausanne