Academia contribution to risk assessment and water quality management: tools and lessons

Session report, 16 January 2015

Session Structure

The session was convened by Joan B. Rose, Michigan State University, who begun providing an overview presentation on the challenges and contributions the academia can make to support the realization of the post-2015 development goals in relation to monitoring and improving water quality, and some examples and tools that can serve to that purpose. The session continued with a panel discussion with different water quality experts, including: John Fawell (Independent consultant, UK), Hung Nguyen (School of Public Health, Hanoi), Rosina Girones Llop (University of Barcelona) and Maureen Taylor (University of Pretoria).

1. Implementation challenges for addressing water quality

Risk assessments and water safety plans can be extremely useful frameworks to address water quality challenges

Water quality degradation is with no doubt one of the major challenges humanity has to face in the years to come. It is not only a major threat for the environment but also for human health and global water security. Addressing water quality management requires the development of comprehensive frameworks to define the status, risks and trends in water quality but also specific frameworks and tools are required to provide appropriate policy and investment advice to achieve changes and improvement in water quality around the world. The risk analysis (comprising risk assessment, management and communication) is a useful framework to systematically address water health risk ie. water quality assessment. Likewise, water safety plans are effective tools in guiding management decisions to improve water quality status and reduce health risk exposure. Both tools are in fact the basis of WHO's Framework for Safe Water.

Yet the implementation and use of these frameworks remains difficult, especially in developing countries, due to the lack of technical capacity and their acceptance. Barriers also arise because health goals and targets associated with pathogen and contaminant reduction associated with sanitation and wastewater treatment has not been defined yet. The Academia can play an important role in generating adequate knowledge to support the definition of these targets as well in building the skills required for undertaking risk assessments and water sanitation plans. Such skills can be used for water quality management system to effectively apply framework to assess, predict and manage risk.

We need to invest more in water quality diagnostics and monitoring to achieve the best return on water improvements

Post 2015 Millennium Development Goals (MDG) include water quality for the first time because of the increasing risk water pollution means for human health, but also because it is quite possible to improve sources that deliver unsafe water. Improvements in water quality call for developing capacity building and this requires further investments in training and equipment, especially to address the chemical pollution. Such investments might be relatively modest and when used properly, they can save a considerable amount of additional and unanticipated costs at a later stages (eg. health costs), and underpin drinking water quality standards. Greater efforts are also required in monitoring. Unless we know what the quality of the water is to start with it is difficult to ensure that improvements will deliver the required quality as well as quantity and convenience. In this respect, investment in two types of monitoring are required: 1) Investigate monitoring to understand what important contaminants might be present in a water source and what changes are occurring over time; and 2) in operational monitoring as a means of checking that system keep working properly over time.

We need to train future water analysts and scientist using a multidisciplinary holistic approach

Achieving a desirable water quality requires investments in terms of the technology to be applied but also in developing a wide range of skills. Future water professionals would need not only to have technical skills that allow them to carry out diagnosis and monitoring activities, but also others related with how to interpret the implications of test results, including economic aspects and resource management. Such training will equip future water analysts with the necessary skills to support the development of adequate national and institutional capacity to ensure a sustainable programme. In developing regions like Africa, such training present challenges as many water analyst will come from resource-poor settings and equipping them with very technical skills e.g. for pathogen testing, will create expectations which may or may not be economically feasible in their home countries. To overcome these barriers, a more dedicated and sustainable funding model needs to be developed in these countries in order to implement these sustainable training programmes.

The Academia is meant to play a role in reaching these ambitious training requirements, and one effective way could be through the development of global and regional water quality centers of excellence, in order to achieve testing and educational opportunities to meet the needs for human resources in the water arena. Otherwise it is very doubtful whether the global goals for safe water and sanitation can be achieved.

2. Addressing the challenges: Developing and using tools

There are different tools, guidelines and other resources developed and used by the academia that may be useful to address implementation challenges and help improving water quality challenges

Cases discussed

Financing: Investigative monitoring by John Fawell, Independent Consultant

Further investments are required in investigative monitoring to understand what important contaminants might be present in a water supply or proposed water supply prior to improvement. A case study in Bangladesh where tube wells contaminated with arsenic was presented, to illustrate

the huge costs this problem caused in terms of human health and remediation measures, and how these could have been avoid with appropriate investigative monitoring.

Governance: 'Water supply and sanitation systems in Thau Thien Hue province, Vietnam' by Hung Nguyen, School of Public Health, Hanoi, Vietnam.

Most of the water related programs have focused mainly on the quantitative aspects such as water supply, sanitation coverage and number of water facilities whereas water quality is often not addressed appropriately. Water quality that comprises drinking water, wastewater and sanitation constitutes an important feature for health, well-being and the environment. The challenge of water quality management consists of the lack of a comprehensive framework that allows the use of science to assist in development of adequate policy for water quality management and translation of science into action. A case study on water supply and sanitation system in a province from Vietnam was used as an example to discuss the above-mentioned topics. This case study was used to discuss how the Water Safety Plan (WSP) and the risk analysis framework developed in Vietnam can be used to integrate science and policy and promote the translation of science into action, applied in water quality domain.

Technology: 'Management and use of Water Resources in the European Union' by Rosina Girones, University of Barcelona, Spain; European Union; NEED Watershed Coalitions.

The management and use of water resources has been the focus of European Union (EU) water policy for many years. Several Regulations and Directives have been approved over the years to address different water-related challenges. The Water Framework Directive (2000/60/EC) to a large extend has acted as an umbrella piece of legislation that embraced all the water-related Directives. The WFD targets the quality of water bodies with the aim of ensuring a sustainable use of water resources protecting the ecosystems and the human health. It is well known that improperly treated wastewater may lead to the transmission of pathogen viruses that are excreted in feces and urine of humans and animals at high concentrations. The EU-FP7-funded VIROCLIME project was developed with the aim of testing the presence of virus pathogens across different case study area through the use of so-called 'Microbial Source Tracking (MST)' tools and see how different levels of wastewater treatment could reduce the exposure risk to these viruses.

Capacity Development: 'Analysing water contaminated with pathogens' by Maureen Taylor, University of Pretoria

The analysis of waters contaminated with pathogens, should be approached from a multidisciplinary perspective. Management, economists, technicians, and scientists should be involved with the training and analysis. In addition, there should be opportunities for continued professional development.

3. Lessons learnt from implementing the tools

Hung Nguyen outlined that implementation of the WSP in Thau Thien Hue province, which was developed in close collaboration between scientists, water utilities and the local government, has brought important and positive outcomes in terms of increasing communication among all involved stakeholders as well as socio-economic benefits resulting from improved health conditions. Meanwhile, this join exercise has also delivered operational benefits resulting in the development of laboratories for monitoring purposes and new treatment plans.

John Fawell highlighted that investments in developing analytical capacities, including qualified training, developing appropriate monitoring tools and equipment are key to address the water quality challenge and reversing the negative impacts on human health and the environment. He remarked that so far we don't have enough water quality specialists, and technical expertise is not just required for improving monitoring for also addressing the impact pathways.

Rosina Girones outlined that the MST tools developed within the EU VIROCLIME project, have proven to be very useful to quantify the presence of human and animal pathogen viruses in sewage waters and demonstrate how the presence of these viruses significantly decreases as the level of waste water treatment improves i.e. from secondary to tertiary treatment. From a water management perspective such results evidence the need to enforce and promote management of wastewater in order to reduce environmental but also human health risks. Climate change scenarios predict an increase in extreme events like floods across many areas, which could exacerbate the dispersion of viruses and associated risks. Under these circumstances it becomes key to improve wastewater management.

Maureen Taylor emphasized that capacity development and knowledge sharing is a key to better understand the links between water quality and water-related diseases, especially in African countries. This capacity development embraces further training in different aspects like short courses related to water, sanitation and food safety, but also more advanced research on health risk assessment. However, existing resources are today mostly allocated to other issues like HIV. Another important challenge is the incentives to carry out these trainings being rather small so far. Training candidates would like to gain this expertise to put it into practice back home and develop a professional career, but opportunities are limited in many cases, and this will require creating the right incentives.

5. Conclusions

Science can play an important role in addressing some of the major water quality challenges i.e. through investigative monitoring, development of tools including risk assessment and WSP. But for this to happen there is an urgent need to address the communication gap and professional isolation existing between Academia, Governments and other related actors.

Complexity of water and social problems is expanding and the 21st Century water curriculum needs to be aware of it and be ready for training future water professionals to undertake multi-disciplinary and even trans-disciplinary research water agendas. This ambitious goal also requires the support of governments and public funds to promote the creation of centres of excellence with a long term vision to address the future water challenges.

Session Photos

Discussion panel: from left to right John Fawell, Maureen Taylor, Hung Nguyen, Rosina Girones and Joan Rose.