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Abstract

Today's water sector is governed by some hot topics, and this is no different in Belgium. As for the International Water Association (IWA), the goal of its Belgian division (B-IWA) is to gather different stakeholders, i.e. academics, policy makers and people from industry active in the (Belgian) water sector and trigger the debate. In May 2015, a first Nocturnal was organised to accomplish just this. Seven hot water topics, proposed by participants at the time of their online registration, were addressed in rotating round table discussions. These topics included resource recovery, micropollutants, water scarcity, hydroinformatics, integrated water management and modelling, technology vs. legislation and Computational Fluid Dynamics in water applications. The lively discussions led to the idea of this short contribution describing the outcomes of these round table discussions, along with some additional research on the topics. Main conclusions include the need for education (both of scholars and young professionals), inter-domain communication and the growing importance of IT in the water sector.
***Keywords**: water sector, legislation, industry, informatics, education*

1. Introduction

It has become very clear lately that water in general is a hot topic worldwide. The World Economic Forum, the UN Millennium Development Goals (MDGs) and several other international entities pose water as a resource with high associated risks and impacts and with an increased need for technology and its transfer (World Economic Forum (2015), Millenium Development Goals Gap Task Force (2015)). Especially in the context of sustainability, water takes up a key role. It is "a key resource (...) for which sustainability assessment is needed to preserve (...) the resource for present and future generations" as stated on the European level (Sana et al. (2012)). On an international level, the United Nations' Sustainable Development Goals (SDGs), the successor of the MDGs, provide the clearest message (United Nations (2015)). In contrast with the MDGs, a lot of SDG targets apply for the Western world as well, e.g. the target of increased recycling and reuse. Stuchtey (2015) is optimistic and states that water is not only a huge challenge but also an opportunity, e.g. within the circular economy paradigm.

Whether a risk or an opportunity, it is clear that water is closely linked with society and sustainability. The Belgian division of the International Water Association (B-IWA) recognizes this link. During its first ever Nocturnal, round table discussion sessions were set up and Belgian water professionals with different backgrounds were asked for their opinions and insights. What follows are the conclusions and suggestions that were gathered from the discussions.

2. The Belgian hot water topics

The topics covered during this stakeholder event are listed in Table 1. These were suggested by event participants upon registration, which ensured a large involvement during the discussions. Table 1 also gives, in some key messages, the most important outcomes per topic, for the sake of completeness. Because elaborately reporting the outcome of every separate discussion would cause this contribution to lose focus, the authors opted to describe the three main conclusions that were a common thread throughout all discussion sessions.

2.1. The growing importance of information technology (IT) in the water sector

IT is everywhere these days, and this appeared to certainly be valid for the Belgian water sector as well. The central role data and IT play in the water sector today, both in expected and less expected fields, became very clear. Three items that deserve more focus could be

Table 1: The seven topics discussed at the first B-IWA Nocturnal, along with a short description of the topic-specific outcomes. This table is added for the sake of completeness; the major part of this contribution will go deeper into the three general conclusions.

Discussion topic	Outcome
Resource recovery	• The order of resources to recover was agreed to be first water, then nutrients and then energy. • Criteria for efficient resource recovery are: Life Cycle Analysis (LCA), balanced supply and demand and safety. • Specific actions to take for a fast resource recovery paradigm shift include environmental cost accounting and a paradigm shift in design and production.
Micropollutants	• The precautionary principle is the right choice to steer legislation. • The choice for reduction at source or end-of-pipe depends on a multitude of factors, including pollutant source and technical or practical feasibility.
Water scarcity	• Belgium is a water-scarce region, but is not experienced in that way by the public. • Legislation and information are the perfect tools to tackle the Belgian water scarcity.
Hydroinformatics	• Data (availability, treatment, management) is becoming increasingly important in the water sector. • Sharing of data and software is felt to provide a faster way forward.
Holistic water management and modeling	• Flexible software, a sound uncertainty propagation and coordinated effort are key in tackling holistic issues that have different time and space scales.
Computiational Fluid Dynamics (CFD) in water applications	• There is a discrepancy between the use of CFD in academia and industry. • A knowledge gap is present between the potential of CFD and its current application.
Technology vs. legislation	• Four interaction scenarios between legislation, industry and research were identified. The main need is the one for correct communication.

distinguished in several of the discussion sessions. An internet search revealed that also on a European level, these items get a lot of attention.

- Data: first of all, with increasing possibilities to gather digital data, sufficient data storage capacity is needed, whether on local drives or using cloud services. Secondly, and more importantly, the technical implementation of saving data is not just a matter of putting the data onto a drive some where. The data format used, incorporation of clear metadata, interoperability between different data sets and automated data validation are essential to streamline the data chain into both a research and industrial setup. When implemented properly, this leads to increased efficiency and diminishes the risk of losing data (and money). The WISE (Water Information System for Europe) partnership, the European Environment Agency's Water Data Center and the Big Data Europe project are good examples of how Europe supports this increased need for data storage and availability (Water Information Systems for Europe (2016), Water Data Center (2016), Big Data Europe (2016), Hering et al. (2010)).

- Specialized IT knowledge and education: Even if data is stored in a consistent way, it still may be hard to handle the large amounts. The ability to handle a pile of data and convert it to usable information is estimated to become a big asset for any water professional. Europe acknowledges this by for example providing the EuroAquae+ Joint Master Course (EuroAquae Consortium (2016)), offering master students a "state-of-the-art learning experience on the use of hydroinformatic tools for smart water management".

- Standardized approaches: The methods and procedures bringing data to the user and the automatic work-flow for this would benefit a great deal from being generally applicable. Standardization is a key point to achieve this and it should be a collective effort of the water sector to set up and follow these data and procedural standards. On an international level, the Hydrology Domain Working Group, for example, develops standards for interoperable exchange of hydrologic information (Looser et al. (2014)).

2.2. Inter-domain communication

The statement that efficient communication can lead to great results is hardly surprising. It was however, still one of the most recurring remarks during the round-table discussions. In general, three entities can be defined in the water sector, between which communication can be

improved a great deal: industry/utilities, academics and policy makers. A few examples mentioned during the discussions are described, indicating how improved communication between stakeholders can help the water sector and society as a whole.

A first example is situated under the topic of resource recovery. Balancing supply and demand was agreed to be one of the prerequisites to make resource recovery in the water sector a success story (Table 1). Previous experiences have shown that it does not suffice to 'have a product' that the market might not be interested in, nor is it good practice to produce quantities that only make up a fraction of the market demand. Examples include nitrogen (Belgium is nutrient-saturated (Coppens et al. (2013)) and buyers for recovered nutrients are hard to find) and phoshorous (worldwide synthetic fertilizer use exceeds potentially recovered struvite production by two orders of magnitude (FAO (2012), Rahman et al. (2014))). As a lot of resource recovery paradigms are currently in the process of making the transfer to industrial scale, it is clear that communication between academics and industry/utilities is a crucial factor to make this work.

When it comes to defining policies, it is the complete three-way communication that needs to be effective. An example here is the use of the BATNEEC (Best Available Technologies Not Entailing Excessive Costs) principle to base policies on. The BATNEEC principle was introduced in EU legislation in 1984 to regulate industrial air pollution. It indicates what the best technologies for a certain pollutant mitigation are, while also providing a definition for 'Excessive Costs' that should be avoided from an economical point of view. In this context, academia provides an insight in the best technologies, while industries provide feedback on the availability' and economic part. Successful implementation then of course entails a correct communication towards the policy level, which has been a bottleneck ever since the adoption of the principle (Sorrell (2002)). Another possible downside coming from an excessive trust in a principle like BATNEEC is the fact that current economic approaches are not always good at taking into account all (environmental) costs involved. The appropriate implementation of the BATNEEC and many other policy principles is thus also based on a mutual trust between communicating stakeholders.

Sector-wide networking events, like the described Nocturnal also was, are one of the classic ways to increase the stakeholder communication. To ease this communication, it is important to at least understand one another, which is where multidisciplinary education takes a very important place. Being the third pillar of the Nocturnal outcomes, education will be discussed in more

detail in the following section (Section 2.3).

2.3. Water education, training and information

Education, in a very broad sense, is a last keyword to take home from the round table discussions. It occurred in a number of contexts and was deemed of relevance on different levels.

2.3.1. Low level education

Wherever higher education at universities is mentioned, it is often forgotten that this education is building further on lower level education. This does not necessarily imply knowledge, but can also mean the stirring of an interest in (water-related) science by for example an external speaker or a visit of a Wastewater Treatment Plant. Especially for the topics where mentality change is one of the bottlenecks (like resource recovery or water scarcity), it is important to provide correct information from a young age. The aim of increasing water-use efficiency by 2030 (United Nations (2015)) can only be reached if also children get this message. Moreover, as was pointed out in Section 1, sustainability in general has everything to do with the future. A sustainable future can only really be sustainable if it starts with children and their education.

2.3.2. High level education

Higher level education becomes of larger importance in the fields where knowledge itself is a limiting factor in making progress. In case of the use of Computational Fluid Dynamics (CFD), for example, CFD software applications are increasingly available and improving in quality and user convenience, but in order to get valuable results, a thorough physical and mathematical background remains a *conditio sine qua non*. This appropriate background can only come from a high level of scientific education. Also IT-related progress, which is gaining importance as indicated in paragraph 2.1, is currently to a certain extent hindered by a knowledge gap. The limiting element in both examples is the fact that their education in Belgium is mostly taking place under civil engineering departments, which is not where education on water (wastewater treatment, hydrology...) is usually done (environmental engineering departments), hence the crossing of both will take time and effort.

Both examples also indicate the importance of multi- and interdisciplinary education. Very specific ways to accomplish this would be, for example, to give scholars and students not only the opportunity, but also to encourage them to take courses that at first sight do not relate closely

to their major, or to do an internship that requires them to think in a different way then they are used to.

2.3.3. Public information

During a lot of discussions, the limited knowledge on water of the general public came forward as an impeding factor for a number of proven and perfectly safe technologies. Also policies could benefit a great deal from an educated public.

A first example of a not or misinformed public appeared to be the disbelief of some about the fact that Belgium is in fact a water-stressed region (European Environment Agency (2016)). Despite being blessed with considerable rainfall (750-850 mm/yr), water availability in Belgium is low due to a combination of a high population density ($\pm$360 inhabitants/km^2), intensive agriculture and important industrial production, causing a high water consumption. The disbelief is likely because of the fact that, up to now, no one has to fear an empty water tap at home on a regular basis, making that the prevalent scarcity is not experienced in that way.

Another example to illustrate the impact of public information on technology adoption is the recovery of resources from wastewater. People generally do not like the idea of waste being recycled back into products. Also water treatment challenges such as the removal of micropollutants could be partially resolved by good public information. Campaigns can be set-up to limit the use of some of these components or advocate the use of alternatives. Providing the correct and maybe even inspiring information can not only convince public opinion, but will in its turn have a big impact on policy.

It is believed that a well-informed public opinion will communicate its wishes, be it about water saving measures, resource recovery or other areas, to the political domain which in turn will provide the legal framework to support change. This makes clear that it is of great importance to pay attention to communication with a broader public. This same thought is also incorporated in the Water Framework Directive (European parliament and EU council (2000)) and the Flood Directive (European parliament and EU council (2007)), both providing guidelines for public participation (Albrecht (2016)).

All of this, however, remains a major challenge in Belgium. One reason for this could be the fact that it is hard to assign the responsibility of '*education of the public*' in this matter. This makes that progress does happen, but it does so rather randomly and thus slowly. To bring

more structure in this, it was decided on a national level to organize a second B-IWA Nocturnal, themed 'increasing water awareness' and meant to reach a broad audience to stir discussions on how to improve water education, training and information in Belgium.

3. Conclusion

All three conclusion themes (IT, communication and information) discussed in this short contribution are of course very interconnected, and should be viewed as synergistic themes that together can move the water sector forward. Interdisciplinarity is felt to be the appropriate keyword to describe the outcome of this first Nocturnal.

The results of the held discussion sessions will be used by the Belgian division of IWA as inspiration to organize events with a clearly defined theme, where as many stakeholders as possible are present and where specific results can be communicated to the Belgian water sector as a whole. As mentioned in Section 2.3.3, the second B-IWA Nocturnal, focused on increasing water awareness towards a broader audience, is the perfect example of this.

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