River basin digital twins as a platform for IWRM and collaborative decision-making

Jan Kwiatkowski

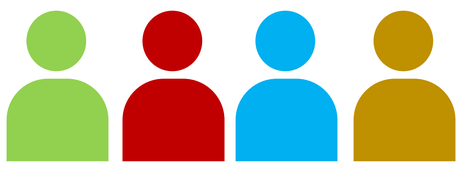
*DHI A/S, Agern Allé 5, DK-2970 Hørsholm, Denmark, jkw@dhigroup.com

INTRODUCTION

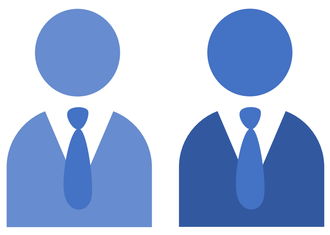
Public participation is an essential component of Integrated Water Resources Management (IWRM) as it plays a crucial role in ensuring that water management decisions are inclusive, transparent, and reflective of the diverse needs and perspectives of stakeholders. The involvement of the public in the IWRM process helps to build trust, foster cooperation, and create a sense of ownership and responsibility among all stakeholders. Public participation in IWRM can take many forms, including public consultations, public hearings, stakeholder meetings, and community engagement activities. The use of digital platforms which integrate data, models, scenarios, and decision support tools within the public participation process are still rare, probably due to the high initial effort of implementation. However, unlike traditional channels, digital technologies are offering multiple opportunities for governments to foster optimal flows of information, as well as to engage meaningfully with stakeholders in new online spaces [1]. It should however be noted that in the current fast-paced digital age public discussions conducted around paper reports with thousands of pages are probably not the optimal way to seek for engagement.

The need for deeper engagement with the public and stakeholders will be strengthened by the impacts of climate change on hydrological patterns. Today water shortages haunt many river basins with increasing frequency, making meeting demands with available resources in a sustainable way increasingly challenging. Flood events will also inevitably be more frequent and dramatic in outcomes.

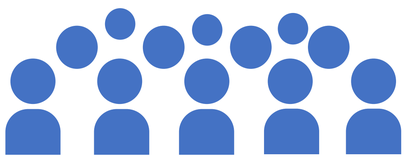
Decision support systems (DSS) for advanced water resource planning and water efficiency optimization have been evolving over the last decades and are becoming a powerful tool supporting fact-based integrated water resources management (IWRM). Digital twins of river basins powered by simulation engines are at the heart of such systems. Technology advances within in-situ measurements, data transmission, databases, meteorological forecasts, climate models and projections, satellite earth observation systems, cloud computation, etc. make DSS's increasingly effective and feasible in terms of implementation. There are numerous benefits provided by such systems, however, in the context of IWRM the use of a DSS to support collaborative decision-making ensuring transparency and a science-based data foundation, seems to be one of the key values.



Stakeholders

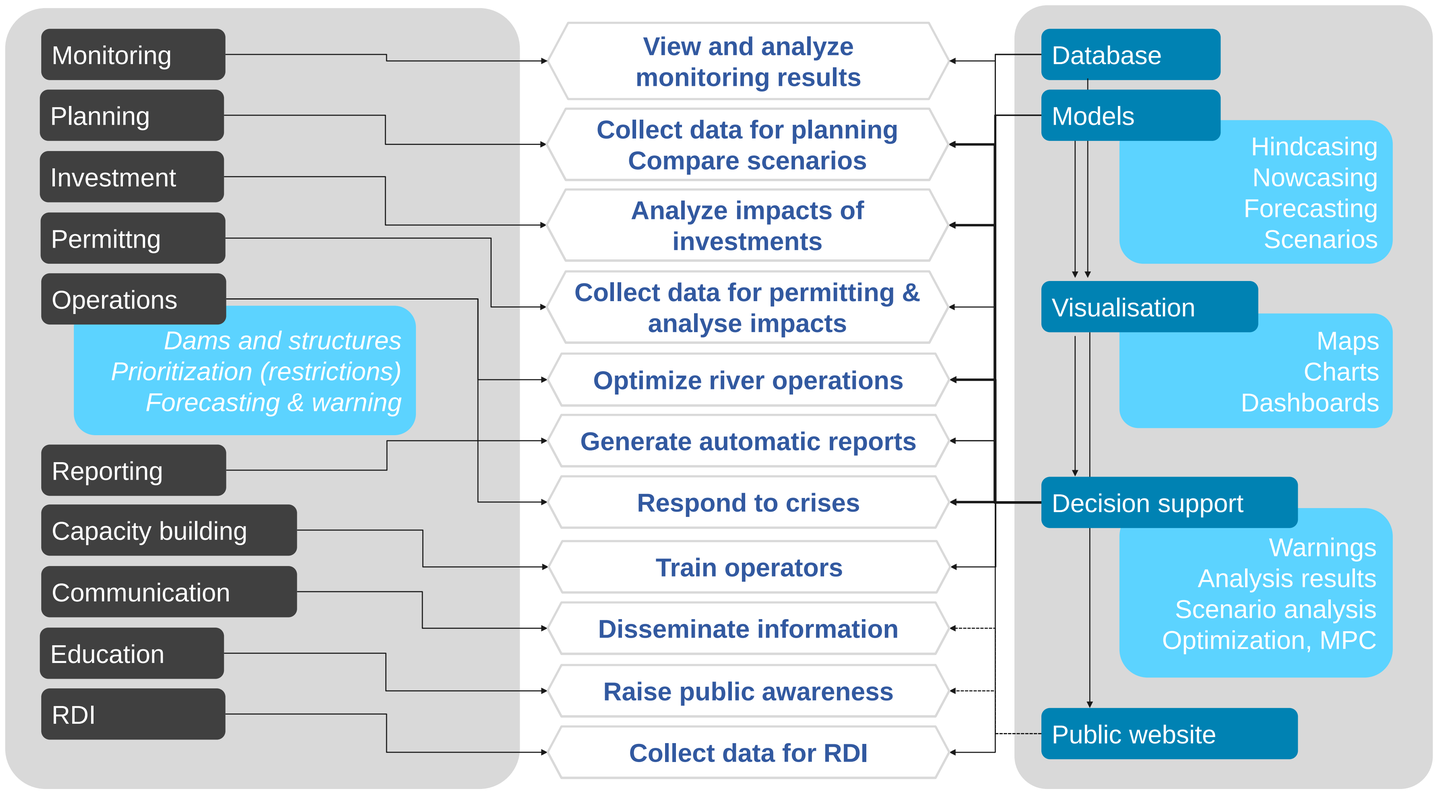


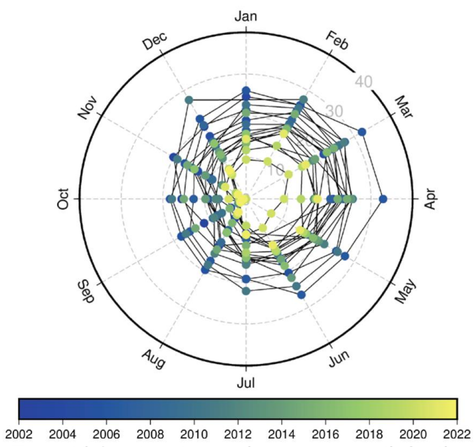
Decision makers



General public

Earth observation





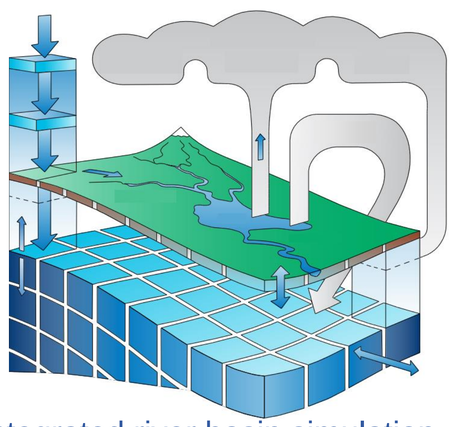
Terrestrial water storage in cm per month for the years 2002–2021 for the Danube river basin. Source: WMO [2]

Visualization

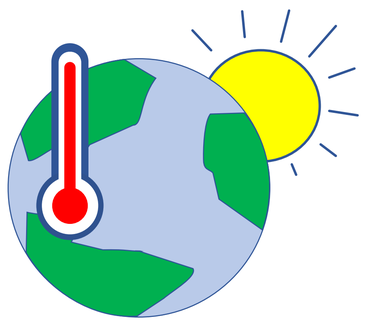
Environmental monitoring

Advanced analytics

Adaptation scenarios



Integrated river basin simulation models



Climate models and projections

CONCLUSIONS

- Modern river basin management in challenging times requires processing of huge datasets from multiple sources and application of an array of complex digital tools and technologies. One way to integrate all these elements and inputs is to build a digital platform powered by simulation engines which can be defined as a „Digital Twin" of a river basin.
- Such „Digital Twins" wrapped by a layer of practical workflows and decision support tools enable fast and pro-active decision making by water management authorities, but additionally lay a strong science-based foundation for stakeholder engagement and public participation in key decisions, thus boosting one of the principles of the IWRM concept
- The technology is available. Implementation remains a challenge due to several key reasons: resistance to change and transparency, data availability, accessibility and fragmentation, outdated heritage systems, organizational challenges and competence conflicts in water management systems, institutional capacity, funding availability.

References: List your references here.
[1] OECD Report on Public Communication : The Global Context and the Way Forward
[2] WMO 2022 State of Global Water Resources 2021. WMO-No. 1308. Report of the World Meteorological Organization, Geneva.
[3] MIKE OPERATIONS product flyer. DHI Group