

WATER RESOURCE GOVERNANCE



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EXPLORING NEW APPROACHES TO TRANSBOUNDARY WATER GOVERNANCE

A key challenge to transboundary river basin management in the southern African region is achieving harmony between national sovereignty and regional optimisation of water resource-based development.

IN AN IDEAL WORLD, river basin organisations (RBOs) would have executive authority to implement basin-wide solutions, but the reality is that countries are sovereign and are protective of their sovereign status. This has led to the prioritisation of technical and state-level analyses with consequent solutions pitched at that scale.

Research investigating the dynamics of cross-cultural interactions in resource management and the complex cultural and power dimensions of water resources management is steadily gaining momentum.

A CSIR multidisciplinary team held a workshop recently to which stakeholders from the Orange-Senqu River basin were invited. This team has developed a unique basket of tools and approaches combining natural science modelling, economic business model thinking, as well as social science elements.

IMPORTANCE OF TRANSBOUNDARY RIVER BASIN MANAGEMENT

Through its research on water governance across national borders, the CSIR and its collaborative partners are exploring ways in which to expand on an understanding of the biophysical environment of the transboundary river basin. CSIR researcher Inga Jacobs says this will expand on a consideration of the socio-cultural context, the significance placed on approaches that ensure economic development through the identification of benefits for all parties involved within and beyond the basin, as well as ways to facilitate the strengthening of institutional processes.

This research aims to drive the development of tools and approaches to integrate these domains with technical modelling and scenario planning as well as to emphasise the importance of awareness of socio-political context.

BUILDING MULTIDISCIPLINARY CAPACITY

Researchers have developed their transboundary water governance component in a very innovative way, drawing on the multidisciplinary skills of colleagues in other CSIR domains as well as international strategic partners such as the Stockholm International Water Institute (SIWI), and Phillips, Robinson and Associates.



They have done this by combining socio-cultural approaches and scientific modelling.

“Conventional approaches in basin management have focused on biophysical research. It has become apparent that social and political sciences should also be deployed to ensure effective implementation of development strategies. Social and economic development in a transboundary context can best be achieved through multidisciplinary teams,” explains Jacobs.

One particular project, led by Dr Marius Claassen, is a GTZ-funded, SADC water sector project that aims to develop tools and approaches to help strengthen transboundary RBOs. The multidisciplinary project team has developed a unique basket of tools and approaches combining natural science modelling, economic business model thinking, as well as social science elements such as the incorporation of culture and values to help governance systems.

MULTIDISCIPLINARITY IN THE GTZ PROJECT

BUSINESS MODELS

Jakob Granit and Rebecca Lofgren, project members and collaborative partners from SIWI, emphasise the importance of incorporating business processes and thinking into transboundary river basin management. They explain that to take full advantage of these opportunities, shared watercourse institutions (SWIs) need to be strengthened and empowered to more effectively carry out their mandates and they need to be given a clear role. An appropriate business model can assist SWIs in doing this.

CULTURALLY-EMBEDDED APPROACHES

Karen Nortje, CSIR social anthropologist and team member, explains that this approach emphasises the benefits of including a culturally-embedded methodology to river basin management. Identity markers (race, gender, religion etc.), historical contexts (historical narratives that are personal, organisational, national and even international) as well as the biophysical environment shape individual perceptions and how these relate to the river and each other. Similarly, longstanding cultural belief systems regarding water and the way it is used may offer useful suggestions as to how transboundary river basin management can and should be conducted.

ORANGE-SENQU RIVER BASIN PILOT STUDY

As part of the project, the Orange-Senqu river basin has been selected as a case study to embed these tools and approaches within a real life example. The objectives of the pilot study are to:

- Demonstrate the potential benefits of adopting selected tools to strengthen RBOs in SADC
- Act as an analytical test for further research on the implementation of these tools in other RBOs in southern Africa.

As part of the pilot study, the CSIR in collaboration with the SADC Water Sector, hosted a two-day workshop to test the applicability and relevance of the tools and approaches developed with a representative sample of the basin. Representatives from various components of the water sector, with particular experience in the Orange-Senqu river attended. A study tour to Lesotho is also planned. According to Inga Jacobs, the study tour aims to document real-life accounts of development in the basin by audio-visually recording people’s perceptions of belonging or not belonging in relation to the river basin. This will evaluate levels of ownership and buy-in for particular development options.

INFORMATION AND COMMUNICATIONS TECHNOLOGY

According to the Meraka Institute’s Derek Hohls, who leads the ICT technical component of this project, ICT is a core component of modern day organisations. In the case of RBOs, which, by their very nature, deal with issues that involve individuals, groups, communities and businesses at local, national and international levels, ICT is critical. The project team has taken the approach that the only platform that can meet the need to share information transparently and effectively is the worldwide web. Hohls therefore looks at appropriate and affordable web-based tools that can be readily adopted and extended to support the range of activities and information needs for an RBO.

BUSINESS PROCESSES

Dr Claassen explains that many of the principles and best practice approaches found in the business world are also applicable to other areas, such as government, NGOs, non-profit organisations, societies and sports teams. The generic business process is an iterative cycle that starts with a vision, which is supported by a strategy. The strategy is pursued through an operational plan, which directs decisions and actions. The efficacy of these actions in relation to the vision and strategy is then assessed through a monitoring and review process. – Kamogelo Seekoei



CSIR researcher, Inga Jacobs, leads the Orange-Senqu River basin pilot study

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SCENARIOS

HELP TO STRATEGISE FOR THE FUTURE

Scenario planning for the future plays an important part in helping policy-makers and other stakeholders to develop strategies that will lead towards a desired future.

WATER RESEARCHERS at the CSIR are applying the scenario method to look at how governance-related issues affect the future of the water sector, which in turn affects the resource itself. They are involved in various projects in which the scenario method is applied.

CSIR water governance research group leader, Dr Marius Claassen, says scenarios, which describe plausible futures, should not be mistaken for predictions.

"Scenarios are future possibilities and they do not necessarily have to be good versus bad but are different possibilities that are all plausible. The bottom line is then to choose the most preferred scenario that would be best suited for the region and its people and to then develop strategies towards realising that," says Claassen.

Claassen recently gave a presentation at the Water Security conference on the role of scenarios and futures research in regional water resource management.

He says scenarios will benefit resource managers and decision-makers and empower all the role players in the water sector to engage in participative governance. They will also help institutions to position themselves in line with the most preferred scenario or to better prepare for other possible scenarios.

One such project involving the CSIR is the Water Research Commission (WRC)-funded *Water Sector Institutional Landscape by 2025* study. Scientists are working with the Human Sciences Research Council (HSRC). The focus here is on scenarios relating to the governance of water.

In the project, scenarios are used to characterise key drivers and uncertainties, which can be used to plan for the future. Inputs to the scenarios are being sourced through a structured participative research process.

The beneficiaries will acquire the knowledge both through participating in the process and by accessing appropriate forms of communication. In this case, the process is as important as the products. The identification, description and ranking of key drivers and uncertainties will be translated to potential implications, both for social and economic development and for the management of water resources and water services.

A deeper understanding of key drivers and trajectories of changes will not only clarify the impact of decisions, but will allow active countering of undesirable trajectories of change by decision-makers.

"Scenarios are also important in changing the behaviour of people," says Claassen. He says

once people are convinced of a scenario, they can work towards realising it.

A five-step approach including preparation, pioneering, map-making, navigation and reconnaissance is used to get to the most preferred scenario or to better prepare for other possible scenarios.

The identification, description and ranking of key drivers and uncertainties will be translated to potential implications, both for social and economic development and for the management of water resources and water services. The selection and development of indicators will serve as navigation instruments to assess trajectories of change and support adaptive management towards desirable outcomes.

"A better understanding of key drivers and uncertainties in the water sector will promote the effective deployment of environmental goods and services towards social and economic development, while allowing for a comprehensive management of environmental risks and ensuring environmental sustainability. The development and use of scenarios in an appropriate manner will also empower society to participate more effectively in water governance," says Claassen. – Kamogelo Seekoei

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Shanna Nienaber (left), and Nikki Funke are involved in the science-policy interface research project – one of the research focus areas within the water resource governance systems research group. They are supported by Wilma Strydom and Karen Nortje (not pictured)

CSIR INVESTIGATES THE UPTAKE OF EVIDENCE INTO POLICY

Governments are faced with issues of increasing socio-ecological complexities around environmental sustainability and global change, which require them to make decisions and develop policies that have the potential to impact substantially on society and economies, and South Africa is no exception.

The CSIR's Nikki Funke says that while there is mounting pressure on governments to base policy agendas, decisions and policies on evidence such as research findings, this has proven to be a complicated challenge for scientists and policy-makers alike. It is therefore important for scientists to develop an understanding of policy-making processes so that their research can be taken up more effectively.

Funke explains that the science-policy interface is one of the research focus areas within the water resource governance systems research group. This research can be applied to a number of projects in the water and environmental sectors in the sense that it explores how to make research as relevant and as influential as possible within the broader socio-political arena of society. Examples include the application of this research to a multi-party project to identify a national network of freshwater ecosystem priority areas.

Participating organisations include the CSIR, the Water Research Commission, the World Wildlife Fund, the Department of Water and Environmental Affairs (DWEA) and the South African National Biodiversity Institute.

In the context of this project, research is being done to ensure that policy-makers in DWEA and the former Department of Provincial and Local Government and selected catchment management agencies will take up and use the research products that are produced. The research includes formulating an understanding of the political decision-making landscape and its complexities in South Africa and specifically in the biodiversity and freshwater conservation sectors and how the research products can and should be taken up into these existing policy and decision-making processes. There will also be a focus on the barriers to the uptake and use of these products and recommendations on how to overcome these barriers.

Funke says a current point of interest for the research group is to explore the complexities of the science-policy interface in the South African context.

"Findings from a thorough literature interview (contained in an article that has been submitted to the *South African Journal of Science*) have suggested that the science-policy interface is not merely a two-way relationship that can be strengthened in isolation, but is situated within a landscape that is shaped by a number of factors," says Funke.

These factors include political influences, alliances, differing perspectives on environmental issues of different groups of stakeholders, coalitions on specific perspectives on complex issues and the intricate nature of political decision-making and policy-making. Current research in the group focuses on a set of research questions and suggests approaches based on established theory in the science-policy field and that of political science on how to best understand this complex landscape.

"The aim of this exploration is twofold. On the one hand the research group aims to strengthen the voice of science organisations in their attempts to influence policy. On the other hand they aim to establish a more realistic picture of how much research can expect to achieve in the policy arena given the highly politicised nature of policy adoption and implementation."

This research takes cognisance of the various initiatives taking place at the CSIR and national level to strengthen the science-policy interface. – Kamogelo Seekoei

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WATER DEMAND PREDICTION MODELS

PUT TO THE TEST

IN A FIRST-OF-ITS-KIND STUDY in South Africa into water demand forecasting using computational intelligence techniques, CSIR researchers Dr Fulufhelo Nelwamondo and Ishmael Msiza have found that the modelling technique based on how the human brain performs a particular task, can be very useful. They found that an artificial neural network (ANN) 'outsmarts' a support vector machine (SVM), which is a classifier derived from statistical learning theory.

The CSIR's Ishmael Msiza says, "Modelling of water resource variables is a very broad field that includes modelling of water quality, the water demand trajectory, water reticulation networks, to mention but a few. There is currently a large pool of modelling techniques and hence there is always a need to investigate which technique is the most efficient for a particular application."

According to the two researchers, concerns arose that the water demand in South Africa may exceed the supply in the foreseeable future. They say, "This is attributable to a number of factors such as the average annual rainfall of 464 mm, which is way below the world's average of 857 mm. However, most of these factors are due to human interventions. These include population growth and economic expansion, especially in Gauteng. The more affluent people become, the more water they use, and the more the population grows, the more the demand for water increases."

Providing the statistics, Msiza says, "Gauteng is South Africa's industrial powerhouse; houses almost a quarter of the South African population; and consumes about 86% of the total water supply provided by Rand Water. As such, Dr Nelwamondo and I decided to focus on the modelling of water demand in this province. With the current population growth rate estimated at 3.13% per annum, the water demand in this province is definitely set to increase."

Over the years, scientists have conducted various studies into the efficacy of ANNs

against SVMs in diverse areas such as wastewater treatment processes forecasting, prediction of wind speed and financial time series forecasting.

"Given that in different situations, certain techniques prove more efficient, studies must be conducted to ascertain which technique is most suitable for the application at hand. We put ANNs against SVMs and the former proved to be 'a genius' when it comes to water demand forecasting," says Nelwamondo.

He explains, "A neural network is an information processing paradigm inspired by the way biological nervous systems like the human brain process information. It is an exceptionally powerful instrument that has found successful use in mechanical, civil, aerospace and biomedical engineering; as well as finance. Due to their ability to gain meaning from complicated data, neural networks are employed to extract patterns and detect trends that are too complex to be noticed by many other computer techniques. A trained neural network can be considered 'an expert' in the category of information it has been provided to analyse. This 'expert' can then be used to provide predictions when presented with new situations."

Nelwamondo says, "The CSIR's modelling and digital science research is directed at contributing to knowledge about physics and

mathematics as embedded in both natural and man-made systems, engineering and the rapidly advancing ICT infrastructure aimed at improving quality of life - that is our primary goal."

Nelwamondo and Msiza concur that "there is clearly an urgent need for the development of tools that will assist in the effective management of water resources and computational intelligence techniques have a significant role to play in this regard." Nelwamondo adds, "We hope that these studies will assist in South Africa's quest to find efficient methods of monitoring and addressing our water challenges and ultimately improve the people of South Africa's quality of life."

- Chiara Lincoln

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