Mapping Irish stakeholder engagement for safe drinking water

Researchers from TEAGASC and Ulster University are investigating stakeholder engagement as part of the EU Horizon 2020 project WaterProtect.

Drinking water governance requires a large stakeholder collaboration of industries, agencies, pressure groups and individual users to ensure high source quality and reduced treatment costs. However, it is important to know how this collaboration operates in practice and if there are bottlenecks that need to be overcome. WaterProtect aimed to create an integrated multi-actor participatory framework including innovative instruments that enable monitoring, financing and implementation of effective management practices and measures for the protection of water sources.

A global question

Drinking water governance is challenging, with different perceptions and priorities among stakeholders in different countries. Before methods and strategies can be developed to ensure drinking water is protected in leaky agricultural areas, country-specific governance systems first need to be assessed. This assessment or 'mapping' has not been completed in Ireland and there is currently no method to complete such a task across the EU. Our project demonstrated how the use of fuzzy cognitive mapping (FCM) addressed this challenge. The method enables direct engagement with representative stakeholder groups. By pooling all the data from different stakeholder groups, factors of importance and their connectivity to one another were explored. This enabled bottlenecks in the existing system to become obvious. Once bottlenecks are identified, strategies to overcome such problems can be tested using a modelling approach.

What is fuzzy cognitive mapping?

FCM is a flexible tool that has been successfully applied in environmental and water policy-related studies. The tool is particularly useful in obtaining stakeholders' perceptions while undertaking face-to-face interviews. The method gathers information from designed group exercises and converts these data into a form that can be analysed.

To build FCMs for this research, face-to-face interview sessions with stakeholder representatives were organised. In total, 11 interviews were undertaken with six representative stakeholder groups, i.e., catchments scientists, Water Initiative Officers, environmental researchers, policymakers, local authorities, and water service providers. During the sessions, each representative group was asked to draw causal interconnections among the stakeholders provided on a water governance map and the factors of importance for the provision of good drinking water quality. Participants were also encouraged to add additional stakeholders and factors of importance to the maps. The resulting interconnections represent either the interactions among stakeholders or the influence that each drinking water quality factor has on the others. The groups were then asked to assign a weight to each connection to specify its strength. The data collation allowed us to: visualise the maps using computer software; develop a more thorough analysis of outcomes individually and as a group; and, rank the views of group representatives. Next a graph theory hierarchy index (h) approach examined if stakeholder groups preferred top-down hierarchical

governance or a more inclusive democratic governance approach. Finally, a sophisticated auto-associative neural network method was deployed on group maps for examination of three scenarios, i.e., changing "Farmers' knowledge", "best management practice (BMP) uptake" and "Farmers' behaviour and belief", and seeing how the system reacted. An example of a constructed FCM is illustrated in **Figure 1**.

Current strengths and bottlenecks

The results of the FCM exercise highlighted the strengths and weaknesses (or bottlenecks) within the current system (Shahvi *et al.*, 2021). Strengths were that most stakeholder representative groups showed similar opinions concerning the ranking importance of the involved stakeholders in the drinking water governance of Ireland. The most important stakeholders identified within the system were "farmers" and "the Department of Agriculture". In addition, all representative stakeholder groups ranked the factors of importance regarding the supply of good drinking water quality in a similar way. The most important indicators that could be used to ensure that water quality targets within agricultural catchments could be met were: "the nutrient concentrations found in water"; and, knowledge pertaining to the "total amount of applied pesticides". The analysis showed a weakness in the structure in that all stakeholder representative groups had a different perception of the water governance framework. This means that certain stakeholders may be unsure of who does what within the framework and who to contact for a particular reason or piece of information.

Most stakeholder groups had a democratic point of view (bottom-up or inclusive approach) regarding water governance structures, and the ranking and importance of the stakeholders within the framework. Other results showed that most of the groups had similar opinions regarding the highest ranked factors affecting drinking water quality and the possible environmental policy options. In this part of the analysis only one representative group showed a democratic outlook, whereas all others had a hierarchal (top down or non-inclusive approach) outlook. Results also showed that boosting "Farmers' behaviour and belief" to the highest possible level on the analysis could result in a large increase in other factors, i.e., a scenario where farmers could benefit from the outcome. This would be achieved by enhancing farmers' willingness and intention to participate in and implement best management practices (BMPs). Discussion group results showed that better results would be achieved where farmers believed in the method being implemented on the ground and could benefit from the outcome. In addition, the analysis showed that keeping "Farmers' knowledge" at the highest point had a positive influence on the other factors. This supports continuation or enhancement of farmer training and knowledge transfer by local and national actors.

Conclusion

The presented method of using FCMs and graph theory analysis was suitable for comparing different actors' and stakeholders' perceptions on both water governance and the indicators affecting water quality, and should be repeated over time in Ireland and rolled out across the EU.

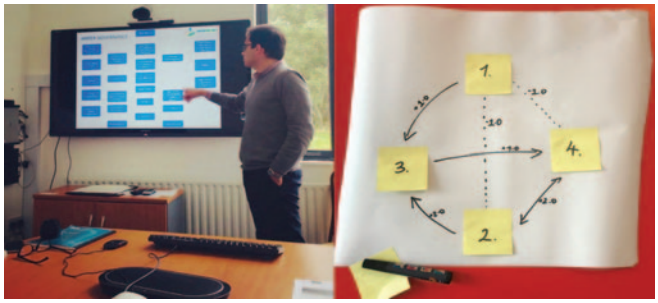

FIGURE 1: Left: presentation of the FCM process to representative stakeholder groups. Right: FCM enables linkages (arrows) between various stakeholders or organisations (e.g., 1, 2, 3 and 4) to be mapped (values on arrows represent their assigned weight).

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Reference

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