

Role Playing Games: A Methodology to Acquire Knowledge for Integrated Water River Management.

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Key words: Decision Support System; Multi-Agent System; Role Playing Games; Integrated Management.

Extended abstract

It is well known that water has become a scarcity resource: water demand has increased while its availability has decreased considerably. The end-of-pipe measures applied to streams cannot ensure the complete recovery of biological communities (Vanrolleghem *et al.*, 2005). Therefore freshwater quality will always be poor. More sustainable measures and approaches are needed for the ecological recovery of water bodies. The current management of sanitation infrastructures (sewer systems, wastewater treatment plants, receiving waters, bypasses, deposits, etc.) it is not fulfilling the objectives of the up to date legislation (EU Water Framework Directive and EPA US Clean Water Act). Decision Support Systems (DSS) based on Multi – Agent System paradigm are promising tools to improve the ecological status of water bodies. When all the different agents involved in the management interact, new important knowledge emerges. This knowledge can be used to build better DSS and to improve integrated water river management (IWRM).

Role Playing Games (RPG) have already been used to support integrated water management at river basin scale for stakeholder participation (Barreteau, 2003). Since they have been successfully used, they are now considered as a new information and communication tool (ICT) for providing support for analysis, knowledge acquisition and negotiation processes. Both MAS and RPG have been developed separately and offer promising potential for synergetic joint use in the field of resources management, for research, training and negotiation support (Barreteau *et al.*, 2001; Wooldridge, 2001). The aim of this paper is to illustrate the development, implementation and use of a RPG as a new ICT tool for knowledge acquisition for building a reliable and useful DSS for integrated management of hydraulic infrastructures at river basin scale. A case study is presented including a scenario composed of three industrial facilities, two WWTPs and two sewer systems.

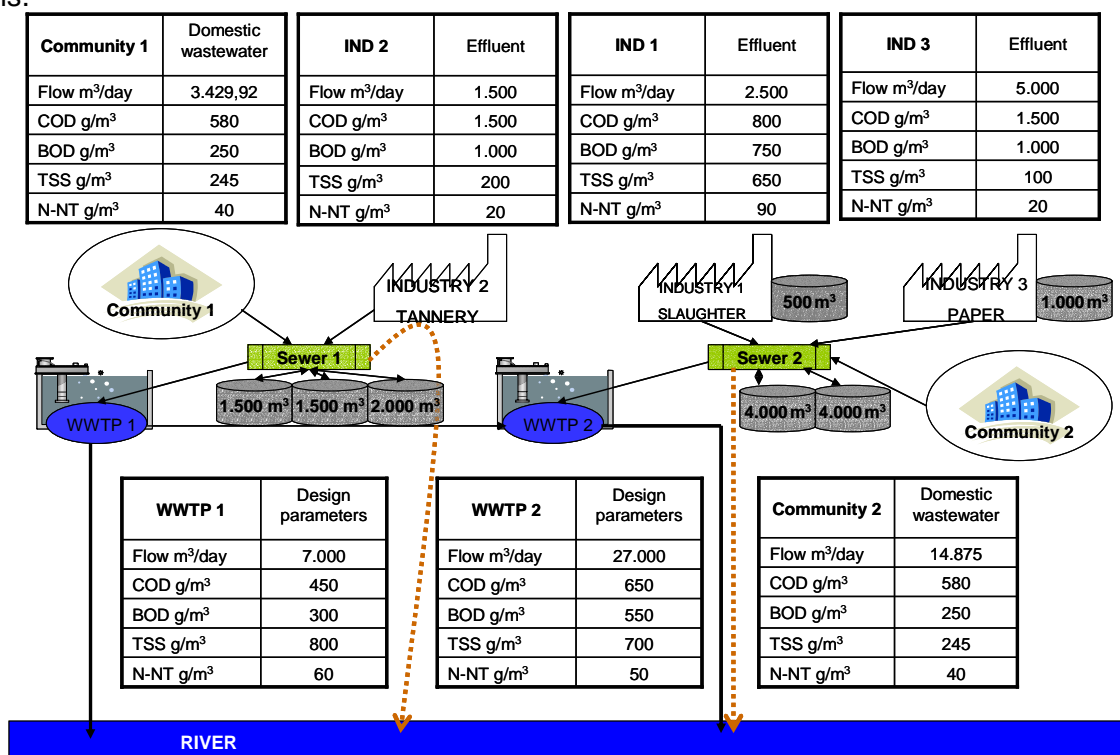


Figure 1. Layout of the RPG for knowledge acquisition about IWRM

The scenario presented is based on a typical Mediterranean river basin. As shown in Figure 1, the case study takes into account two communities (*Com1* and *Com2*) connected to their particular sewer systems (*SS1* and *SS2*) and WWTPs (*wwtp1* and *wwtp2*). *SS1* receives wastewater from one industry (*Ind1*) and *SS2* from another facility (*Ind2*). In between *wwtp1* and *wwtp2* there is a connection channel, allowing bypassing wastewater from *wwtp1* to *wwtp2*. Moreover *SS1* and *SS2* have pluvial tanks to store rain or storm water and *Ind1* and *Ind3* have their own storage tanks. Each infrastructure is represented for one specific agent performing a concrete role. The main goal of the game is to achieve a good ecological status of the receiving media (e.g. the river) by the collaboration of the agents whose individual goals might be different (e.g. *Ind*: improve their benefits; *SS*: transport wastewater to WWTP; *WWTP*: spill to river fulfilling the legislation thresholds). Each agent has a workspace in which they can introduce their beliefs (informational state) and desires (motivational state). Workspaces are the basic tool of the game and calculate automatically matter balances according to update beliefs and desires.

Different problematic scenarios are randomly built (i.e. hydraulic, organic and toxic shock). To solve the problematic situation, the different players (each one representing a different agent) interoperate and communicate each other in order to take the best possible punctuated decision. Therefore, the result is a punctuation representing the ecological status of the river.

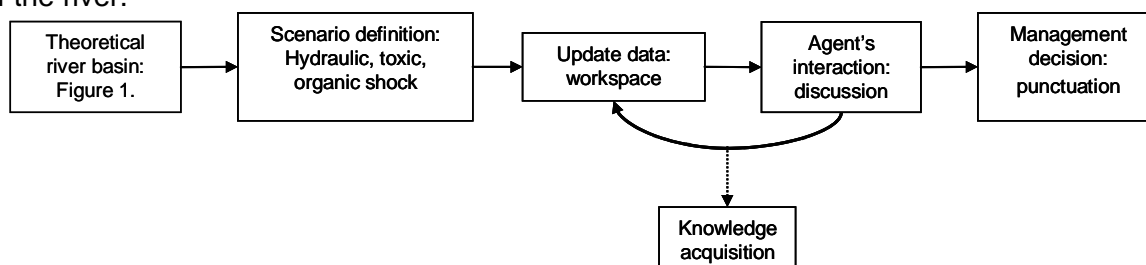


Figure 2. Procedure to acquire knowledge

The interaction and discussions between agents permit us to acquire knowledge for a future MAS implementation in the DSS. Dialogues in discussions carried out among agents for each scenario allow to study the argumentation processes, the expert reasoning and the critical questions posed to undertake the dialogue. Furthermore, through roles it is possible to better understand how intelligent agents act. The game has been tested with experts (water managers, university professors and PhD students) who argued satisfactorily in the different scenarios developed. Beside RPG demonstrates the necessity of integrated river management. Figure 3 illustrates a comparison between the ecological status punctuation reached when using “individual” management versus an integrated management of hydraulic infrastructures.

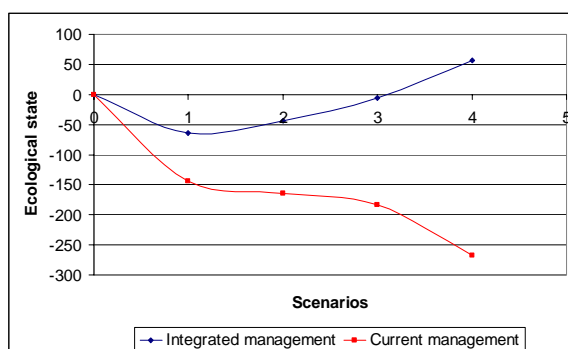


Figure 3. Results of the Individual vs. integrated management by using the RPG developed.

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