

DESIGNING A SERIOUS GAME FOR PARTICIPATORY REUSE PLANNING IN THE WEST BANK

CONCEPTION D'UN JEU CONSÉQUENT POUR LA PLANIFICATION PARTICIPATIVE DE LA RÉUTILISATION DES EAUX EN CISJORDANIE

B. Noury¹, M. Ramnuth², T. Cazalis², F. Abu Seif³, I. Dababat⁴, I. Atallah⁵, and C. Papin⁶.

ABSTRACT

Wastewater reuse (REUSE) for irrigation is increasingly considered a strategic adaptation option in Mediterranean and water-scarce regions facing climate change, growing population pressure and increasing pressure on conventional freshwater resources. However, beyond technical feasibility, the effective implementation of REUSE projects often remains constrained by fragmented governance arrangements, limited coordination between water, sanitation and agricultural stakeholders, insufficient planning capacities and persistent social and institutional barriers. These challenges are particularly visible in the West Bank, where water scarcity, territorial fragmentation and asymmetric access to water strongly constrain agricultural development and local water management.

This paper presents an ongoing project aimed at designing a serious game to support participatory planning of treated wastewater reuse for irrigation in two Palestinian territories: the Tayassir area in Tubas Governorate and the Kharas area in Hebron Governorate. The approach combines participatory modelling, territorial diagnosis and role-playing methodologies inspired by the Wat-A-Game and Companion Modelling frameworks. Rather than functioning as a simple awareness-raising tool, the game is conceived as an intermediary planning device intended to facilitate dialogue between stakeholders, explore management scenarios and support collective reflection on allocation rules, infrastructure constraints, agricultural practices, environmental risks and institutional responsibilities.

Particular attention is given to the operational scale represented in the game. Instead of adopting a conventional river basin approach, the project focuses on wastewater treatment plant effluents and associated irrigation perimeters. This intermediate scale allows stakeholders to directly engage with tangible interactions between sanitation performance, water availability, irrigation demand and collective management arrangements.

The paper analyses the conceptual framework guiding the project, the territorial and institutional context of wastewater reuse in the West Bank, and the methodological principles structuring the co-design process.

Keywords: Wastewater reuse; territorial fragmentation; water management; water availability; Irrigation demand; Methodological principles.

¹ Independant consultant, 9B rue d'Hem, 59170 Croix, France Email: Bjm.noury@gmail.com

² Experts Solidaires, Parc Scientifique Agropolis 2. Boulevard de la Lironde 34980 Montferrier-Sur-Lez, France, Email: contact@experts-solidaires.org & tcazalis@experts-solidaires.org

³ Al ARD, Sateh Marhaba street, Ramallah, Palestine Email: info@al-ard.org

⁴ Tubas Joint Water and Sanitation Services Council, Tubas, Palestine Email: Tubas.jwssc@gmail.com

⁵ Joint Service Council for Water and Wastewater in North Hebron, Palestine Email: issatalal36@yahoo.com

⁶ Eau, agriculture et territoires (EAT), 500 rue Jean-François Breton. 34093 Montpellier, France Email: Celine.papin@inrae.fr,

RÉSUMÉ

La réutilisation des eaux usées (REUSE) à des fins d'irrigation est de plus en plus considérée comme une option stratégique d'adaptation dans les régions méditerranéennes et celles souffrant de pénurie d'eau, confrontées au changement climatique, à une pression démographique croissante et à une pression accrue sur les ressources en eau douce conventionnelles. Cependant, au-delà de la faisabilité technique, la mise en œuvre efficace des projets REUSE reste souvent entravée par des dispositifs de gouvernance fragmentés, une coordination limitée entre les acteurs des secteurs de l'eau, de l'assainissement et de l'agriculture, des capacités de planification insuffisantes et des obstacles sociaux et institutionnels persistants. Ces défis sont particulièrement visibles en Cisjordanie, où la pénurie d'eau, la fragmentation territoriale et l'accès asymétrique à l'eau freinent fortement le développement agricole et la gestion locale de l'eau.

Cet article présente un projet en cours visant à concevoir un jeu conséquent destiné à soutenir la planification participative de la réutilisation des eaux usées traitées à des fins d'irrigation dans deux territoires palestiniens : la région de Tayassir dans le gouvernorat de Tubas et la région de Kharas dans le gouvernorat d'Hébron. L'approche combine la modélisation participative, le diagnostic territorial et des méthodologies de jeux de rôle inspirées des cadres « Wat-A-Game » et « Companion Modelling » (~ Compagnon de Modélisation). Plutôt que de fonctionner comme un simple outil de sensibilisation, le jeu est conçu comme un dispositif de planification intermédiaire destiné à faciliter le dialogue entre les parties prenantes, à explorer des scénarios de gestion et à soutenir la réflexion collective sur les règles d'allocation, les contraintes d'infrastructure, les pratiques agricoles, les risques environnementaux et les responsabilités institutionnelles.

Une attention particulière est accordée à l'échelle opérationnelle représentée dans le jeu. Au lieu d'adopter une approche conventionnelle par bassin hydrographique, le projet se concentre sur les effluents des stations d'épuration et les périmètres d'irrigation associés. Cette échelle intermédiaire permet aux parties prenantes de s'engager directement dans des interactions concrètes entre les performances en matière d'assainissement, la disponibilité en eau, la demande d'irrigation et les modalités de gestion collective.

Cet article analyse le cadre conceptuel qui guide le projet, le contexte territorial et institutionnel de la réutilisation des eaux usées en Cisjordanie, ainsi que les principes méthodologiques qui structurent le processus de co-conception.

Mots-clés : Réutilisation des eaux usées; Fragmentation territoriale; Gestion d'eau; Disponibilité en eau; Irrigation demande; Principes méthodologiques.

INTRODUCTION

Water scarcity, wastewater reuse and governance challenges

Water scarcity is becoming one of the main constraints affecting agricultural production and rural livelihoods across the Mediterranean region. Climate change projections indicate a significant reduction in precipitation, increased evapotranspiration and growing variability of hydrological regimes, leading to heightened pressure on already limited freshwater resources (IPCC AR6, 2023). In many semi-arid territories, irrigated agriculture faces increasing competition with domestic, industrial and environmental water uses, while remaining essential for food security, rural employment and territorial stability. In this context, non-conventional water resources, and particularly treated wastewater reuse (REUSE) for irrigation, are increasingly considered strategic adaptation options capable of reducing pressure on conventional resources while supporting agricultural resilience and local food production (UNESCO, 2017).

Over the last two decades, substantial investments have been made in wastewater collection and treatment infrastructure throughout the Mediterranean region and the Middle East (World Bank, 2018). However, the effective deployment of agricultural REUSE remains uneven and frequently below

expectations. Beyond technical considerations related to treatment performance or irrigation infrastructure, many projects encounter difficulties linked to institutional fragmentation, limited planning capacities, insufficient coordination between water, sanitation and agricultural sectors, as well as concerns regarding public acceptance, health risks and long-term governance arrangements. Several studies have highlighted that REUSE projects cannot be reduced to purely engineering challenges, but instead involve complex socio-technical and territorial systems in which water quality, return flows, agricultural practices, institutional arrangements and downstream dependencies interact across multiple scales (Van Opstal et al., 2025). These challenges are particularly visible in politically and institutionally constrained environments such as the West Bank, where water governance is shaped by severe resource scarcity, fragmented territorial control and asymmetrical access to water resources. In this context, treated wastewater represents one of the few locally available and relatively reliable water resources over which Palestinian stakeholders retain a certain degree of management autonomy. Recent investments in wastewater treatment plants have created new opportunities for agricultural reuse in several territories. Nevertheless, the transition from wastewater treatment infrastructure to effective and collectively managed reuse systems remains difficult. Questions related to allocation rules, infrastructure management, irrigation practices, treatment reliability, institutional responsibilities and farmers' acceptance often remain unresolved, limiting the sustainability of reuse schemes. Existing studies on wastewater reuse in Palestine also underline the persistence of multiple governance arrangements, limited coordination capacities and weak articulation between sanitation infrastructures and agricultural planning processes (Costea, 2022; Experts-Solidaires, 2025).

Participatory approaches and objectives of the study

In parallel, increasing attention has been given to participatory and interdisciplinary approaches capable of supporting collective decision-making in complex water management situations. Serious games and participatory modelling approaches have progressively emerged as innovative tools for facilitating dialogue between stakeholders, exploring management scenarios and improving shared understanding of socio-environmental systems. Rooted in companion modelling approaches (Etienne, 2013) these tools combine simplified representations of territorial dynamics with interactive decision-making processes, enabling participants to collectively explore trade-offs, constraints and possible futures. However, many applications remain confined to awareness-raising, academic experimentation or training activities, with limited integration into local planning and governance processes. This paper therefore explores the potential contribution of a serious game approach for participatory wastewater reuse planning in the West Bank.

The project focuses on two Palestinian territories facing strong agricultural dependence, water scarcity and growing pressure on conventional resources. Rather than adopting a conventional river basin management perspective, the approach focuses on the scale of wastewater treatment plant effluents and associated irrigation perimeters. This choice reflects both the governance context of the West Bank and recent work emphasizing the importance of analysing water reuse dynamics at intermediate territorial scales. At this level, interactions between return flows, agricultural practices and collective management become more tangible for local stakeholders. The paper analyses the territorial and institutional context underlying the project, discusses the methodological principles guiding the participatory design of the game, and reflects on the opportunities and limitations of implementing participatory planning approaches in fragile and highly constrained socio-political environments.

CONCEPTUAL AND METHODOLOGICAL FRAMEWORK

Serious games as participatory planning tools

Serious games and participatory modelling approaches are increasingly used in the water sector to support dialogue, collective learning and the exploration of complex socio-environmental systems. A role-playing game generally combines a game board, players assigned to specific roles, rules governing interactions, and resources that evolve according to players' decisions. This structure makes it possible to represent, in a simplified way, the interactions between water resources, infrastructures, uses, institutional responsibilities and territorial constraints. In the field of water management, such

approaches have been applied to a wide range of issues, including natural resource management (Hassenforder et al., 2016), sanitation (Aucante et al., 2024), and water reuse (Noury, 2021). Within the Companion Modelling tradition, these tools are not designed primarily to predict outcomes, but to create a shared space where stakeholders can interact, test assumptions and discuss the consequences of collective decisions (Etienne, 2013).

Their value lies partly in their capacity to create a reflective distance from reality. By temporarily placing participants in a simulated situation, role-playing games make it possible to address sensitive or contested issues in a less confrontational way. Participants can experiment with other actors' objectives and constraints, observe the consequences of their own decisions, and collectively discuss trade-offs that are often difficult to make explicit in conventional meetings. This experiential dimension is central: the game is not only an awareness tool, but a structured situation through which participants produce shared understanding. The debriefing phase is therefore essential. It allows the group to move from the simulated experience back to the real situation, identify lessons learned, clarify disagreements and discuss possible implications for action (Daré et al., 2010).

However, many serious games used in water management remain confined to awareness-raising, training or academic experimentation. Their connection to management-related processes is often limited. The approach developed in this project seeks to address this gap by positioning the serious game as a practical support tool for participatory planning of treated wastewater reuse for irrigation. The objective is not merely to raise awareness about REUSE issues, but to support structured discussions on allocation rules, infrastructure constraints, treatment reliability, irrigation practices, health and environmental risks, and institutional responsibilities. In this sense, the game is conceived as a facilitation device intended to support the formulation of concrete management actions.

The design process draws on the Wat-A-Game approach developed within the joint research unit "Water Management, Actors, Territories" (UMR G-EAU), which provides methodological principles and practical design elements for constructing role-playing games on water and territorial management issues (Abrami & Becu, 2024). The game is intentionally designed as a physical and simplified tool. This choice aims to make the modelling process understandable and accessible to local stakeholders with different technical backgrounds, while allowing direct manipulation of resources, infrastructures and management options. Rather than seeking an exhaustive representation of the system, the model focuses on the key variables that matter for planning: available treated wastewater, seasonal irrigation demand, treatment constraints, storage and distribution infrastructure, crop choices, reuse rules and stakeholder responsibilities.

Co-design principles and territorial anchoring

A central principle is the early involvement of stakeholders in the design process itself. Farmers, water and sanitation operators, municipal representatives, civil society actors and local institutions are involved in defining system boundaries, relevant variables, roles and plausible scenarios. This participatory design phase is essential to ensure that the game reflects agricultural realities, institutional constraints and local perceptions of treated wastewater reuse. This issue appears particularly important in Palestine, where several studies have highlighted the disconnect that may exist between infrastructure-centred water projects and local socio-territorial dynamics (Perrier, 2020).

In this perspective, the role-playing sessions are not conceived as isolated participatory events but as intermediary steps within a broader collective planning process. Particular importance is therefore given to the debriefing phase. Beyond discussing the gaming experience itself, this phase is designed to create a structured space for stakeholders to collectively identify priorities, formulate concrete actions and discuss institutional responsibilities related to wastewater reuse management.

The outputs generated during the debriefing sessions are intended to feed into local territorial action plans associated with the reuse schemes. In the West Bank case, this approach supports the use of the wastewater treatment plant effluent and associated irrigation perimeter as the main scale for participatory discussions. At this scale, the links between sanitation performance, water availability,

agricultural use and collective management become sufficiently tangible to support discussion, negotiation and the formulation of planning options.

STUDY AREA AND REUSE CHALLENGES IN THE WEST BANK

Water governance and scarcity in the West Bank

Water management in the West Bank is shaped by hydrological scarcity, geopolitical constraints and institutional fragmentation. Groundwater constitutes the main source of freshwater in the West Bank, which relies primarily on the mountain aquifer system shared with Israel. Access to these resources remains highly asymmetrical, while climate change projections indicate increasing pressure on already limited water resources (Perrier, 2020).

Water availability remains insufficient to meet both domestic and agricultural needs. Agriculture nevertheless remains a strategic sector for rural livelihoods and food security, despite limited infrastructure development and comparatively lower levels of investment in irrigation systems (Trottier, 2024). Domestic water access is also highly constrained. Average water consumption remains below the WHO recommendation of 100 litres per person per day and can fall to around 68 litres/day/person during summer periods in localities such as Kharas (Experts-Solidaires, 2025). These pressures are further aggravated by infrastructural inefficiencies and weak maintenance capacities. Despite recent network rehabilitation works, non-revenue water reaches up to 48% in some areas, reflecting both technical losses and broader governance challenges.

Water reuse policies and implementation limits

In this context, treated wastewater reuse is increasingly considered a strategic local resource for irrigation. The National Water and Wastewater Policy and Strategy for Palestine (PWA, 2024) identifies treated wastewater as a non-conventional resource contributing to agricultural development and water security. However, despite important investments in wastewater treatment infrastructure over the last two decades, actual reuse levels remain limited. In 2022, approximately 20% of treated wastewater produced in the West Bank was effectively reused for irrigation. Several constraints explain this situation, including insufficient effluent quality, limited storage infrastructure, fragmented institutional responsibilities, weak coordination between sanitation and agricultural actors, and persistent concerns regarding health risks and social acceptance (Costea, 2022).

Previous research on wastewater reuse projects in Palestine also highlights the limits of infrastructure-centred approaches that insufficiently consider local agricultural practices, territorial dynamics and social organization (Perrier, 2020). The challenge is therefore not only to develop treatment infrastructure, but to support collective management arrangements capable of articulating sanitation systems, agricultural uses and territorial planning processes.

The two pilot territories: Tubas and Kharas

Against this backdrop, the project focuses on two pilot territories illustrating different configurations of these challenges: the Tayassir area in Tubas Governorate and the Kharas area in Hebron Governorate.

The targeted communities in Tubas Governorate represent approximately 37,000 inhabitants and include extensive agricultural and rangeland areas, with more than 26,000 dunums of pastures and shrubs and nearly 8,000 dunums of fallow land considered suitable for agricultural development. Agriculture in the area is relatively diversified, including fodder, vegetables, greenhouses and irrigated crops. While the Tayasir wastewater treatment plant was designed for 4,300 m³/day, only 800–1,100 m³/day are currently treated. At the same time, the Water User Association estimates agricultural demand at more than 4,000 m³/day, while only 500–600 m³/day of treated wastewater are currently supplied to farmers. This severe supply-demand gap creates both tensions and opportunities around wastewater reuse.

In contrast, the territories in Hebron Governorate, representing approximately 17,500 inhabitants, are characterized by more limited irrigation development and stronger dependence on rainfed agriculture. Agricultural systems are dominated by olive trees, grapes and perennial crops. Although a wastewater treatment plant exists in Kharas, reuse remains limited due to effluent quality concerns, insufficient infrastructure and lower farmer confidence in treated wastewater reuse.

The contrast between these two territories is central to the design of the serious game. In both cases, treated wastewater is not simply an additional water resource but a socio-technical object shaped by infrastructure performance, institutional coordination, agricultural practices and local perceptions. These characteristics make the wastewater treatment plant effluent and associated irrigation perimeter a particularly relevant scale for participatory planning approaches.

DESIGNING THE SERIOUS GAME

The project is currently being implemented in a highly constrained regional context marked by repeated disruptions to field activities. At the time of writing, two field missions initially planned in December 2025 and April 2026 had to be postponed due to the regional situation. As an alternative, a preliminary framing workshop was organized in France during a technical visit involving Palestinian project partners. The first field mission dedicated to the co-design of the game is currently scheduled for June 2026. Consequently, this paper primarily presents the conceptual framework, territorial anchoring and methodological design of the process, while more concrete results and prototype developments are expected to be discussed during the oral presentation at the ICID Congress in October 2026.

Participatory planning objectives

The serious game is conceived as a participatory planning support tool intended to facilitate dialogue between stakeholders involved in wastewater reuse management at the local scale. Beyond awareness-raising objectives, the game aims to support collective reflection on the conditions required for the development of treated wastewater reuse schemes in the two pilot territories. More specifically, the device is designed to help stakeholders visualize interdependencies between sanitation systems, water availability, agricultural practices and territorial governance arrangements. The game also aims to facilitate collective discussions on allocation rules, infrastructure priorities, environmental and health risks, agricultural strategies and institutional responsibilities. In this perspective, the objective is not to identify a single optimal solution, but rather to facilitate collective exploration of possible management pathways and support the formulation of implementation-oriented actions that may later feed into local planning processes.

Attention is given to the choice of the scale represented in the game. Rather than adopting a conventional river basin perspective, the game focuses on the wastewater treatment plant effluent and the associated irrigation perimeter. This intermediate territorial scale appeared particularly relevant in the Palestinian context for several reasons. First, it corresponds to a management scale that remains understandable and tangible for local stakeholders, including farmers, municipalities, sanitation operators and local associations. Second, it makes it possible to directly represent the interactions between wastewater production, treatment performance, storage capacities, agricultural demand and collective allocation rules. Finally, this scale reflects the local realities of reuse management in the West Bank, where wastewater reuse projects are often implemented through localized infrastructures and territorial arrangements rather than through integrated basin-scale governance systems.

Participatory co-design process

Building on these principles, the design process follows an action-research and co-design approach inspired by the Wat-A-Game methodology (Abrami & Becu, 2024). The tool is progressively constructed through iterative interactions with local actors. The process began with a baseline study combining territorial diagnosis, stakeholder mapping and analysis of existing water and sanitation dynamics. This phase aimed to produce two territorial monographs synthesizing the main infrastructural constraints,

governance dynamics, agricultural practices and local perceptions related to treated wastewater reuse in the two pilot territories.

A first collective workshop was then organized in Montpellier with representatives from Palestinian municipalities, technical services and agricultural organizations. The workshop introduced the general objectives of the project and clarified the potential role of serious games as participatory planning tools. Participants also tested the INI-WAG simulation device to familiarize themselves with participatory gaming approaches and collective water management dynamics. This first exchange helped clarify expectations, identify locally relevant issues and discuss the specificities of the two territories.

Several priorities emerged during these discussions. Common objectives included strengthening treated wastewater reuse as an alternative water resource and improving coordination between sanitation and agricultural stakeholders. In Kharas, participants emphasized environmental and sanitary concerns linked to wastewater management, including the impact of household effluents and solid waste on sanitation infrastructure performance. Discussions also highlighted low farmer confidence in treated wastewater reuse and concerns regarding water quality. In Tubas, stakeholders focused more strongly on the integration of treated wastewater within broader water resources management strategies, the valorization of water for land conservation and the development of agricultural economic activities and employment opportunities.

A second phase consists of field missions in the two pilot territories to support the co-design of the game prototype. These missions combine site visits, technical discussions and participatory workshops addressing the main stages of game conception.

- Framing: clarification of the objectives of the game, the geographical scale, the main wastewater reuse issues to be addressed and the indicators associated with local water management challenges.
- Conceptual modelling: structuring of the spatial representation of the territory, identification of the main stakeholders and resources involved (water, nutrients, money, land ownership, knowledge, etc.), and analysis of the relationships linking these stakeholders, resources and water reuse issues.
- Prototyping and pre-testing: progressive definition of the different roles represented in the game, clarification of actors' objectives and activities, and development of the first spatial representations and game sequences through initial testing sessions.
- Finalization: refinement of the game board, resource dynamics, scenarios, events and management options in order to balance realism, readability and usability for local stakeholders.
- Calibration: adjustment of activities, scenarios and management options using simplified and relative orders of magnitude to preserve both the coherence of interactions and the accessibility of the device for participants.

The game is intentionally designed as a physical and simplified tool rather than a computerized simulation model. This choice facilitates direct interaction between participants, collective manipulation of resources and transparency regarding modelling assumptions. The representation focuses on a limited number of key variables considered central for local planning discussions: available wastewater volumes, irrigation demand, storage infrastructure, crop choices, treatment reliability, maintenance constraints and collective management rules. Temporal dynamics are represented through successive management sequences allowing participants to observe the consequences of their decisions over time. Following the prototype development phase, the game and facilitation protocol will be refined through iterative testing sessions and the preparation of a facilitation manual. A second field mission will support training-of-trainers sessions aimed at enabling local actors to facilitate game sessions autonomously.

Debriefing and action planning

The debriefing sequence is conceived as a central component of the process for linking the simulated experience to real territorial dynamics. Inspired by previous Wat-A-Game facilitation protocols, the debriefing combines collective feedback on the simulation, discussion of coordination difficulties and comparison between simulated dynamics and local realities to identify possible management actions and territorial priorities. To support the transition from discussion to action, participants are also invited to complete individual action sheets specifying proposed measures, responsible actors, implementation scales, expected impacts and possible implementation timelines. These contributions are intended to facilitate the consolidation of locally grounded proposals that may later feed into wastewater reuse planning and territorial action plans.

DISCUSSION AND PERSPECTIVES

Participatory planning in a fragile political context

The implementation of this project must first be discussed in light of the highly unstable political and regional context in which it is being conducted. These disruptions directly affect the continuity of the co-design process. Consequently, this paper mainly presents the conceptual and methodological architecture of the process rather than stabilized operational results. More broadly, conducting participatory planning processes in the West Bank raises important methodological and political questions related to uncertainty, territorial fragmentation and constrained planning horizons. In many of the targeted areas, agricultural dynamics are affected not only by water scarcity and infrastructural limitations, but also by broader processes of land fragmentation, restricted access to agricultural areas and the progressive intensification of pressures on agricultural land linked to settlement expansion and territorial control dynamics. In such contexts, discussing long-term irrigation development, collective infrastructure management or territorial planning may appear particularly difficult.

The project also highlights the complexity of discussing decentralized and multi-actor governance arrangements in a context where water management reforms have historically remained strongly shaped by centralized institutional logics. Research conducted on Palestinian water laws and reforms has shown how decentralization discourses have often coexisted with parallel dynamics of institutional recentralization and increasing control by central water authorities over local water management practices (Perrier, 2020). In practice, wastewater reuse management still relies on multiple overlapping institutional arrangements involving municipalities, water authorities, agricultural actors, donor-funded projects and informal local coordination mechanisms. In this perspective, the serious game may help create a temporary space where these different stakeholders can collectively discuss allocation rules, responsibilities and coordination difficulties. However, the approach does not eliminate underlying asymmetries of power, institutional rivalries or dependencies linked to external funding structures.

Institutional limits of participatory gaming approaches

This also raises broader questions regarding the actual institutional effects of participatory gaming approaches. While the game may facilitate dialogue between actors who rarely interact directly, the capacity of these exchanges to influence concrete decision-making processes remains uncertain. The stakeholders involved in participatory workshops do not necessarily possess the institutional authority, financial resources or political autonomy required to transform collective discussions into implemented management decisions. There is therefore a risk that the game primarily contributes to improving dialogue and mutual understanding without significantly altering existing governance arrangements or implementation capacities. This limitation appears particularly important in contexts where water management remains strongly dependent on external funding structures, centralized institutions and broader political constraints.

Legitimacy and cultural perception of gaming approaches

Another important discussion point concerns the use of gaming approaches themselves in such contexts. While role-playing games may facilitate dialogue by creating a reflective distance from sensitive issues, they may also generate misunderstandings, reluctance or forms of resistance depending on cultural representations associated with games and participatory facilitation methods. Participatory gaming approaches are never neutral devices and may be perceived differently depending on local social norms, professional cultures and power relations. In certain contexts, the playful dimension of the device may initially appear disconnected from the seriousness of the issues discussed, particularly when dealing with highly sensitive questions related to water scarcity, agriculture or territorial tensions. The legitimacy of the tool therefore largely depends on facilitation quality, the credibility of the process and the ability to clearly articulate the gaming experience with concrete territorial issues and planning discussions.

Perspectives for action-research and territorial dialogue

These elements suggest that the contribution of the project should probably not be assessed only through the technical quality of the final game prototype, but also through its capacity to create conditions for dialogue in politically unstable and institutionally complex environments. From this perspective, the action-research dimension of the project is central. Rather than being conceived as a finalized expert tool transferred to local actors, the game is developed as a progressive co-construction process through which stakeholders discuss territorial representations, identify tensions and explore possible management pathways. The next stages of the project, including the June 2026 field mission, prototype testing sessions and training-of-trainers activities, should make it possible to further evaluate the relevance, limitations and adaptability of this approach within the Palestinian context.

Despite these limitations, the project illustrates the potential contribution of participatory gaming approaches for supporting dialogue on wastewater reuse management in uncertain governance environments. By combining territorial diagnosis, co-design processes and participatory simulations, the approach seeks to strengthen dialogue between technical, agricultural and institutional actors. Beyond the Palestinian case, the methodology may provide useful perspectives for other Mediterranean territories facing increasing water scarcity, governance fragmentation and growing interest in non-conventional water resources.

REFERENCES

- Abrami, G., & Becu, N. (2024). Designing and using role-playing games for water and land management. In N. Ferrand, E. Hassenforder, & S. Girard (Eds.), *Transformative Participation for Socio-Ecological Sustainability*. Editions Quae
- Mélaine Aucante, Rémi Lombard-Latune, Alpha Ba, Camille Cheval, Paul Moretti and Nils Ferrand (2024). Integrating expert technical knowledge in a sanitation planning process with stakeholders: WasteWAG modelling and game in Senegal. In N. Ferrand, E. Hassenforder, & S. Girard (Eds.), *Transformative Participation for Socio-Ecological Sustainability*. Editions Quae
- Costea 2022 - Wastewater reuse in agriculture initiative - Palestine' synthesis report (p. 44)
- Daré, W., Paassen, A. V., Ducrot, R., Mathevet, R., Queste, J., Trébuil, G., Barnaud, C., & Lagabriele, E., 2010. Apprentissage des interdépendances et des dynamiques. In *Modélisation d'accompagnement* Michel Etienne (Eds) (p. 223-250). Editions Quae.
- Étienne, M. (ed.), 2013. *Companion Modelling: A Participatory Approach to Support Sustainable Development*. Springer Netherlands. ISBN 9789401785570.
- Experts-Solidaires, 2025, Integrated water resources management and improvement of living conditions for rural households in the West Bank - phase 2. Final baseline report (p.32)
- Hassenforder, E., Ducrot, R., Ferrand, N., Barreteau, O., Anne Daniell, K., & Pittock, J., 2016, Four challenges in selecting and implementing methods to monitor and evaluate participatory processes: Example from the Rwenzori region, Uganda. *Journal of Environmental Management*, 180, 504-516.

- Noury, B., 2021. Acceptabilité sociale et communication participative : le cas de la réutilisation des eaux usées traitées dans le Luberon. Doctoral dissertation. Aix-Marseille University.
- Perrier, J, 2020. Quelle gouvernance des eaux pour quelle construction étatique dans les territoires palestiniens? : l'étude des constellations hydropolitiques des eaux douces et usées entre adaptation, fragmentation et colonialité. Doctoral dissertation, Paul-Valéry Montpellier 3 University
- Trottier, J, 2024. Les mécanismes de la dépossession de la terre et de l'eau en Palestine. Réunion thématique AGTER # 57 du 8 octobre 2024
- UNESCO/UN-Water, 2017. The United Nations World Water Development Report 2017: Wastewater, the Untapped Resource.
- Van Opstal, J., Droogers, P. & Kaune, A. 2025. Reuse of water in agricultural systems – Follow the Water. Bangkok, FAO. (p.29)
- World Bank. 2018. Beyond Scarcity: Water Security in the Middle East and North Africa. MENA Development Report.