

The use of game-based participatory modelling to facilitate social and infrastructure resilience planning

Bryann Avendano 

*Department of Civil and Natural Resources Engineering, University of Canterbury, Christchurch,
Aotearoa New Zealand
Email: bryann@pg.canterbury.ac.nz*

Abstract: Resilience building has become critical in disaster planning, especially with the increasing impacts of climate change. Formal modelling methods have been developed for informed decision-making. However, a comprehensive framework involving multiple stakeholders is needed to address the complex issues related to community resilience planning. Participatory modelling and gaming have emerged as effective approaches that aid data-driven decision-making (Elsawah et al., 2023), enabling stakeholders to create, adjust, and learn from interactive models and use insights to inform their decisions.

This contribution is an ongoing doctoral thesis aimed at developing and testing a participatory modelling methodology that engages planners, policymakers, resilience experts, and community leaders dealing with floods in the Canterbury region, South Island-Aotearoa New Zealand. The objective is to simulate a decision-making process and understand the trade-offs between infrastructure and social assets when planning resilience investments. The study focuses on creating a collaborative process that ensures the diverse interests and concerns of stakeholders are represented and integrated into the planning process.

To achieve these objectives, the study developed a tailored methodology called *Playing with Uncertainty*: facilitating community-based resilience building. This game-based participatory modelling methodology includes role-playing negotiations and game elements to enhance participant engagement. The methodology provides an opportunity for stakeholders to come together, without preconceptions, to participate in these decision-making game-based simulations and discuss data and evidence in resilience planning for future events.

A total of six workshops were conducted between 2020 and 2022. Each tailored session involved three categories of stakeholders: community leaders or locals, policymakers, and resilience experts. Participants included students from the University of Canterbury, resilience experts, industry professionals and planners, and policymakers from the local government in New Zealand. This research was conducted under human ethics permission HEC-2020/88.

The study found that the game-based participatory modelling methodology was effective in engaging stakeholders in the decision-making process. The role-playing simulations and game elements provided a structured and interactive platform for participants to explore different scenarios and trade-offs between infrastructure and social resilience investments. Furthermore, the tailored methodology allowed for the identification of key issues and challenges related to community resilience planning in the Canterbury region, which can inform future planning efforts.

This study contributes to the growing literature on participatory modelling and gaming (Bakhanova et al., 2023) as effective approaches for community resilience planning. The importance of this research is to bridge the gap so that all stakeholders are confident and open to tough discussions on the social and technical aspects of planning resilience. The tailored methodology and lessons learned from this process have the potential to improve risk management and resilience governance practices, ultimately influencing the science-policy interface in New Zealand and beyond.

REFERENCES

- Bakhanova, E., Garcia, J. A., Raffe, W. L., & Voinov, A. (2020). Targeting social learning and engagement: What serious games and gamification can offer to participatory modeling. *Environmental Modelling and Software*, 134, 104846. <https://doi.org/10.1016/j.envsoft.2020.104846>
- Elsawah, S., Bakhanova, E., Hämäläinen, R. P., & Voinov, A. (2023). A Competency Framework for Participatory Modeling. *Group Decision and Negotiation*. <https://doi.org/10.1007/s10726-023-09818-0>

Keywords: *Community engagement, policy gaming, resilience planning*