**SUPPLEMENTARY MATERIALS**

Playing with Uncertainty: Facilitating Community-based Resilience Building

The supplementary materials are a collection of detailed information and complementary documentation that support our contribution. We present a description of serious games analysed in Table 2 of the manuscript and its references aligned.

**Serious games from Table 2 in detail**

The following three examples are related work to facilitate resilience-building using serious games. The analysis of the games located in Asia, America, and Europe is intended to extract lessons learned from game elements that can be used to create our participatory modelling methodology to facilitate resilience building in socio-technical systems STS. This process allows us to collect valuable lessons towards a design framework that can be used for resilience challenges in local governance, informing both theory-building and practical application.

1. **Asia: Thailand – ‘Kin Dee You Dee’, Enhancing community resilience.**

Marome, Natakun, and Archer (2021), present a sequence of three serious games to enhance risk awareness in the Bangkok Metropolitan Region, Thailand. Among Asian countries, Thailand has the longest history of disaster management focused on risk reduction since the twentieth century (Marome, Natakun & Archer, 2021).

The purpose of Kin Dee You Dee, which literally means ‘Eat well, live well’, is to function as a toolkit to facilitate and foster discussions about community resilience building in the context of climate change adaptation (Marome, Natakun & Archer, 2021). The question that derived from the researchers’ inquiry was about how to increase meaningful community engagement and effectively enhance disaster risk awareness. A sequence of serious games was developed under the program Planning for Eco-Cities and Climate-Resilient Environments: Building Capacity for Inclusive Planning the Bangkok Metropolitan Region (PEACE-BMR). The conceptual framework was initiated with the problem statement and objective of the game design. Then, game tests and revisions were conducted through trials with underrepresented communities, and a final version of the game was launched in a series of workshops to develop inclusive resilience strategies and strengthen community awareness. These methodological stages were useful to create future policy recommendations when using games to enhance community resilience (Marome, Natakun & Archer, 2021).

The game setting consists of local municipal authorities, community members, and strategic government agencies that come together to build a common understanding of how to build a community-based resilience pathway. Researchers designed workshops to foster participation in managing qualitative data, create definitions, maps, and activities to obtain information about how to improve the toolkit and create user-friendly material. During three years, researchers carried out pilot tests with groups of over ten (10) participants in five provinces of the Bangkok Metropolitan Region (BMR). A final version of the toolkit was tested in early 2019 with a flood-impacted community of the BMR. Sessions were then replicated in case studies with four local authorities and representatives from the public and private sectors to examine the replicability of the experience (Marome, Natakun & Archer, 2021).

According to this research, serious games are effective in enhancing resilience. At the same time, participants argue that: *“the toolkit can help the government develop the all-encompassing policies that promote resilience, rather than leaving it all up to the communities to deal with uncertain futures”* (Marome, Natakun & Archer, 2021: 10pp).After the appropriation of the toolkit, communities in BMR were able to produce a strategic plan during the workshops that can signal the effectiveness of serious games to foster initial conversations around community needs and self-organising strategies on how to cope with natural hazards before asking authorities for help (Marome, Natakun & Archer, 2021).

**2. America: Ready for Drought? A Community Resilience Role-Playing Game.**

Researchers at the University of Nebraska-Lincoln studied the usability of a game as an educational tool to encourage collaborative discussions among multiple stakeholders involved in drought planning of the Missouri River Basin region (Podebradska et al., 2020). The team of Podebradska et al. (2020) used simulations from real-world decisions and trade-offs to learn about multiple factors involved in decision-making processes during disaster risk management. They developed a serious role-playing game that presents drought impacts to simulate a decision-making process on water banking that debates on water resources before and during a disaster under difficult resource-sharing scenarios with multiple stakeholders (Podebradska et al., 2020). The game is called: ´ready to drought? ´. It starts with introducing concepts, relationships, and complexities of drought planning. Then, players (In this case, tertiary education students and professionals) choose a role from six different sectors involved (citizens, community members, local decision-makers, responders and agents from business and government) to discuss decisions for each of the four phases of the event (drought planning, drought event, impact assessment and reconstruction). The authors use pictograms, cards, and graphical representations of phenomena with low technological requirements as elements of the game (Podebradska et al., 2020).

Investigators of the game: ´ready to drought? ´ found that participants improved their level of understanding about droughts and were willing to recommend the game to other future players as a learning tool for building awareness about extreme events. As a result of the game, participants report were more likely to explore a different approach to problem-solving, decision making, and/or planning connected to drought and role-playing games improve knowledge acquisition while different perspectives and interests are shared because of social interaction in the game (Podebradska et al., 2020).

**3. Europe: The Netherlands – MoBinn**

MoBinn (Mobilize Innovation) is a simulation game developed and implemented to enable stakeholders to experience the need for sustainable collaboration in innovation ecosystems. Mobinn is a game based in the transportation domain tailored to the case of truck platooning. The design of the game is based on the idea that innovation ecosystems are used as a vital concept to address the number of stakeholders, assets, and interactions involved in such processes, including the government that provides policies and support. Stakeholders in an innovation ecosystem must deal with a high level of uncertainty, for example on the development of the technology, the market demand, and emerging competition (Roukouni et al., 2020).

The case of the MoBinn game was developed in the context of the increasing pressure on the road network in the Netherlands and neighbouring states with the aim to become more sustainable. Truck platooning makes use of wireless vehicle-to-vehicle communication and advanced driver assistance systems in the hope of leading to a smoother traffic flow, higher traffic safety, fuel savings and a reduction in CO2 emissions (Roukouni et al., 2020).

The MoBinn game represents the relationships and decisions involved in setting up a truck platoon in a simplified way in the form of a board game. The physical elements of the game include: one game board, four role cards, five action cards per role, event cards, tokens, and pawns. The roles of the players in the game correspond to the key actors of the truck platooning ecosystem (Roukouni et al., 2020). The aim of the game is to bring key performance indicators into a ‘green’ zone, representative to ‘make the innovation happen’. Players are confronted with certain events during the game play, depicted by event cards, that can either pose a positive event, or rather a negative disruption to the flow of the game, and the decisions of the players. The game also fostered creative thinking, as some players came up with solutions that were not laid out in the initial game rules. Feedback from experts included the view that identifying all actors involved in an innovation ecosystem, along with their potential actions, is a very powerful characteristic of the game (Roukouni et al., 2020).

**References:**

***Asia: ‘Kin Dee You Dee’, Thailand:***

Marome, W., Natakun, B., & Archer, D. (2021). Examining the use of serious games for enhancing community resilience to climate risks in Thailand. *Sustainability (Switzerland)*, *13*(8). 4420. https://doi.org/10.3390/su13084420

***America: Ready for Drought? A Community Resilience Role-Playing Game, The United States of America:***

Podebradská, M., Noel, M., Bathke, D. J., Haigh, T. R., & Hayes, M. J. (2020). Ready for drought? A community resilience role-playing game. Water (Switzerland), 12(9). https://doi.org/10.3390/w12092490

***Europe: Game MoBinn (Mobilizing Innovation), The Netherlands:***

Roukouni, A., Lukosch, H., Verbraeck, A., & Zuidwijk, R. (2020). Let the game begin: Enhancing sustainable collaboration among actors in innovation ecosystems in a playful way. *Sustainability*, *12*(20), 1–17. https://doi.org/10.3390/su12208494