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INTEGRATING EXPERIMENTAL ECONOMICS AND LIVING LABS IN WATER RESOURCE MANAGEMENT

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ABSTRACT

The ultimate goal of water resource management is the efficient allocation of increasingly scarce water resources. One of the most crucial and often obscure aspects of water resource management pertains to the behavioural particularities of the societal relationship with water; how people value the resource, how utility companies price the resource, and how policy makers derive financial instruments to address social dilemmas associated with common pool resources and public goods. This chapter explores the use of two complimentary approaches to derive both quantitative and qualitative data within an iterative process to provide evidence-based decision support in the sustainable management of water resources. Within this integrated approach, participatory Living Labs use small focus group settings to collect qualitative data about key phenomena. This qualitative evidence provides foundation for theoretical models that produce testable suggestions for economic experiments. The economic and behavioural experiments focus on gathering quantitative data to test a prediction, subsequently raising further questions – such as heterogeneity of behaviour, causal relationships between factors - that can be explored deeper by living labs qualitative angle. The Living Labs and Experimental Economics approaches have an iterative relationship, examples of which will be highlighted in this article.

KEYWORDS: Water, Living Labs, Experimental Economics, Stakeholder Engagement, Participatory Approaches

With the ever-increasing strain placed on global water resources – over-exploitation, drought, pollution (Navarro-Ortega et al., 2015; Loucks and van Beek, 2017; Jägermeyr et al., 2017; Gerten et. al., 2020; Vanham and Leip, 2020), effective and sustainable water resource management has become more crucial than ever. As water not only plays a central role in supporting life on earth, but also in meeting sanitation needs, energy generation, food production, supporting economic activity and many instances transportation, it functions as both a public and economic good (UN, 2014). Thus, the sustainable water resource management aims to strike a delicate balance to achieve water security in the face of conflating stresses and competing and competing demands. Over the last few decades, Integrated Water Resource Management (IWRM) approaches have proven to be one of the most effective approaches available to managers in the water sector, as such approaches bring together a broad range of knowledge and methodological approaches from various disciplines in order to provide sound decision support for practitioners and policy-makers alike (Giupponi and Sgobbi, 2007; Qi and Altinakar, 2011). "Integrated water resources management is based on the equitable and efficient management and sustainable use of water and recognises that water is an integral part of the ecosystem, a natural resource, and a social and economic good, whose quantity and quality determine the nature of its utilisation" (GWP, 2020). That said, while current IWRM approaches have made great strides towards the integration of scientific input from the physical sciences, there is still room for closer integration of economic methods and critically participatory methods that seek to incorporate stakeholder input (Giupponi and Sgobbi, 2013; Akinsete et. al., 2022).

The greatest challenge in terms of water resource management is accounting for the human-factor. While nature runs its course through environmental cycles – precipitation, groundwater recharge, surface runoff etc. (Adams, 2021), accounting for the impact of human activity, and more importantly the mechanisms of real-life human decision-making are central to inform effective, human-centric approaches to water resource management. In particular, insight into the value that society places on its water resources is necessary to design robust water management measures and appropriate economic exchange mechanisms to support the allocation of water resources and the associated costs and benefits among stakeholders (Koundouri and Groom, 2002; Koundouri and Pashardes, 2002; Koundouri, 2004; Koundouri and Dávila, 2015).

Despite the importance of carefully considering the hydrological and environmental as well as the socio-econmic parameters of water resource management through integrated sciennce-based policy and decision support tools, the uptake of such tools by policy and decition makers is limited due to the fact that such stakeholders are unlikely to use tools they are unfamiliar with and do not deem trustworthy (Adams, 2021). In order for these integrated scitentific approaches to be effectively embedded in the descision-making process, it is important to incorporate methods which encourage stakeholder participation throughout the process. In other words, stakeholder participation through science-fed collaborative processes embed co-determined inputs developed by scientists and stakeholders during periodic meetings (Liu et al 2008; Gupta et al 2011; Adams, 2021).

Living Labs (LLs) provide a co-creation space to conduct such periodic stakeholder engagement. LLs are a collaborative approach geared towards tackling complex challenges through stakeholder-driven open innovation. They are both a research methodology and tool, bringing together key stakeholder including scientists, decision-makers, water managers and users in a co-creation and co-involved innovation processes which includes testing, experimentation, and evaluation within real-world contexts (Schuurman et al., 2011; Leminen and Westerlund, 2019; Delina, 2020; Christine et. al., 2022). The LLs not only bridge the gap between scientists and stakeholders, but they also provide a means to elicit qualitative insights in on relevant water management issues such as supply (Hirshleifer et al., 1969), demand (Franks et al., 2002) and scarcity (Olstead, 2010). Such areas of focus may then be further investigated utilizing experimental economic methods.

Experimental economics relies on an established methodological toolbox to provide evidence-based insights into individual and collective decision-making, as well as strategic interactions between individuals and groups. At heart of the method is creation of controlled settings, keeping potential confounding variables fixed between groups under consideration. Varying a single aspect of interest, one may attribute differences in participant's behavior to this aspect. This approach grants causal conclusions (internal validity; Lonati et al. 2018). Extensive control, however, comes at the cost of reduced external validity. The gap separating controlled designs and 'real life' likely explains systematic differences between lab settings and natural environments (Galizzi & Navarro-Martinez 2019), questioning whether lab studies may truly provide quantitative conclusions (Loewenstein 1999). However, the linchpin of empirical findings is their applicability in real-life, as economics aims to inform about the best course of action. Consequently, field experiments alleviate this issue by moving investigations from the lab to more realistic contexts (Harrison & List 2004). However, the distinction between lab and field is not necessarily synonymous with a trade-off between internal and external validity (Lonati et al. 2018): experimenters applying scientific rigour and careful designs may succeed to preserve both also in field settings (Harrison & List 2004).

Three major groups of experiments related to environment more broadly, and water resources in particular

- study of how behavioural particularities of individuals may affect society's value of resources and the environment. Environmental valuation models may be enriched by including affective value of natural resources (Lopez-Mosquera & Sanchez 2011, Welsch & Kuhling 2009), and accounting for cognitive biases such as myopic temporal discounting (Weber 2010, Clot & Stanton 2014), gain-loss discrepancies (Jang et al. 2020, Ölander & Thøgersen 2014), and suboptimal emotional forecasting (Nisbet & Zelenski 2011). Specifically for water resources, for example, willingness-to-pay for water resource protection, and role of use and non-use aspects (Halkos and Matsiori, 2014).
- how incentives and institutions affect decisions and outcomes. Here studies explore, for example, how markets manage water resources (García-Gallego et al., 2012), and optimal features of water market design (Garrido, 2007)
- typical problems of group externalities or social dilemmas associated with common pool resources and public good issues with direct applications to resource and environmental issues – such as managing common resources (Cardenas, 2000)

Scientists strive to reap the benefits of observing behaviour in the natural setting while maintaining some control over explanatory factors, which leads to more collaborative efforts with outside parties (Levitt & List, 2009). LLs have the potential to facilitate this gap-bridging between lab and field. Examples of water-specific experimental economics studies supported by LLs include feedback on water use (enabled by smart-meters) results resulted in a long-term 8% reduction of volumetric water consumption among almost 50% of the households, with the effects persisting for over two years after the program's start, especially for the households receiving sub-daily smart meter information (Cominola et al., 2021). The quantitative results of the study raise further qualitative questions that could be addressed by the Living Labs – e.g. the reasons behind the remaining half of the households not showing any savings (lack of engagement with the feedback, long-formed water consumption habits, or something else?), the success factors of the saving households (social responsibility, money saving, or something else?). Thereby, the LLs provide further insight into the results of the behavioural experiments via an iterative process and producing more robust outputs to support the establishment of appropriate economic arrangements, the success of which are largely determined by stakeholder engagement processes (World Bank, 1999).

Despite approaches towards the integration of such economic and stakeholder engagement processes in the field of water management remaining in their infancy, the co-developmental nature of these approaches help promote a closer and more transparent working relationship between the various actors in the water management sector. Furthermore, in the broader sense, facilitate a system-wide shift towards greater sustainability, social equity, and inclusive policy development within water management (Hermans et. al., 2006; Voytenko et al., 2016; Hossain et al., 2019; McPhee et al., 2021).

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