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Adaptive capacity in the water sector under socio-economic and climate uncertainty.

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Under the impelling challenges posed by climate change, population growth, and evolving socio-economic landscapes, the ability of water systems to adapt to changing conditions is critical for ensuring resilience and sustainable resource management. As various regions face escalating water scarcity and more intense occurrences of droughts and floods, many of these areas also deal with underdeveloped infrastructure, a lack of access to sanitation services and essential water resources for both population and agricultural activities.

When rainfall patterns change and groundwater is at risk of exploitation, water-saving techniques and alternative water sources such as desalination and water recycling need to be made available, which implies higher costs than conventional water sources.

Using different datasets on technology adoption and country survey data, we assess the historical development of potential adaptation technologies (desalination and wastewater treatment), as well as trends in water infrastructure providing access and sanitation services. We then study the relation of these variables to socio-economic factors (e.g. population, GDP, governance) and climate variables (temperature increase, water stress, flood intensity). We use regression models to understand the future capacity to develop and adapt under different socio-economic futures (identified with the Shared Socio-economic Pathways, SSPs) and climate scenarios, defined by levels of warming.

Preliminary results show a strong linkage between water access and sanitation indicators with GDP and inequality, while governance structure seems to play a significant role in the deployment of desalination technologies.

Comparative analyses of different technologies will help modelling communities explore the effectiveness of different adaptive strategies and inform policy decisions on the most suitable and challenging adaptation options in the water sector.