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Challenges and best practices of a participatory approach**

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### **Q methodology among smallholders: Challenges and best practices of a participatory approach**

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Smallholder farming is a backbone of millions of livelihoods in the Global South. It provides up to 80% of the food demanded in Sub-Saharan Africa and Asia while scarcely occupying 12% of the global farmland. About 1.5 billion deeply poor households - especially those located in rural areas - depend directly on smallholder agriculture. Stimulating its sustainable intensification is thus of utmost importance in the fulfilment of SDG 2: Zero Hunger and SDG 1: No poverty. Despite decades of (top-down) scientific research, technology transfer and international aid, effective development of this sector remains a summit hard to reach. Profound heterogeneity of smallholder farming systems exacerbates the challenges of this endeavor. Their intricate differences does not only make a single, ultimate development model impractical/impossible, but ignoring them leads us to biases that result in leaving the most disadvantaged out.

We argue that well facilitated participatory research is a sounder way to understand, and hence to act. First, it enables a bottom-up, co-creative process of mutual generation of knowledge together with relevant stakeholders. Second, it gives voice to the (generally) voiceless, therefore turning into a more inclusive and empowering exercise. We resorted to Q-methodology - a powerful qualiquantological participatory method - to explore smallholder adoption of sustainable irrigation technologies in Nepal and Indonesia. We interviewed 19 farmers and 24 experts about the uptake of a hydro-powered water pump commercially known as the Barsha pump. Through this research technique, we found three different viewpoints that placed themselves beyond typical social constructs of smallholder farming (e.g. country, land size). This deeper understanding may become an enabler for a more context-sensitive transfer of farming technology. On the flipside, the implementation of Q methodology in low-resource (rural) settings still poses a number of underreported challenges that are worth discussing, especially in light of big shocks such as the ongoing COVID-19 pandemic. We therefore raise questions such as, which good practices facilitate the application of Q methodology in low-resource settings? How to empower local researchers with a method that remains 'property' of developed countries? How to democratize the tools to allow people to learn better about themselves?

### **Socio-material bricolage: co-design of institutions by materialities and society in Turkey**

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Drip irrigation is often considered as a compound technological solution for diverse problems in agriculture. It is being promoted to increase water use efficiency and crop productivity as a means to 'save' water. However, unintended consequences of implementation are often ignored and little attention has been paid to the socio-material processes that play around the implementation of drip irrigation in community managed systems. Based on data collected through an ethnographic research on the introduction of drip irrigation in Ağlasun, a rural town in south-west of Turkey, the aim of this paper is to examine the socio-material effects in irrigation systems. We investigate how the switch from surface irrigation to drip irrigation influences institutional arrangements, materialities and people's practices. Although critical institutionalism scholarships offer a deep understanding on how actors affect and being affected by institutions, specifically through the concept of institutional bricolage, the agency of materialities and how materialities shape and are shaped by both institutions and people's behaviour have been less examined. We propose socio-material bricolage to bridge between actors, institutions and materialities. The concept of socio-material bricolage focuses on how both actors and materialities shape institutions and in turn shaped by them through various feedback mechanisms. We argue that analyzing the agency of actors and materialities in the same system will enhance institutional analysis and offer a deeper understanding of the relations between institutions, actors and materialities. Our findings demonstrate that the change in irrigation type in Ağlasun reshapes the irrigation infrastructure which transforms institutional arrangements of cleaning and maintenance of irrigation canals, water distributional rules and environmental values of society.