Literature review of the effects of adopting more efficient water irrigation technologies

Language: English

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Background: Reviews and evaluations of how technologies contribute to overall farm-level sustainability are scarce. Many evaluations focus on how one aspect of sustainability is affected by a specific innovation. Less common are studies that provide insights how technologies contribute to overall sustainability and how that might differ in different applications of the technology. To ensure a development towards a more sustainable agriculture, technologies introduced on farms should be evaluated regarding how they affect overall sustainability. It is especially important to consider indirect effects from technology adoption. *In this context, indirect effects of technology adoption refers to effects arising from farmers changing their behaviour after having adopted a technology resulting in e.g. rebound effects, spillover effects or other effects which were not the stated purpose of the technology.*

Increasing water irrigation efficiency have been found to have indirect effects, mainly rebound effects, where this in some studies have been found to lead to increased water usage, the very opposite of the intended effect. There are already reviews on the effects of increased water irrigation efficiency, but these are focusing on narrowly defined effects such as rebound effects. Currently, no systematic overview of the different types of direct and indirect effects of this technology exists. A literature review of the effects of water irrigation technologies can provide important insights on the overall effect of improved water irrigation on sustainability and what direct and indirect effects have been found to this technology.

Objective: To provide a systematic overview of the direct and indirect effects of improved water irrigation efficiency on sustainability by means of a literature review.

Approach:

- Discuss potential indirect effects of improved water irrigation efficiency based on theoretical models and concepts.
- Compile previous empirical findings of improved water irrigation efficiency and discuss their implications for different aspects of sustainability (economic, environmental and social).
- Identify potential conflicts or synergies between theory and empirics as well as the different aspects of sustainability.
- Discuss why the effects of increased water irrigation efficiency might differ between cases and what might determine whether this has positive or negative effects on sustainability.

References to start:

Empirical study showing that improved water irrigation can cause increased water usage
Pfeiffer, L., & Lin, C. Y. C. (2014). Does efficient irrigation technology lead to reduced groundwater extraction? Empirical evidence. *Journal of Environmental Economics and Management*, *67*(2), 189-208.

Examples of spillover effects from more efficient water usage
Li, M., & Long, K. (2019). Direct or spillover effect: The impact of pure technical and scale efficiencies of water use on water scarcity in China. *International journal of environmental research and public health*, *16*(18), 3401.

For an example of how improved water irrigation can cause improved productivity
Hassanli, A. M., Ahmadirad, S., & Beecham, S. (2010). Evaluation of the influence of irrigation methods and water quality on sugar beet yield and water use efficiency. *Agricultural Water Management*, *97*(2), 357-362.

Literature review on rebound effects; Provides insights on how to conduct a literature review and rebound effects from water irrigation technologies.
Paul, Carsten, Anja-Kristina Techen, James Scott Robinson, and Katharina Helming. 2019. “Rebound Effects in Agricultural Land and Soil Management: Review and Analytical Framework.” *Journal of Cleaner Production* 227 (August): 1054–67.

An economic perspective on the potential gains from improved water irrigation efficiency
Wichelns, D. (2002). An economic perspective on the potential gains from improvements in irrigation water management. *Agricultural Water Management*, *52*(3), 233-248.