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ABSTRACT SUBMISSION ACKNOWLEDGEMENT

Thank you for submitting your abstract for the IWRA World Water Congress XV

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Abstract Title:

SEFFICIENCY (SUSTAINABLE EFFICIENCY) AND REALLOCATION OF WATER USING AGRICULTURAL AND URBAN SCENARIOS

Abstract text:

1. Introduction

Water efficiency (%) is among the most crucial performance indicators for sustainable management and design of water systems, such as, irrigation and urban areas, industries and basins. For that almost all the countries and regions of the world have water efficiency as one of their top priorities: China 3 red lines, EU Horizon 2020 and JPI-water, Portugal PNUEA, California, etc. This has many drivers, such as, climate change, economics, population, resource scarcity and technology.

The validity of the concept of efficiency is, of course, easy to understand: "Efficiency is thus not a goal in itself. It is not something we want for its own sake, but rather because it helps us attain more of the things we value." (Stone 2002) So the requirement of efficient systems by decision makers heavily relies on this crucial explanation. However, translating this concept to reality have been very difficult. One of the fundamental reasons is confusion and flaw in the computation of efficiency. For example, for decades Classical Efficiency (CE) (Seckler, Molden, & Sakthivadivel, 2003) has been used both in agriculture and urban areas. We now know that CE is error-prone and should not be used.

The objectives of this study is to introduce a new efficiency index called Sefficiency (Sustainable efficiency) by applying it to agriculture and urban areas and present possible changes in the performance of the systems as water is reallocated.

2. Methods/Materials

Efficiency expressions in water development need certain requirements: being systemic and comprehensive, obeying the law of the conservation of mass (water balance = WB), inclusion of water quality and benefits, applicable to different scales and levels, inclusion of climate variables, and the possibility of promoting active involvement of stakeholders. A set of complex efficiency indicators at Micro-, Meso- and Macro- levels (3ME) were developed on the basis of the above requirements and is called Sefficiency (Haie & Keller 2012 and 2014). Although the generic expression of Sefficiency is $Es = (UC + i \times UR) / (UI - c \times UR)$, its specific expression for each level is different. In this expression: i is for inflow models and c for consumptive ones ($i, c = 0$ or 1; $i + c = 1$), UI = Useful Inflow, UR = Useful Return and UC = Useful Consumption. These all depend on the Usefulness Criterion which is the product of the weights of quality and benefits of water. For definitions and explanations of these variables and concepts, the reader should refer to Haie and Keller (2014). One of the important issues in these developments is the distinction, based on quantity and quality, between water use and consumption. The latter being defined as the outflow that is unavailable for reuse.

Examples are used to briefly discuss the Sefficiency indicators. The numbers presented for different cases show the general tendencies based on real data with an agroclimatic and urban setting, having in mind that they can potentially exhibit wide ranges of values. They include the treatment for water, i.e., the waste water treatment plant (WWTP) of an urban area as part of the MacroEs and the Water treatment (WTP) as part of the MesoEs and MicroEs.

3. Results and Discussion

To discuss the results, it is supposed that the decision makers assume that "any efficiency difference within 2pp (percentage point) is not significant, and as a result the two efficiencies (e.g., before and after interventions) can be considered practically the same and should be labeled as "Equal". However, if the difference between efficiencies is closer to 5pp, the greater is labeled as "Slightly Higher"." (Haie & Keller 2014)

Having this in mind, we show that a change from surface irrigation to drip has two distinct results: increases MicroEs but cMesoEs values are slightly higher and the iMesoEs values are equal. Meaning that using technology and increasing the local efficiency (MicroE) by reallocating water from irrigated land to other uses, such as, urban or nature, may not actually increase the efficiency of the irrigated land if the impact of the return flows are considered (MesoEs level). Additionally have in mind that higher technology systems, such as, drip, may actually have the contrary effect of increasing water consumption (Haie & Keller 2014). On the other hand, in an urban setting, using technology by introducing low flush devices (LFD), such as LFToilets, would increase MicroEs slightly but MesoEs and MacroEs may remain almost the same.

4. Conclusion

First it should be mentioned that Sefficiency is complex and simulates reality more closely giving results that sometimes challenge our current models. For example, we can check if it is efficient to use LFTs for a city? Sefficiency shows us that MicroEs increases but MesoEs and MacroEs basically stay the same meaning that useful outflow per unit of useful inflow for the two scenarios may remain equal. This is partially due to the fact that the downstream flows (VD) remain the same under the two situations while the withdrawals (VA) and the returns (R) change, i.e., the scenario with LFT has lower VA and R. So, if our prime objective is to have more water downstream of the city, LFT may not be a serious solution.

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Themes

140 Sub-theme 9: Water allocation among competing uses and users

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