

Integrated assessment of human and animal waste

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Humans and animals produce an important quantity of waste that affects health and environment. Waste must be seen as resource and resources recovered from wastes and reused, while considering health safety and effectiveness. We developed a conceptual framework for improving health and environmental sanitation using an approach combining health, ecological, socio-economic assessments.



Conceptual framework development

The framework (Fig. 1) has three main components: health status, physical environment, and socio-economic environment. Information on each of these three components can be obtained using standard disciplinary methods and an innovative combination of these methods. Analyses lead to extended characterization of health, ecological and social risks while allowing the comprehensive identification of critical control points (CCPs). Interventions deriving from the comprehensive analysis consider biomedical, engineering and social science perspectives or a combination of them.

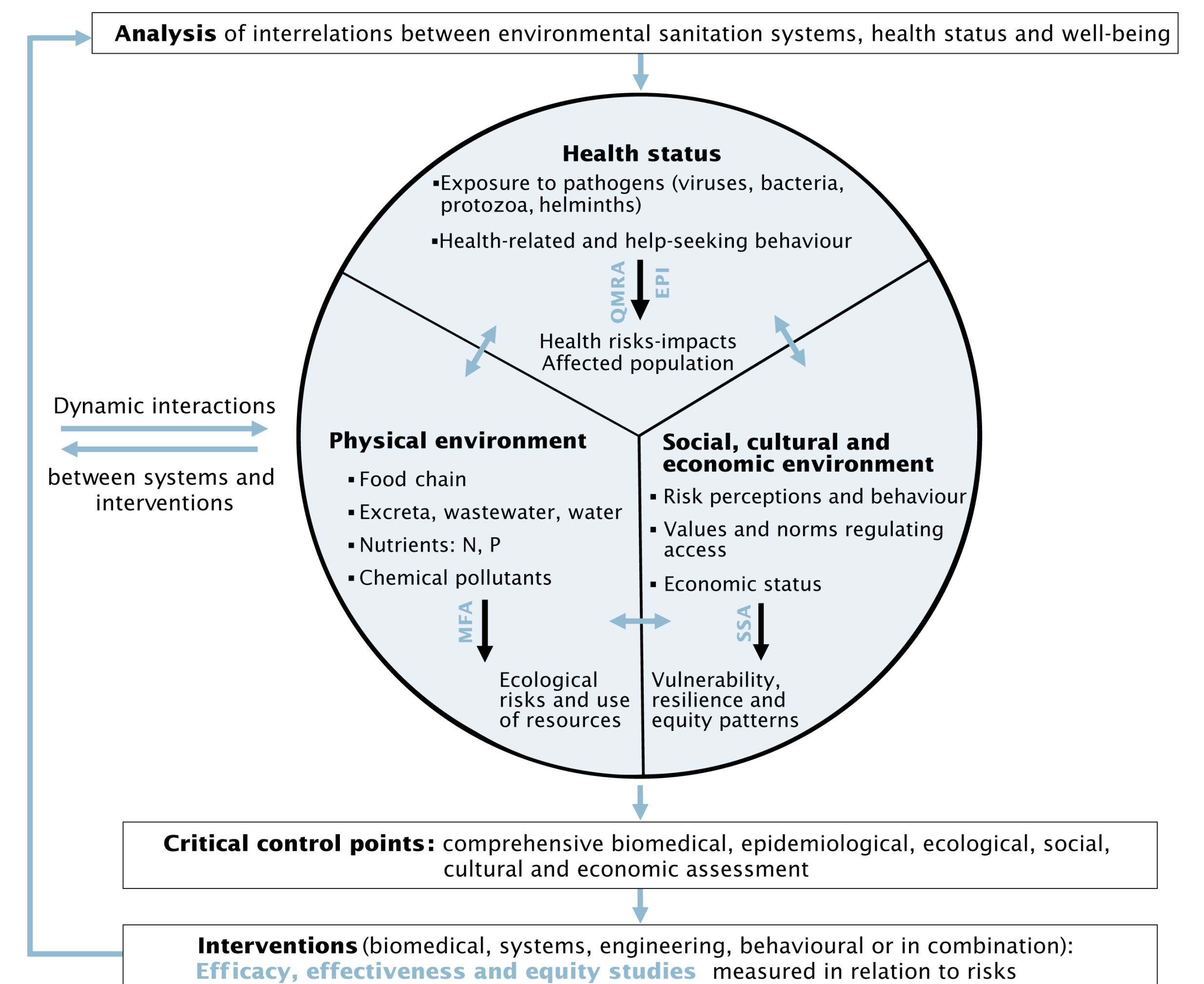


Figure 1: Conceptual framework of integrated assessment for health, environmental sanitation, and society. EPI: Epidemiology, QMRA: Quantitative Microbial Risk Assessment, MFA: Material Flow Analysis, SSA: Social Science Analysis.

Application of the Framework for Integrated Assessment of Human & Animal Waste Management

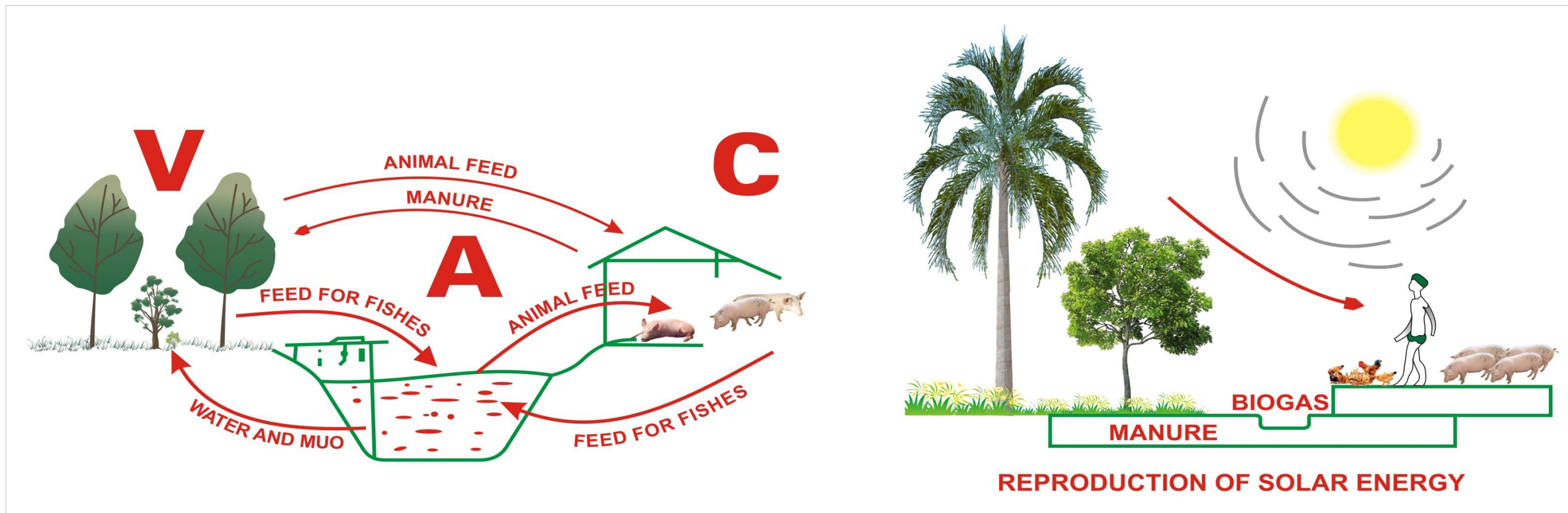


Figure 2: Integrated Crop (V) – Fishery (A) – Livestock (C) (V-A-C) in Vietnam



Figure 3: Biogas (Left) and Farmers working with excreta and wastewater in a field in Hanam, Vietnam (Right).



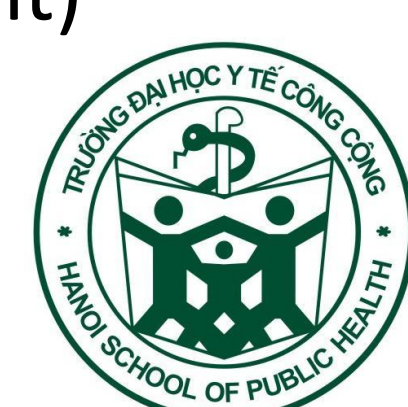
Figure 4: Flyer of combined human and animal waste composting (left) and its experiment model in the field (right)

Case study in Ha-Nam: 85% of population have been engaged in agricultural activities; predominantly smallholders and often raise 2-20 pigs on land simultaneously residential, agricultural, aqua-cultural, and horticultural (Fig. 2).

The application of the framework identified the distinctions between the theoretical organization of the framework and the fluid interactions that occurred in the real life case study. Ideally, all components of the framework should be prepared such that they begin at the same time. In practice, diverse information from the three components was combined.

The actual risks identified by the epidemiological studies supported and complemented the QMRA, which assessed the risk of infection, giving CCPs in terms of health risk. The socioeconomic and cultural assessment looked at the behavior and perception of participants with regards to these CCPs and the cost and willingness to pay for sanitation options. Participants' perceptions of the health and environmental risks of intensive waste recycling and reuse within their agro-ecosystem was not consistent with the actual risks measured. However, they were willing to pay for better sanitation facilities.

The combined assessment showed the importance of identifying CCPs in this system to be targeted for interventions. On-site sanitation systems and the combined management of human and animal waste appear to be promising interventions (Fig. 4).



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