Analyzing incentives in adoption-opinion models

Keywords sustainable transition, opinion dynamics, technology adoption, targeted intervention

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Background To facilitate the transition to a sustainable society, it is important that individuals and communities adopt new technologies and behaviors. Policymakers can support this transition through targeted incentives and information campaigns. However, since typically there is a limited budget available, it is important to study how these incentives should be allocated in order to maximize their impact.

In previous work we studied a coupled adoption-opinion model in which population is described through two interacting layers, that can be observed in Figure 1. The first layer captures the adoption process and is inspired by epidemics models: individuals may adopt or abandon a technology or behavior over time. The second layer is an opinion layer that describes the evolution of opinions, which influence the propensity to adopt [1]. Your peers' opinions and adoption behavior can influence your own opinion and vice versa. Note that the two influence networks might be different. For instance, your friends could be against solar panels, while seeing all your neighbors install them could makes you more inclined to do so as well.

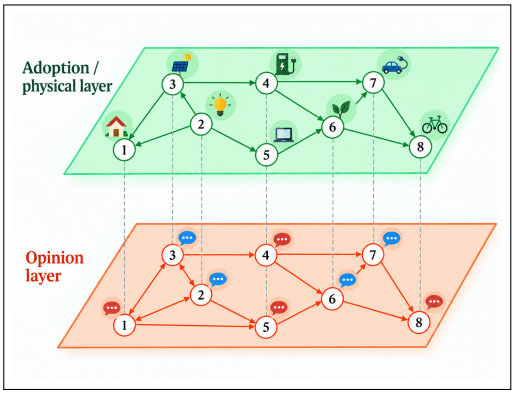


Figure 1: Illustration of the coupled adoption-opinion model.

In recent work, we studied how we can model and design incentives for the opinion layer, also considering the trust each individual has in the external entity providing these incentives. We now want to combine this with the behavior-adoption model and investigate whether similar results can be obtained when the final objective is adoption rather than opinion change. Additionally, we would like to calibrate the model with real-world data and study if it can explain the influence of incentive campaigns on the adoption of sustainable technologies.

M.Sc. Thesis Outline

1. Literature study. We will provide important references for studying the underlying models
2. Combine the coupled behavior-adoption model with our new incentive model and study the resulting targeting problem.
3. Validate the model with real world data, like the Malawi technology adoption experiment [2].

Prerequisites Currently enrolled in a Master's programme in electrical/control/robotics engineering or computer science, possibly with interest in working with real-world data.

Programming Languages Python.

Application documents CV, academic transcripts, short motivation letter (optional).

References

[1] M. Alutto, Q. Xu, F. Dabbene, H. Ishii, and C. Ravazzi, "Model predictive control for coupled adoption-opinion dynamics," in *64th IEEE Conference on Decision and Control*, pp. 7178–7183, 2025. ISSN: 2576-2370.

[2] L. Beaman, A. BenYishay, J. Magruder, and A. M. Mobarak, "Can Network Theory-Based Targeting Increase Technology Adoption?," *American Economic Review*, vol. 111, pp. 1918–1943, June 2021.