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Seed Selection Strategies in a Sparse Social Network in Rural Zambia: An Empirical ABM Approach

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Abstract

Identifying the optimal set of seeds (farmers who obtain information initially) in social networks poses an important question for policy-makers and organisations in developing countries where information is commonly spread through word-of-mouth communication. Widespread provision of adequate information to farmers is particularly important in the context of innovation adoption which has high potential to improve farmers' productivity and adaptation abilities. This paper systematically evaluates different strategies for seed selection with the aim of optimising the seed set to improve knowledge diffusion in a sparse social network in a case study area of rural Zambia. The seed selection strategies include random, hierarchy (village heads), betweenness, closeness, degree, and eigenvector based choice. In addition, the effect of the number of seeds on the diffusion process is investigated. To test for robustness, the study includes the assessment of interaction effects between seed size and seeding strategy. An agent-based model adjusted to a case study area in rural Zambia is applied.

Key findings show that degree based seed selection performs best out of the selection strategies in terms of speed and reach of the diffusion in the sparse network. Also farmers with high betweenness centrality who function as bridges to connect network components enhance the diffusion. Eigenvector and closeness based seed selection do not result in a widespread reach. Further simulations shows that higher seed size increases reach, but this effect is more pronounced for small seed sizes and in the short run. These results highlight the importance of taking the time frame into account when planning diffusion of information. While for random, degree, and betweenness based seed selection the results are robust, the simulation shows that closeness and Eigenvector based seed selection significantly improves if the seed size is enlarged. All in all, the findings indicate that seed selection according to degree centrality is a good starting point to improve the diffusion process and that seed sizes should not be too small to ensure widespread reach, but increasing large seed sizes further will only result in marginal benefits.

Keywords: Agent-based modelling, information diffusion, seeding, sparse social networks