Impacts of Neighbourhood Influence on SHS Social Acceptance

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Dr. Nicholas N. Opiyo

n.opiyo@ulster.ac.uk

Introduction:

Social acceptance is necessary for successful diffusion of a new technology within a given community, and this is especially so with solar microgeneration systems which impact on individuals' spaces both passively and actively [1]. The figure below shows a house with various solar hhome systems (SHS).

Fig. 1: A House with SHS in Kendu Bay, Kenya

According to Roger's theory of diffusion, the probability that a household deciding on PV actually install one at a given time t is given by [2]:

$$\big(p + qF(t)\big) \qquad (1)$$

Where p is the coefficient of innovation, q is the coefficient of imitation, and $F(t)$ is the proportion of adopters at time t.

The probability density function for a house that is deciding on PV at a time t is given by

$$f(t) = \big(p + qF(t)\big)\big(1 - F(t)\big) \qquad (2)$$

And the corresponding cumulative density function is given by:

$$F(t) = \frac{1-exp(-(p+q)t)}{1+\frac{q}{p}exp(-(p+q)t)} \qquad (3)$$

Given a market potential factor m, cumulative adoption of PV at a time t is given by $F(t) \times m$. Coefficients p and q, and market factor m are considered environmental variables to account for the changing and unstable environment within which diffusion of a new technology occurs.

Methodology:

A short survey was carried on SHS installed in Kendu Bay area of Kenya to gather information on reasons for such installations as detailed in [3]. Specifically, the survey sought to gather information on how neighbourhood influence and social pressure impacted on SHS installation decisions. The surveyed area was divided into three regions as shown in the table below. Survey data was used to inform an agent-based model (ABM) developed in netlogo as described in [4]

Region	Population	Households	Sample	Inclusion Probability
Gendia	12,000	3,000	88	0.029
Kanam	10,000	2,500	67	0.027
Pala	9,000	2,000	53	0.027
Kendu Bay (Total)	31,000	7,500	208	0.028

Table 1: Total Populations, Households, Samples, and Inclusion Probabilities

Results and Discussion:

Influence-radius (IR) is the radius within which a household influences, or is influenced by, its neighbours. Figure 2 compares impacts of different IR on temporal diffusion of SHS within Kendu Bay area. With a default IR of 1 km, 4,325 households would have installed SHS after 25 years. This figure increases with increasing IR, with an IR of 5 km showing 8,999 SHS installations after 25 years, more than twice the value with 1 km. Increasing neighbourhood influence radius therefore leads to exponential increases in SHS installations.

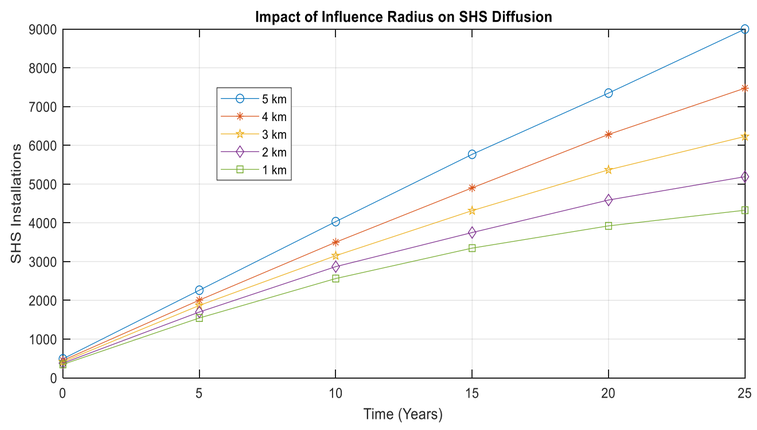

Fig. 2: Comparison of SHS Installations Over 25 Years with Different Influence Radii

Neighbourhood threshold is the minimum percentage of neighbours within a given IR that must have installed SHS for a household to consider doing the same. Figure 3 compares impacts of different neighbourhood thresholds on temporal diffusion of SHS within Kendu Bay area. With a default threshold of 5%, 4,325 households would have installed SHS after 25 years. The optimum threshold is between 12.% and 15% where 5,666 households would have installed SHS after 25 years. On the other hand, thresholds above 20% lead to lower installations, with a threshold of 25% leading to 2,076 installations after 25 years. If neighbourhood threshold was factored into SHS installation decisions, thresholds of between 12.5 and 15% would be recommended.

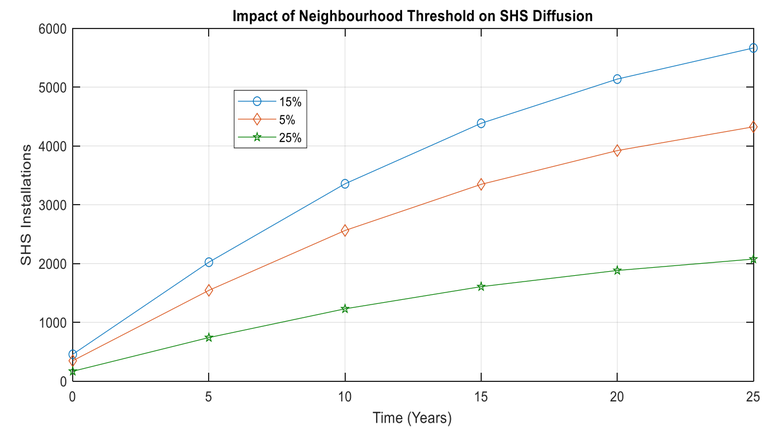

Fig. 3: Comparison of SHS Installations Over 25 Years with Different Neighbourhood Thresholds

Conclusion:

Results show that increasing neighbourhood influence leads to increasing SHS installations within a given rural developing community. Specifically, results show that increasing of a household's neighbourhood influence radius, the radius within which a household can be influence by its neighbours, leads to exponential increases in SHS installations. This is because as more households install SHS within a given sensing radius (neighbourhood), a threshold is reached where a household begins to take notice. With increasing observations, greater communication via visibility, word-of-mouth, and elevated social status of those with SHS, a household is increasingly pressured to consider doing the same. This leads to more SHS installations within a given area as a result of greater neighbourhood influence. Potential methods to increase neighbourhood influence within a given community include increased advertisements through posters, billboards, or even the local radio and TV channels, community outreach through chiefs and other local leaders, roof-top mounting of PV systems to increased external visibility, and compensated referrals, as is currently being done by ART in Kendu Bay.

1. Sauter, R., Watson, J., *Strategies for the Deployment of Micro-Generation Implications for Social Acceptance*, Energy Policy **35**:2770-2779, 2007
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3. Opiyo, N., *A Survey Informed PV-Based Cost-Effective Electrification Options for Rural Sub-Saharan Africa*, Energy Policy **91**: 1-11, 2016
4. Opiyo, N., *Impacts of Neighbourhood Influence on Social Acceptance of Small Solar Home Systems in Rural Western Kenya,* Energy Research & Social Science, **52C:** 91-98, 2019