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Exploring the role of stakeholder dynamics in residential photovoltaic adoption decisions: A quantitative survey in Germany

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1. Introduction

Residential decision-making with respect to low-carbon technologies has been studied intensively. Yet, in behavioural studies to date, individuals are typically assessed in isolation from their social environments [1]. Furthermore, in existing energy transition modelling approaches, relevant stakeholder interactions and their effects are barely accounted for [2]. The research at hand addresses this research gap by investigating stakeholder dynamics in residential PV decision-making from a procedural perspective. Based on a quantitative survey, we investigate the perceived influence of various stakeholders on decision-making. Special attention is given to the relative importance of different stakeholders in the different stages of the adoption process, while also considering the socio-economic characteristics of the participants. Individual credibility dimensions (hereinafter referred to as (stakeholder) attributes) are found to explain the varying influence of stakeholders along the decision stages in the PV adoption process.

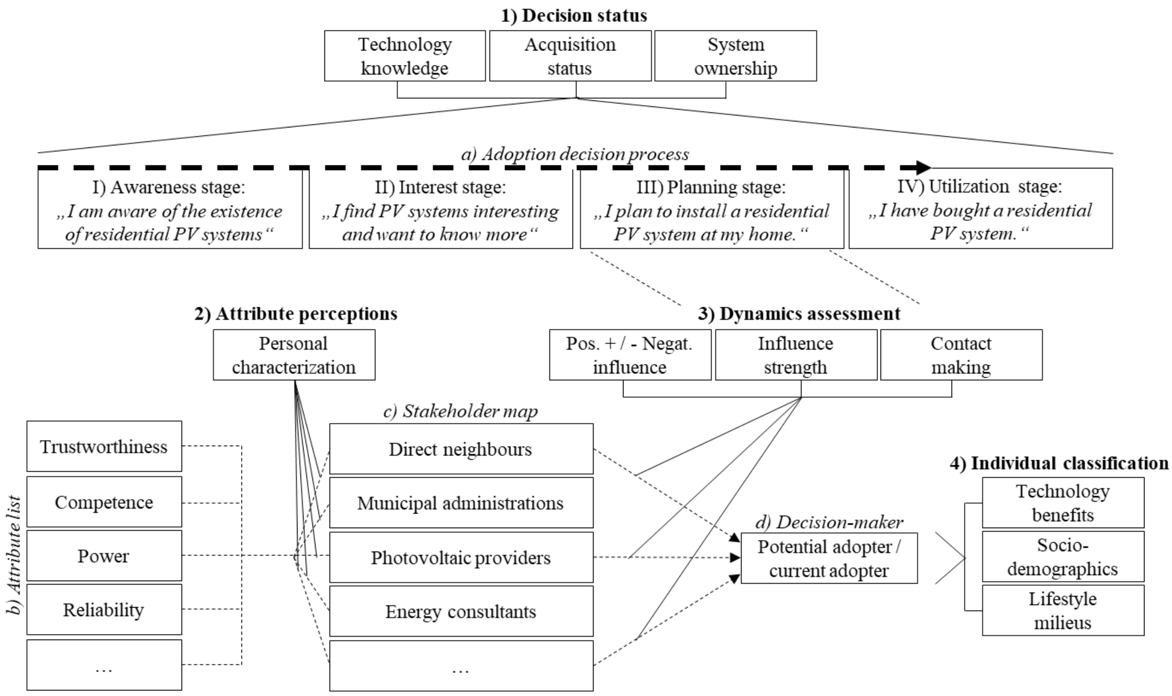

Figure 1: Composition and structure of the computer-aided survey (1-4 set out the general structure, I-IV represent the different stages of the decision process, a-d are answer possibilities of the participants).

2. Methodology

The stakeholder dynamics has been explored with the help of a computer-aided survey. Survey participants were required to be house owners with decision-making power over their rooftops and awareness of PV systems. The survey consists of 1,165 completed questionnaires. Fieldwork was completed in late 2019. The survey is divided into four main parts (1-4) as illustrated in Figure 1 which will be referred to in the subsequent discussion.

First, the adoption decision status was determined by asking respondents whether they currently own a PV system (Current Adopters, CAs) or alternatively, how strong (5 point Likert scale) their intentions to adopt within the next three years are (Potential Adopters, PAs).

The decision process (a) was divided into four stages. The participants were first asked to indicate their current stage in the adoption decision-making process: e.g. the awareness stage

(I), interest stage (II), planning stage (III), or utilization/purchase stage (IV). Participants who, after becoming aware of PV, were still in the process of developing interest in PV, or planning to adopt PV, were classified as potential adopters (PA), while participants who had acquired PV were classified as current adopters (CA). Participants were then asked to describe their relations with stakeholders (c) during the stages that they had completed (stage I; stages I and II; or stages I, II, and III). Specifically, participants were asked which stakeholders (c) they had communicated with; whether these stakeholders had influenced them positively or negatively toward PV; and the strength of the stakeholders' influence. Participants were also asked to rate the credibility attributes of each stakeholder (b). Lastly, driver and barrier statements, and socio-demographic and lifestyle questions were asked to differentiate decision-maker segments (4).

3. Results and Findings

The survey participants are largely distributed between the sub-groups PAs with low adoption intention (n=486) vs. high adoption intention (n=285) as well as CAs (n=394). High intention PAs are defined as those participants who agree or strongly agree to adopt within the next three years. Study participants report a higher net equivalent income (2186 €/month) compared to the national mean (1959 €/month). The mean net equivalent income of CAs and high intention PAs does not significantly differ, whereas the mean income of low intention PAs is significantly lower (-247€/month, $p<0.001$).

Both CAs and PAs who indicated a high intention to adopt show a positive relationship with statements about the environmental, economic, autonomy, and social benefits of adopting PV. CAs are most likely to agree, followed by high intention PAs. This confirms the expectation that respondents who strongly believe in the benefits of adopting PV also harbour stronger intentions to adopt PV.

Furthermore, communication with various stakeholders is important for the adoption decision. The descriptive analysis reveals that the reported contact rates with stakeholders vary during the decision stages and differ among the decision-maker sub-groups (CAs, PAs Stage III, PAs Stage II). Across all study participants, the stakeholders with whom participants are most likely to have contact in all decision stages comprises family and relatives, friends, acquaintances and colleagues, neighbours, manufacturers, and providers as well as the local utility. A closer look at the sub-groups reveals that on average CAs perceive a larger number of stakeholders as exerting positive (pro-PV) influence throughout all stages of the decision process compared to PAs. Furthermore, PAs with a high intention to adopt perceive a larger number of stakeholders as exerting positive influence compared to PAs with a low intention to adopt. This is supported by [3], who assess “a high level of communication”, between solar company and adopter as important for reducing perceived complexity. [4] also state that “established social connections [are] more important than geographical proximity”, as most active peer effects resulted from existing relationships.

To measure the influence of the stakeholders on the decision, PAs were also asked how likely they were to adopt PV. We find that positive (pro-PV) and high-influence contacts with family, neighbours, energy consultants and PV providers have significant ($p<0.05$) and

positive coefficients when regressed on the probability to adopt (R^2=0.18).
The influence strength of the stakeholders can largely be explained by their perceived attributes (R^2 between 0.4 and 0.72 for varying stakeholders and varying phases). The most important attribute over all phases for nearly all stakeholders is competence ($p<0.1$). While reliability has a stronger impact for commercial stakeholders ($p<0.1$), likability is more important for social peers ($p<0.1$).

4. Discussions and Conclusions

The exploratory assessment reveals that the influence of stakeholders is indeed dynamic: The influence of different stakeholders varies depending on their perceived attributes, as well as on the decision-maker's current stage in the decision-making process. The PV adoption intention is strongly dependent on income and on the influence of stakeholders who are perceived as credible (e.g. competent, reliable, likeable, etc.). It is further correlated to perceived non-financial benefits. This leads to three policy implications that could increase residential PV adoption: strengthening the influence of administrative and commercial stakeholders by enhancing their reliability and competence, clarifying non-financial benefits and elevating financial benefits.

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