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Trust-Promoting Seals in Green Information Systems: The Case of Smart Meters and Privacy

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Abstract

Green Information Systems (IS) often require to obtain data in order to assess environmental outcomes and improve sustainable behaviours. As a result, privacy concerns can act as a barrier to the utilization of Green IS. We explore the case of smart meters, which track users' personal energy usage data and provide real-time information, thus allowing users to reduce energy consumption. In this research-in-progress paper, we report on the development of a research model and experimental design to test the impact of trust seals, which can help to build trust and alleviate privacy concerns. For this reason, we refer to green energy and privacy seals that assess and certify the energy efficiency and privacy practices of companies. We further explore opt-out mechanisms, which give consumers the possibility to opt out of smart meter data collection that can also lead to a reduction of consumers' privacy concerns with smart meters.

Keywords: Green IS, environmental sustainability, trust seals, smart metering technology, privacy

1 Introduction

In information systems (IS) research, an increasing number of studies have been conducted to investigate how IS can support individuals and organisations to become more environmentally sustainable. In order to reduce harmful impacts on the natural environment, Green IS requires relevant data to assess environmental outcomes and improve sustainable behaviours (Melville 2010; Watson et al. 2010). For example, smart meters provide real-time information and thus allow users to reduce energy consumption and shift their use away from peak times with the result of improving cost and energy efficiency (Krishnamurti et al. 2012). For this purpose, however, smart meters require to track users' personal energy usage data, which can lead to privacy concerns and therefore hamper the diffusion of smart meters (Horne et al. 2015). Possible extracted information from the smart meter tracking can comprise, e.g., the number of residents and the presence or absence of residents in the house, or information about the household equipment and their daily usage patterns (McKenna et al. 2012; Souri et al. 2014). As a reaction to consumers' privacy concerns, for example, trust seal company TRUSTe launched PrivacySmart, a trust seal program specifically for smart grid products such as smart meters, which assesses and certifies the privacy practices of companies that require access to consumers' energy usage data (TRUSTe n.d.).

In order to investigate the effect of trust seals on privacy concerns in a Green IS context, we focus on the case of smart metering technology. Besides privacy seals such as PrivacySmart, we are also interested in the role of seals that promote trust toward the environmental performance of the product. In this regard, for instance, the Center for Resource Solutions launched Green-e, a certification program for renewable energy, greenhouse gas reductions, and energy efficiency (Green-e n.d.). Since providing consumers the possibility to opt out of smart meter data collection can alleviate privacy concerns (King and Jessen 2014), we are also interested in moderating effects of opt-out mechanisms. We develop our research by drawing on the trusting beliefs model (McKnight et al. 2002) to understand how green energy and privacy seals affect consumers' trust; and the privacy calculus theory (Culnan and Armstrong 1999; Laufer and Wolfe 1977) to examine the role of privacy when using a particular Green IS. While privacy seals have been in the focus of several studies (e.g., Keith et al. 2015; Özpolat and Jank 2015; Tsai et al. 2011), there has been little research on green energy seals. We aim to fill this research gap and explore the following research question: *Why are consumers willing to provide personal energy usage data as an exchange to reduce energy consumption?*

In this paper, we first describe the trusting beliefs model and the privacy calculus theory that shape the fundamental basis for our research. We then present our research design by developing our research model and hypotheses. After that, we explain how we plan to test hypothesized relationships of our research model by outlining the measurement procedure and the treatment of a field experiment. Finally, we provide expected contributions of our research-in-progress and give limitations.

2 Theoretical Background

2.1 Trusting Beliefs Model

Trust is defined as the truster's willingness to voluntarily take risks at the hands of the trustee (Schoorman et al. 2007). To analyse the impact of green energy and privacy seals on consumers' trust toward smart meter providers, we build on McKnight et al.'s (2002) trusting beliefs model. In this model, the construct of trust is divided into three dimensions: **competence**, **benevolence**, and **integrity**. *Competence* is defined as the "ability of the trustee to do what the truster needs" (McKnight et al. 2002, p. 337). In this regard, ability refers to a company's skills in a specific domain to meet the consumer's expectations (Lankton et al. 2015). *Benevolence* is described as the "trustee caring and motivation to act in the truster's interests" (McKnight et al. 2002, p. 337). It reflects the belief that the company will do good to the consumer, neither purely driven by a profit motive, nor acting opportunistically or manipulatively (Dinev and Hart 2006). *Integrity* refers to "trustee honesty and promise keeping" (McKnight et al. 2002, p. 337) and constitutes the belief that a company adheres to a set of principles or rules generally accepted by the consumer (Xu et al. 2016). For instance, principles in online retailing comprise timely shipping of products, timely and accurate billing, and maintaining confidentiality of personal information (Bhattacherjee 2002).

2.2 Privacy Calculus Theory

Since trust is linked to benefits and risks (Pavlou and Gefen 2004; Schoorman et al. 2007), we turn to the privacy calculus theory (Culnan and Armstrong 1999; Laufer and Wolfe 1977), which posits that individuals disclose their personal information if **benefits** of information disclosure exceed **risks**.

Privacy is defined as "the claim of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others" (Minch 2004, p. 2). In this regard, privacy concerns are related to a "possible loss of privacy as a result of information disclosure" (Xu et al. 2008, p. 4). With regard to the privacy calculus, *benefits* refer to economic or social advantages (Chellappa and Shivendu 2007) and *risks* describe that individuals may perceive their personal information will not be used fairly (Culnan and Armstrong 1999). In our Green IS context, we posit that consumers disclose their personal information in exchange not only for economic or social advantages, but also as a trade-off for environmental benefits.

3 Research Design

3.1 Research Model and Hypothesis Generation

In order to build our research model (see Figure 1), we start with developing our hypotheses. According to the privacy calculus theory, we present our first two hypotheses, where the intention to disclose personal energy usage data is influenced by perceived benefits and risks. In previous studies, the impact of benefits and risks on the intention to disclose has been tested empirically several times (e.g., Dinev and Hart 2006; Xu et al. 2009). In a smart meter privacy context, we propose:

H1: Perceived benefits of information disclosure will lead to an increasingly positive intention to disclose personal energy usage data.

H2: Perceived risks of information disclosure will lead to an increasingly negative intention to disclose personal energy usage data.

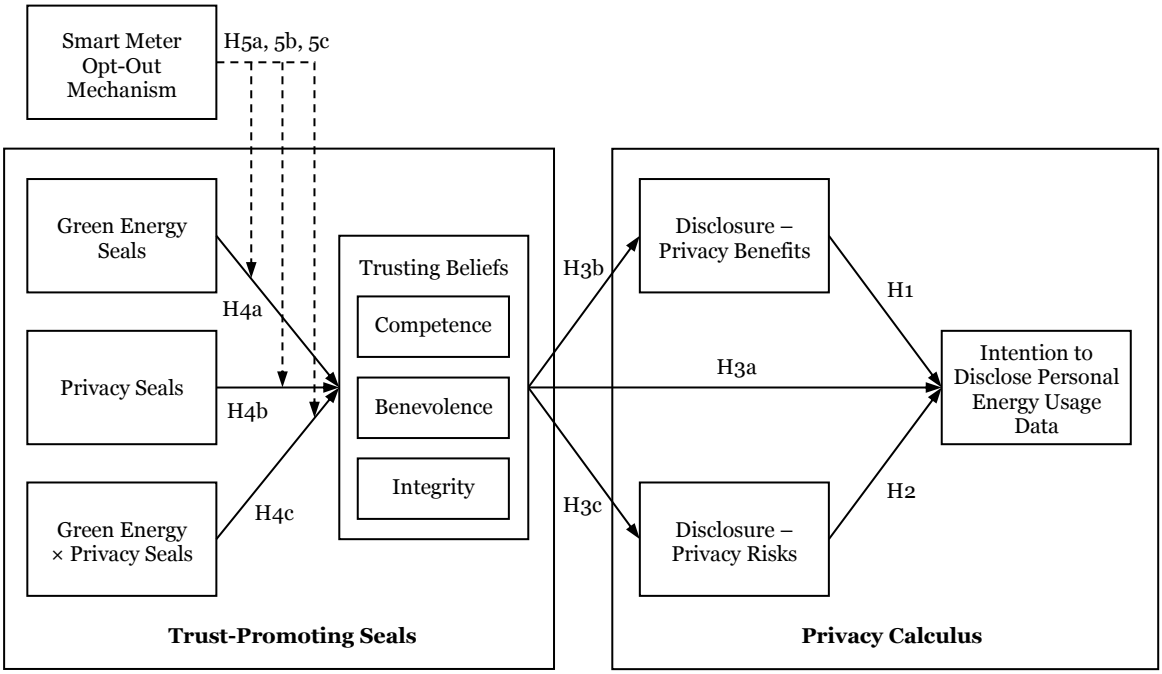

Figure 1. Research Model

With regard to the trusting beliefs model, we propose that consumers' trust toward smart meter providers will directly influence intention to disclose as well as over perceived benefits and risks. Previous studies show that trusting beliefs affect intention, benefits and risks (see, e.g., Lankton et al. 2015; Pavlou and Gefen 2004). We conceptualize trusting beliefs as a second-order construct with its three dimensions competence, benevolence, and integrity, because trust theory proposes that trust is a general construct comprising specific dimensions or facets (Lankton et al. 2015). We state:

H3: Trusting beliefs regarding the competence, benevolence, and integrity of the energy provider will have a positive effect on (a) the intention to disclose personal energy usage data and (b) perceived benefits of information disclosure, and there will be a negative effect on (c) perceived risks of information disclosure.

To signal quality and reliability, which have been found to be strong predictors of trust (Corbitt et al. 2003), a commonly used way is displaying trust seals (Özpolat and Jank 2015; Tsai et al. 2011). Regarding the influencing effects of trust-promoting seals on trusting beliefs, we rely on previous studies which primarily focused on privacy seals (e.g., Keith et al. 2015). Due to the sustainable characteristic of smart meters, we suggest that green energy seals will also affect consumers' trusting beliefs. Furthermore, providing both green energy and privacy seals might lead to an interaction effect. We propose the following hypothesis:

H4: Trusting beliefs will be positively influenced by (a) green energy seals and (b) privacy seals, and (c) there will be an interaction effect of both seals, which will influence trusting beliefs even more positively.

Despite trust seals, opt-out mechanisms can also lead to a reduction of consumers' privacy concerns with smart meters (King and Jessen 2014). We propose moderating effects of an opt-out mechanism which gives consumers the possibility to opt out of smart meter data collection. We posit that without opt-out mechanisms, trust seals will be even more important to build trust:

H5: Without a smart meter mechanism to opt out of energy usage data tracking, trusting beliefs will be stronger influenced by (a) green energy seals, (b) privacy seals, and (c) the interaction effect of both seals.

3.2 Measurement and Treatment

The constructs intention to disclose, perceived benefits and risks, and trusting beliefs are latent and will be measured in a survey instrument. For these constructs of our research model, we will use reflective multiple-item scales, drawn from pre-validated measures. Intention to disclose will be measured using the three-item scale from Keith et al. (2015). With regard to perceived benefits, we will adapt item scales from Wunderlich et al. (2012), who used the scale to measure how individuals perceive smart meters help to reduce their energy consumption. We will measure perceived risks with three items adapted from Xu et al. (2009). The construct of trusting beliefs and its three dimensions benevolence, integrity, and competence will be adapted from McKnight et al. (2002) with three items for benevolence, and four items each for integrity and competence.

To measure the impact of green energy and privacy seals, we will conduct a field experiment to collect data. For this purpose, we will create a scenario with a smart meter provider and manipulate the presence and absence of a green energy and privacy seal. For the green energy seal, we will use Green-e by the Center for Resource Solutions (Green-e n.d.), and for the privacy seal we will use PrivacySmart by TRUSTe (TRUSTe n.d.).[1] Figure 2 shows the trust seals that will be used as treatments for our experimental study. The opt-out mechanism will be realised as a further scenario, where the participant is given the option to opt out of smart meter data collection. Hence, we will use a 2 (with/without green energy seal) × 2 (with/without privacy seal) × 2 (with/without opt-out mechanism) between-subject, full-factorial experimental design. This will allow us to test main effects and interaction effects of both trust seals, and also moderating effects of the smart meter opt-out mechanism. Participants will be randomly assigned to 8 different groups which we schedule to be the size of about 25 participants for each group (200 participants in total). We plan to recruit customers of a utility company to participate in our study. The collected data will be analysed using structural equation modelling to test the hypothesized relationships of our research model.

Figure 2. Green Energy Seal (Green-e) and Privacy Seal (PrivacySmart)

[1] Green-e and TRUSTe are institutions with headquarters in the United States. We note that the trust seals from these institutions are one of many types of certification that might differ from region to region and with respect to the institutions governing them. From an empirical aspect, our research should be considered as a series of studies which is bound to one type of certification at a time.

4 Expected Contributions and Limitations

Our results will provide first insights into how trust seals will help to alleviate privacy concerns towards smart meters using green energy and privacy seals. Since Green IS requires relevant data to assess environmental outcomes and improve sustainable behaviours, our study will contribute to Green IS research by analysing the case of smart metering technology. The collection of consumers' personal energy usage data entails several benefits for energy providers such as the analysis of consumer behaviour for marketing purposes, as well as for consumers like real-time feedback to reduce energy consumption and thus to save money and greenhouse gas emissions. Drawbacks implicate privacy concerns due to data collection, which can lead to a restraint of the diffusion of smart meters. For practice, our paper will inform energy providers about the impact of green energy and privacy seals for a successful distribution of smart meters considering consumers' privacy concerns. In our paper, energy providers will also be informed about moderating effects of opt-out mechanisms that can serve as a substitute or extension to trust seals in smart meter programs.

Our study will be subject to the following limitations. First, we focus on smart meter technology as a Green IS artefact. We plan to consider additional artefacts such as smart plugs that are used to plug in home appliances, which then can be controlled with mobile applications. This will widen our research and make our theory more generalizable. Second, we use green energy and privacy seals as trust-promoting seals for smart metering technology. However, there might be further trust seals, which we are not aware of yet and which might also affect consumers' trusting beliefs and privacy concerns. Third, we focus on two specific trust seals, i.e., Green-e and PrivacySmart. A specific choice of trust seals is important in order to make our scenario as realistic as possible, but at the same time it limits generalizability. Fourth, generalizability will also be limited by our sample frame which will contain customers of a utility company. Hence, there will also be limitations with regard to population and geography.

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