Deriving User Interaction Determinants for a Social License To Automate in Demand Side Management

Lisa Diamond
Austrian Institute of
Technology
Vienna, Austria
lisa.diamond@ait.ac.at

Peter Fröhlich
Austrian Institute of
Technology
Vienna, Austria
peter.froehlich@ait.ac.at

Abstract

Automated demand side management is a critical component of the energy transition, but to unfold its full potential, end-user acceptance needs to be achieved. A clear understanding of acceptance conditions and their variation across contexts and user segments is needed and system-related interaction aspects are central to this acceptance. To explore such factors, we have developed a number of questions on end-user interaction properties of the system based on critical aspects of trust in automation. These factors will be integrated within a larger framework encompassing regulatory, institutional, socio-technical, energy-practice-related, and interactional factors determining the granting of a "social license to automate" and applied in an international comparison of country profiles.

Author Keywords

Automation; demand side management (DSM), social license; trust; interaction.

CSS Concepts

• **Human-centered computing→HCI design and evaluation methods**

Introduction

The smart grid as the future of the energy supply network centers around the integration of a significantly increased share of renewable energy resources, which are considerably more volatile than traditional fossil-fueled energy production [9]. Creating flexibility in the energy grid is therefore conditional for a successful integration of such resources, in order to allow for the fluctuating nature of sustainably produced energy. Flexibility through behavioral adjustments is hard to achieve as it poses a significant strain on consumers to adjust their behavior continuously based on current conditions in energy production [5,6,12].

Automated forms of demand side management are a more reliable way to create the desired flexibility, since they does not require a continuous, active effort but rely on automated processes. Automation does, however, take control away and perceived loss of control tends to create feelings of uncertainty and resistance [2,10]. To implement automated demand side management, it is therefore of great importance to understand which factors play a role in furthering the acceptance of and trust in the automation.

Understanding the factors that determine the granting of "a social license to automate"– a term stemming from sociological research denoting the informal approval by an affected community [2]- can be expected to contribute centrally to the success of automated DSM programs. This topic is currently being investigated by an international group of experts within the framework of the User-Centered Energy Systems Technology Collaboration Platform (TCP) of the

International Energy Agency (IEA)[1]. The analysis within this group is considering regulatory, institutional, socio-technical, energy-practice-related, interactional, and transversal economic factors impacting the acceptance of DSM automation [4].

Automated demand-side management systems typically offer their users ways to interact with them, , e.g. through an online portal, an app, an in-home-display, alternative ambient displays, or messaging. As central points of contact between consumer and automation these interfaces deserve specific attention and the present paper provides such attention by focusing on user interaction aspects of a social license to automate. In the following, we present a short overview of factors that are crucial for acceptance and trust in automation and introduce an overview of user interaction aspects in end-user systems that are likely to impact the granting of a social license to automate.

Determinants for user interaction

The concept of a social license to automate was originally developed to express acceptance and approval of mining by locally affected communities. Aspects of this concept relating to user interaction components are perceptions of benefit, perceived reliability regarding keeping promises made, perceived fairness, an open dialogue, perception of a long-term contribution to the well-being of the whole region, shared decision-making, and perceived transparency [2].

Much of this can be found among factors known to play a central role in technology acceptance and trust

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[1] https://userstcp.org/annex/social-license-to-automate/

building. Besides overall usefulness and ease of use [e.g.,7], further prominent factors are the provision and communication of control though (nuanced) choices, transparency, system reliability, the communication of appropriate privacy and security measures, and the communication of accountability [1,3,11]. As trust implies a willingness to accept a certain degree of vulnerability under the expectation of a fair treatment, clear communication of purpose and benefits is also of key importance [8].

Questionnaire Framework

Based on these factors, we identified aspects that relate to these acceptance and trust requirements and have an according potential to impact the granting of a social license to automate through deliberate design decisions on user interaction features and their design. In Table 1, an initial overview of identified relevant aspects is provided which will form the basis of a short questionnaire that will be distributed to project leaders, researchers, stakeholders and end-user representatives worldwide within the network of the partners' network of the IEA TCP on User-centered Energy Systems.

These aspects describe important information communicated to towards end-users such as the purpose and procedure of automation, the achievable benefits, control options, status information, as well as security and privacy options. Also, the questionnaire asks about how the information is provided, whether the system provides choices to end-user. Further questions relate to whether and under which circumstances end-users are invited to actively engaged to interact with the system, and how they can get in touch with the organization responsible for the automation.

Question	Explanation
What does the system communicate to end-users?	Aims at identifying what information is provided to end users such as purpose explanation, principles underlying information, benefits, control options, information on status, post, and planned processes, as well as security and privacy measures
How is this information provided?	To identify the form(s) per content such as text, graphs, tables, pictorial information, video, audio, non-specific sound or light
Does the system provide choices to the end user and if yes, which ones?	This concerns beyond opt-in/opt-out personalization options such as comfort zones, timeframes, or similar, the possibility to intercept or adjust planned automated processed, as well as requirements of direct consent before process start
Are end-users actively engaged to interact with the system and if yes, how?	Possible engagement measures might include self-monitoring and feedback, social comparisons, and rewards
Does the system provide a way to get in touch with the organization responsible for the automation?	This includes ways to ask questions and give feedback, as well to request changes or file an official complaint

Table 1: Aspects covered within the questionnaire framework for user interaction aspects for a social license to automate

Conclusions and Outlook

Within this paper we have outlined currently ongoing work on understanding user interaction aspects of demand side management and their contribution towards a social license to automate. This questionnaire will be detailed further and integrated within the context of a larger one covering additional questions concerning the previously mentioned socio-technical, institutional, regulatory, energy-practice related, and transversal economic factors. The resulting framework will be used to document and analyze implemented automated demand side management use cases in order to identify the central acceptance and trust factors that determine the granting of a social license to automate.

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