Sociotechnical Transition: An Exploratory Study on the Social Appropriability of Users of Smart Meters in Wallonia.

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ABSTRACT

Optimal and autonomous daily use of new technologies isn't a reality for everyone. In a societal context driven by sociotechnical transitions [1] many people lack access to digital equipment and skills, preventing their participation in digital social life, including energy services. Our exploratory and phenomenological research, guided by European Union directives [2], explores the social appropriation [3] of new technologies during the deployment of smart meters in Wallonia. The study investigates social behaviour of audiences with support during smart meter installation and identifies barriers to technology appropriation. In an exclusively qualitative approach, the field surveys aim to determine to what extent individual participatory forms [4][5] and collective forms [8][9] of support, through active pedagogies like experiential learning [6][7], can include digitally vulnerable users. The central role of field professionals as interfaces [10] is also highlighted within the service relationship [11] that connects, on one hand, the end consumers and, on the other hand, the organization responsible for deploying the smart meters. While our study does not directly utilize CAPE methods and tools, it investigates the current social implications of digitalization.

Keywords: Sociotechnical Transition, Social Appropriability, Smart Meters.

A SOCIOTECHNICAL CONTEXT

The sociotechnical transition

The innovations developed to deal with the climate challenges of our century raise several questions regarding the adoption of new transition technologies by households with very diverse socio-economic realities and digital skills. In this context, energy transition is carried out alongside the digital transition, making them complementary [12]. Therefore, Socio-technical transitions differ from technological transitions in that they include changes in user practices and institutional (e.g., regulatory and cultural) structures, in addition to the technological dimension [1]. For instance, the need for innovation in managing complex energy systems [12] is reflected, among other things, in EU directives mandating 80% smart grid deployment by 2020 across its territories [13]. Despite practical challenges, this deployment is crucial for achieving the EU's energy transition goals: renewable energy investment, energy efficiency, and energy sobriety [2].

The deployment of smart meters in Wallonia

In Wallonia, the deployment of smart meters follows the European directives on energy transition. According to the decree of July 19, 2018, the smart meter is defined as an electronic system that can measure the energy taken or injected by adding information that a conventional meter does not provide, that can transmit and receive data in the form of electronic communication, and that can be operated remotely (...) (art. 2, 29°bis). However, the numerous investments in technology for ecological sustainability and energy efficiency raise questions about end-user technological adoption. Literature suggests that with increasing household innovations, service provisions will become more self-organized by individuals (or communities), limiting professional intervention to key moments [14]. Therefore, users, including the most vulnerable, will need to be able to familiarize themselves with these devices for autonomous use post-service provision.

Smart meters and their users

Besides concerns about electromagnetic waves and privacy, users doubt the intelligent nature of the technology [15]. While technology outcomes depend on users, their digital skills often do not evolve at the same pace as the technological advancements, leading to dependence rather than empowerment [3][16]. Thus, studies highlight user difficulties in understanding device data and using complementary tools like websites or platforms. Users also struggle with complex data presentations via multiple graphs, units in kWh, etc. [17]. In the wake of these results, the issue of digital inequalities emerges, encompassing aspects related to access, use, and digital participation in the social life of users.

Digital divide in Wallonia

The digital divide is multifaceted and occurs at three levels: access to ICT, use of ICT and digital skills, and active participation in social life via ICT, such as e-services. In Wallonia, the digital divide is significant. According to the Digital Maturity Barometer of Walloon Citizen, in 2023, 6% of individuals lacked access to digital devices [18]. Beyond the material dimension, it has been observed that having access to the internet (...) does not guarantee full and complete practice, that is, autonomous and effective (...) and is therefore not synonymous with greater equality. However, digital practices are not self-evident and require 'digital skills' [19]. Digital exclusion is an important factor to consider in the deployment of smart meters, especially for vulnerable populations. Not all their users have internet access or digital devices to manage their consumption data or use online tools.

Using smart meters through digital divide

According to the Walloon legislator [20] the deployment of smart meters in Wallonia primarily targets households in payment default, one of the objective indicators of energy poverty [21]. Digital inequalities, linked to poverty, exacerbate this issue, as those experiencing energy poverty are often most affected by the digital divide [22]. When resources are limited, digital inclusion is not a priority and may lead to debt for acquiring equipment, training, etc. [23]. Furthermore, digital skills vary widely based on income, age, socioeconomic status, sociodemographic characteristics, education, employment status, illiteracy or disability [24][25]. In 2021, 32,2% of households faced energy poverty [21]. Considering those elements, it seems more than appropriate for energy professionals, as well as users, to consider diverse public profiles to ensure effective smart meter deployment (profiles, needs, expectations, etc.) while supporting the population.

THE SOCIAL APPROPRIATION OF TECHNOLOGIES

The interface situation and the service relationship

In the context of the deployment of smart meters, the support relationship involves an interface situation with devices for the public, managed by professionals [10]. The interface situation forms a triangular relationship between the public (client-experimenter, client of a service relationship, user, local partner, manager, decision-maker, etc.), devices (technical objects, management devices, and organizational structures), and professionals (actors positioned at the boundaries of different dimensions and responsible for managing the uncertainties arising from them). This interface situation links various social worlds (users, professionals, organizations, etc.) and their respective issues through which energy exists [10].

The backdrop of this interface relationship between the client and the professional in the context of the deployment of smart meters can be framed by the service relationship which is defined as a triangular relationship bringing together a professional (holder of a skill requested for the accomplishment of a 'repair'), an object to be repaired, and its owner (requesting the skill of this professional for the purpose of repair). The realization of the service here requires the involvement and cooperation of both parties. In this sense, the service participates in a social relationship through the confrontation and mutual adjustment it demands from each of its parties [11][26]. Therefore, field professionals act as intermediaries between the device, the public, and themselves. However, despite theoretical preparations for user support, real-world challenges arise due to the unique characteristics of users, such as socioeconomic status, sociodemographic characteristics, social inequalities, etc.

From acceptability to appropriability

The introduction of technologies in the energy market faces several challenges since their logic are not necessarily compatible with social logics [27]. Moreover, these technologies are based on standardized conceptions of social practices [27] and their use assumes that their users possess skills they do not necessarily have [19]. Engineering sciences use the concept of social acceptability of the technological devices [27], which allows for the analysis of the mechanisms governing the anchoring of a project or decision within a social dynamic without reducing them to the formal institutional framework [28]. However, this concept is questioned in the scientific literature since to reason in terms of social acceptability is to shift the responsibility to the target public to adopt or not the concerned technologies. It is to consider that only the social dimension plays a role in realizing the potentials invested in the technologies [29]. Nevertheless, given that the reluctance to engage with

technologies is more complex than just a socioeconomic barrier, the technical dimension must also be considered. Thus, it is more appropriate to speak of social appropriability which encompasses a set of complex processes: the technical culture of users, their social representations, the origin of the innovation and the means by which it was presented to its users, the practices and uses of the innovation, the type of communication that accompanies it, the users' lifestyle and their relationship to comfort, their previous technical experiences, the collective dynamics in which they are involved, etc. [30].

SOCIAL APPROPRIATION THROUGH PARTICIPATION

User participation in the service relationship

In response to the challenges related to the process of social appropriability of technologies, the service literature highlights positive aspects of user participation in the service relationship [4][5][14]. In this context, consumer participation, in the broad sense, characterizes an involvement (physical and/or mental) in the process of producing the company's product or service [4]. In Wallonia, smart meter deployment involves a standardized support protocol, inviting the client to participate in system demonstrations or satisfaction online surveys. However, user participation is not guaranteed. To engage users, the system must be able to interest them, engage them, or also socialize clients who have different perceptions of participation: the idea is thus to develop a flexible and evolving system, integrating options, services, and communication supports to remove potential barriers to participation [4]. Moreover, when the public adheres to the support system, positive effects of client participation include increased productivity, leveraging consumer know-how for innovation, strengthened company attachment, a sense of freedom of choice, power transfer to users, alignment with client preferences, and improved service quality [4][5][14].

User participation against social inequalities

Active public involvement presents numerous advantages in addressing digital inequalities, especially when user participation is viewed through the lens of active pedagogies. Firstly, experiential learning, through a meaningful practice, is essential in the context of training adult learners in the use of ICT: the 'learning-by-doing' and 'do-it-yourself' approaches appear even more important as the primary goal of adult learners in training is not to assimilate theoretical and technical concepts, but rather to concretely learn to use certain aspects of ICT for activities carefully selected based on daily concerns [7]. Secondly, social proximity also plays a crucial role in individuals' digital usage [7]. Indeed, group learning in mastering ICT represents a significant advantage [8]

considering that bringing people together around the same table and involving them in a common project promotes meeting and socialization, as well as collaboration and informal learning among learners, which are essential dimensions for the successful completion of ICT training [6]. These advantages are important to consider for vulnerable and/or precarious populations, who are often isolated and lack support assistance. Similarly, the group effect represents a significant asset when support is aimed at non-voluntary or hard-to-reach individuals [9], which are populations also affected by the deployment of smart meters in Wallonia.

The sociotechnical transition through user participation

Through participation, the consumer, who was previously passive towards services, becomes a 'prosumer' or, in other words, a consumer who participates and engages alongside companies [31]. Additionally, participation seems to restore a central role to clients by considering the human factor in support processes, regarding real-life experiences from the field. Thus, this approach redefines individuals as 'users' rather than just 'consumers' or 'clients'. However, considering user support in smart meter deployment solely through the lens of participation is not sufficient. User engagement depends on numerous factors, with the central question ultimately being the meaningfulness of using the technologies in question. In fact, user engagement depends on the meaningfulness of technology use. Considering that, the Reflexive Practice theory [32] emphasizes that autonomy and systematic thinking lead to relevant practice changes [33]. This principle also applies to the deployment of smart meters and their sustainable use in the daily management of household energy.

METHODOLOGY

The present research focuses on the support provided to the public in the context of deployment of smart meters in Wallonia in an exploratory and phenomenological perspective. Considering all the elements reviewed and presented in the conceptual framework, our research question is as follows: do the current support mechanisms for the public (individual or collective) enable the social appropriability of smart meters in Wallonia?

To achieve this, data collection was conducted using semi-structured interviews with four samples: non-requesting users (N=10), requesting users (N=17), field professionals (N=5) and mixed profiles users (N=10). The investigation of individual public support was conducted with reference to the following indicators, derived from scientific literature on engagement, including the use of ICTs: digital inequalities, perception, attitude, motivation, voluntarism, sense of social justice, trust, user postures,

and relationship to energy. On the other hand, collective support was observed through the conduct of focus groups workshops.

Data analysis and processing were conducted using a hybrid method that combines general inductive analysis [34] with analysis using conceptual categories [35], with the aim of identifying potential links between (sub-)categories through updating coherences [35]. In addition, the data collected from field professionals were analyzed using thematic analysis [35].

RESULTS

Individual support

The linking of conceptual entities for individual support highlighted differences in the social appropriability of smart meters and associated online tools between sample 1 (non-requesting users) and sample 2 (requesting users). First, digital inclusion was linked to educational attainment, with half of sample 1, who were experiencing digital inequalities or disconnection, having no higher education degrees. The level of digital inclusion among participants also appeared to impact their proactivity in engaging with the technology. Thus, the results show that in sample 2, all of whom were digitally included, 15 individuals were proactive in using the smart meter and associated online tools, compared to only one person in sample 1. User voluntarism also appears as a determining variable in the process of social appropriability of technologies. Three relationships were identified between voluntarism and amotivation, the level of proactivity, as well as trust. Indeed, the results showed that among the non-voluntary participants regarding the deployment of smart meters, 5 individuals exhibited signs of amotivation to use the technology, compared to only one amotivated person in sample 2, which consisted of voluntary users. Additionally, among the 10 individuals in the non-voluntary sample, only one person showed signs of proactivity, compared to 12 proactive individuals in the voluntary sample. Furthermore, within the non-voluntary sample, 7 out of 10 individuals exhibited signs of distrust towards both the technology (the smart meter and associated online tools) and the organization overseeing the deployment of these technologies. Additionally, in this group, 8 out of 10 individuals showed signs of prescribed (default) trust, partly due to digital inequalities that hinder their access to relevant information. Conversely, 14 out of 17 individuals in the voluntary sample felt confident about the smart metering system at all levels (technical, organizational, and the expertise of field professionals), with 7 individuals exhibiting prescribed (default) trust. Finally, two relationships were observed between users' usage stance towards the smart meter, including the associated online tools, and on the one hand, their relationship with energy, and, on the other hand, their attitude towards technological change. First, all 5 individuals in sample 1 who were experiencing digital inequalities or disconnection adopted a disinterested usage stance towards the smart meter and associated online tools. Additionally, out of the 10 individuals in sample 1, 2 showed some interest in the technological change but considered its use not a priority in their daily lives. In contrast, within sample 2, which consists of individuals digitally included, 10 out 17 adopted a non-priority usage stance, while 7 were disinterested. Second, regarding the attitude towards technological change, 5 out of 10 individuals in the sample 1 who adopted a potential contributor usage stance (volunteers for involvement in the support management process), 4 of them had a positive view of the deployment of smart meters. Within sample 2, among the 9 out the 17 individuals who adopted the same potential contributor stance, 4 also had a positive view of the change.

The perspective of field professionals

In addition to field surveys with users, interviews were conducted with field professionals to explore their experiences of individual support within the deployment of smart meters. The thematic analysis of the data highlighted several themes related to their role in the service relationship. First, training: generally, technicians receive standardized technical training for the smart meter installation, but not for using associated online tools. While their technical training is well-received, technicians often didn't feel fully prepared for field contingencies. Second: fieldwork. Technicians must adopt multiple roles beyond technical tasks, including communication and social interaction, and adapt to the unique profiles of individuals they encounter (vulnerabilities, inequalities, delicate situations, etc.). This necessitates continuous hands-on-training, often self-directed or peer-supported. Third, application of training: despite having a standardized support protocol, the level of support provided varies widely, from 'fully applied, with additional personal contributions' to 'not applied at all'.

Collective support

The data analysis collected from sample 4 (mixed profiles users) highlighted four relationships between conceptual entities for collective support. The first relationship is situated at the level of experiential learning, between pedagogical demonstration and the active participation of users supported in collective workshops. The results showed that among the 5 out of 10 individuals experiencing digital inequalities, all left with a higher sense of digital competence thanks to their active participation during the pedagogical demonstration (handling of a real smart meter, moments of exchanges and sharing, exploration of guides and brochures, discovery of online tools, etc.). Additionally, for the 2 more digitally

experienced individuals of the group, the workshop served as a constructive reminder. The second relationship is situated between pedagogical demonstration and the collective participation of users during the workshops. For all group members, collective participation in the pedagogical demonstration facilitated new theorical and technical learning. As well, 8 out of 10 individuals reported a positive customer experience. The third relationship is situated between pedagogical demonstration and the collective participation of users during the workshops. The third identified relationship relates to group effect, between the interactions and social support experienced by users during the workshops. Indeed, thanks to the interactions and sharing of experiences, 7 out of 10 individuals felt social support during their active participation in the workshop. The fourth and final relationship for collective support is between collective participation and the evolution of users' energy management. At the end of the workshops, among the 8 out of 10 individuals who had a positive customer experience, 5 left with the intention to improve their home energy system through new practices or by utilizing digital tools. Moreover, the 2 digitally vulnerable individuals in the group left the workshops with a renewed interest in using the smart meter and associated online tools, which they had previously given up.

DISCUSSION AND CONCLUSION

Overall, our research findings align with the scientific literature and support the issues highlighted by the scientific community in the field of social appropriability of technologies. Therefore, we answer our research question both affirmatively and negatively. Yes, the current support systems (individual or collective) in Wallonia enable the social appropriability of smart meters for digitally proficient individuals and/or those interested in digital matters. However, the standardized support systems do not facilitate the social appropriability of technologies for less digitally proficient and/or digitally vulnerable individuals. Nevertheless, our results highlight the importance of local and collective support, which seems to be effective in this context. In conclusion, our research has highlighted the importance of supporting the public from a holistic perspective that considers the unique profiles of individuals. It also underscores the significance of technician training, particularly through practical cases, to ensure quality support. Furthermore, it is essential to promote the development of local and participatory support protocols, paying special attention to vulnerable populations, who are often overlooked by statistics or sociotechnical transition scenarios.

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