



Technology users and standardization: Game changing strategies in the field of smart meter technology



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ABSTRACT

Struggles over technology standards are typically reported for competing technology providers. Technology users often play not much of a role in standard development. This paper presents findings from the emerging innovation system of smart meter communication, in which large technology users act as standard developers. This phenomenon is relatively rare, as users often lack the resources and competences to actively engage in standard development. Over a period of 14 years (2000–2013), we track how different standards emerged and changed, why and how users became standard sponsors, and what impact this had on the field. Our analysis is based on variety of data sources, including participatory observation and expert interviews. After an initial period, in which only proprietary standards were available, two large users started to develop open standards together with alliance partners and standard development organizations. Consequently, sponsors of proprietary standards change their strategies, also toward open, alliance-based standards. A central condition for this shift in standardization was that the two users controlled large shares of the market. Our research points to the conditions for user involvement in standardization, thereby contrasting three different settings for standard development. We interpret the case as an example for the larger issue of institutional structures in technological innovation systems developing over time in a patchwork-like way, thereby shaping and changing the conditions for strategic action.

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1. Introduction

Technology standards play a key role for the development of technological fields. Standards facilitate the integration of different technological components such as computer platforms, periphery devices and software into coherent systems (Jain, 2012; van de Kaa et al., 2011). Furthermore, standards reduce variety and lower transaction costs (Brunsson et al., 2012; David, 1994), thereby eventually creating economies of scale (West, 2007). Finally, standards also facilitate coordination and cooperation among actors (Brunsson and Jacobsson, 2000; Lawrence, 1999; Timmermans and Epstein, 2010).

For firms and other actors, standards are of major strategic importance as they affect the distribution of resources and the relative positions of players in a field (Brunsson et al., 2012; Lawrence, 1999; Garud et al., 2002). Standard battles, i.e. struggles of organizations over the dominance of standards are therefore a common phenomenon in the development of technological fields (Suarez, 2004). Well-documented examples include VHS winning over Sony's Betamax in the field of video recorders (Cusumano et al., 1992), the struggle of IBM, Apple and Sun for dominance in the field of IT platforms (West, 2003)

or the long lasting competition of different standards for mobile telecommunication (Funk and Methe, 2001; Lyytinen and Fomin, 2002).

In most cases, standard battles are fought between competing technology providers that seek to get most out of their proprietary technologies. In contrast to technology providers, *technology users* typically do not play much of a role in standard development (West, 2007; Hawkins, 1995). In fact, there are indications for users being underrepresented in the committees of standard development organizations (Jakobs et al., 2001; de Vries et al., 2003) and the literature reports just a few instances of users actively taking part in the development of technology standards (Lyytinen and Fomin, 2002; Bresnahan and Chopra, 1990; Dankbaar and van Tulder, 1992; Koehorst et al., 1999). A prime reason for this is that most technological fields are characterized by a large number of different users (individuals, private and public organizations) with potentially fragmented interests.

In this paper, we use the technological innovation systems perspective (Bergek et al., 2008; Markard et al., 2015) to portrait a standard battle, in which users - in the form of firms that control major shares of the market - have played a central role. With our study, we shed light on the conditions for and consequences of large users developing standards. A closer look at users is particularly interesting as they can be expected to have diverging interests from technology providers, including a preference for open standards (West, 2007; Bresnahan and Chopra, 1990). Such dynamics are highly relevant both for businesses with strategic

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interests in technology standards as well as for policymakers seeking to spur the development of specific technologies.

In the following, we analyze the development of all major technology standards in the field of smart meter communication in Europe (10 standards of which 3 are user-driven) from 2000 to 2013. Smart metering is an emerging technological innovation system (Planko et al., 2016). Utility companies (more specifically: distribution system operators) are the buyers of smart meters. Together with end consumers, they use smart meter technology, e.g. to track and control power consumption (Erlinghagen et al., 2015). The market for smart meters spans different national electricity markets with different structures. Some markets comprise a large number of small users (distribution system operators), while others are characterized by users that control large market shares. What makes the case of smart meter communication even more interesting is that demand for smart meters in some countries was 'activated' through regulation at different points in time. In other words, the innovation system expanded step-wise and there were different organizations with different standards in different sub-systems competing over time.

As of today, the battle over smart meter standards in Europe is still ongoing. What we find though, is a clear trend towards open standards developed by inter-firm alliances. Our analysis shows that the standardization strategies of two large users have significantly contributed to this trend as they delegitimized the originally proprietary strategies of technology providers in the field.

With this study, we do not only enrich the sparse literature on user involvement in standardization but also direct attention to how powerful user interests can change the nature of technology standards and the standardization 'game'. Moreover, we suggest a distinction of ideal-type contexts in which technology standards are developed: These contexts vary in terms of whether they are dominated by technology providers, governments or users and this has implications for how struggles over standards unfold.

The paper is structured as follows. Next, we present the theoretical background and our analytical framework. Section 3 introduces the technological field of smart meters. Section 4 displays the study design. The empirical results are presented in Section 5. In Section 6 we discuss our findings in the light of the literature. Section 7 concludes.

2. Theoretical background

Standards are agreed-upon rules "about what those who adopt them should do" (Brunsson and Jacobsson, 2000, p. 4); they both enable and constrain action thus facilitating coordination among actors (Timmermans and Epstein, 2010). Here we concentrate on *technology standards*, which are formal standards that specify the properties, a product or technology must have, to be compatible with other components and to be integrated smoothly into a larger technical system (Jain, 2012; Brunsson et al., 2012). Technology standards can be viewed as formal institutions in a technological innovation system (Bergek et al., 2008; Musiolik and Markard, 2011). Technology standards are created, reproduced and transformed by the actors in the focal field (Brunsson et al., 2012; Garud et al., 2002; Slager et al., 2012).

2.1. Users in standard development

Technology standards have received quite some attention in economics, management and innovation studies due to the profound impact they have on technology development (exponential growth, dominant designs, lock-in) and the fate of firms (Suarez, 2004; West, 2003; Narayanan and Chen, 2012; van den Ende et al., 2012). The overwhelming majority of studies have looked into technology providers and/or governments involved in standardization, which is why we know comparatively little about how *technology users* affect standard development.

This gap is essential because technology providers and users may have very different interests. It can be assumed that technology providers want to recover their development costs and generate high revenues from a novel technology, while users want the products or services that spawn from the technology to be low cost. Users also prefer a high degree of compatibility to benefit from a broad range of complementary products and not become locked in (Bresnahan and Chopra, 1990; Dankbaar and van Tulder, 1992). As a consequence, users tend to prefer open standards that are widely accessible for a broad variety of competing technology providers and complementors (West, 2007).

To date, the literature on standardization reports just a few examples of users assuming the role of standard developers, or sponsors (Lyytinen and Fomin, 2002; Bresnahan and Chopra, 1990; Dankbaar and van Tulder, 1992; Koehorst et al., 1999). A prominent case in this regard is MAP, an IT communication standard for factory automation, that was developed and promoted by General Motors in the 1980s to better integrate pieces of equipment from different technology vendors (Bresnahan and Chopra, 1990; Dankbaar and van Tulder, 1992). GM's initiative as a large technology user was later supported by other automobile manufacturers, by large firms in the aircraft industry and by the US military. Another example is the development of 1st and 2nd generation mobile phone standards, in which national telecommunication network operators (in their role as technology users), technology providers and governments played an influential role (Funk and Methe, 2001; Lyytinen and Fomin, 2002).

While from these studies we have learned much about the interests of users, we still know little about how users and providers interact as they compete as standard sponsors in an emerging technological field.

2.2. Analytical framework: novel technologies in existing contexts

In the literature on innovation studies, the technological innovation systems (TIS) framework is a widely applied perspective scholars use to analyze emerging technologies (Bergek et al., 2008; Markard et al., 2015). Among others, the TIS framework directs attention to the key role of actors and institutional structures, both affecting technology development.

New technologies do not emerge in an 'empty space' but in the context of existing markets, industries, professions, regulations, societal values, culture etc. (Garud et al., 2002; Muzio et al., 2013; Wirth et al., 2013). We can think of the context as a patchwork of semi-coherent institutional and organizational structures that affect the way, in which firms and other players interact when developing the focal technology (Bergek et al., 2015). In other words, there is not just one context but a variety of different context structures for an emerging technology to cope with.

We expect a focal TIS to reflect these context differences and to show patchwork-like structures (e.g. in the sense of sub-systems), especially in early stages of development. At the same time, as the innovation system matures, it will develop common overarching institutional structures such as technology standards, dominant designs, collective expectations or shared practices of use. In our study, we will come across different TIS sub-systems, in which the influence of users on standard development varies.

Several studies have shown that novel technologies do not necessarily develop evenly along a global trajectory, but that socio-technical configurations may vary depending on the context conditions in different regions, countries or sectors (Wirth et al., 2013; Dewald and Truffer, 2012; Hansen and Coenen, 2015). Technology development can be viewed as the interplay of local activities in specific areas, or sub-systems (e.g. national markets), and more general, overarching processes at level of the entire technological innovation system. Also standards may unfold both locally and globally. In mobile telecommunication, for example, standards were first (in the 1980s) developed at national levels and later (1990s onwards) also internationally (Funk and Methe, 2001).

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