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Anri Kivimäki

University of Oulu, anri.kivimaki@oulu.fi

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Anri Kivimäki
University of Oulu, Finland

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The complexity of organizational and technological changes confronting most organizations has made an organizational change and adaptation a topical research question. This paper examines the process of wireless standardization viewpoint and sets out a framework for understanding organizational changes in wireless standardization organizations by applying institutional theory. It is concluded that such a framework can reveal more about the changes occurrence in standardization processes.

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Institutional Viewpoint on Wireless Standardisation Process

Anri Kivimäki

National Technology Agency and University of Oulu

Abstract

The complexity of organizational and technological changes confronting most organizations has made an organizational change and adaptation a topical research question. This paper examines the process of wireless standardization viewpoint and sets out a framework for understanding organizational changes in wireless standardization organizations by applying institutional theory. It is concluded that such a framework can reveal more about the changes occurrence in standardization processes.

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1. Introduction

IT (Information Technology) technology has pervaded our daily lives. Seldom do we think about how technology works, or what makes it work, or how a dominant design emerges, or what factors encourage or limit the implementation of new technology (i.e. the nudges or restrainers) in one way or another. Some scholars have gone as far as arguing that it is power or social consensus, rather than economic efficiency, that determines which broad path is ultimately followed (Nelson and Winter 1982). We can add that it is an end user's own or created need which drives technology development forward. In the current technology environment, there are many issues to be taken into account to ensure that new technology works and ends up on a customer's table or in a user's pocket. A number of detailed studies document various features of the environment which are forced to adapt and change in response to new developments in the technology industry. These responsive processes include the setting up of collective bodies, decisions being taken by voluntary organizations, government agencies and other political action

In this article we discuss *standardization process through institutional theory*, to understand the nudges and restrainers in the standardization process. A view of both fields is presented in this paper. Institutionalism represents a distinctive approach to the economic, social and political elements in the study of social phenomena generally and organizations specifically. Standards provide mechanisms that support the interests of diverse social groups and create incentives to develop and operate with a common technological basis.

The paper is structured as follow. In section one, the origins of wireless standardization are outlined. In section two, the main issues of institutional theory are discussed. Section three presents the research approach, setting and research methods. Institutional theory and standardization are combined in section four. Finally, the conclusions are drawn in chapter five.

2. Standardization

Generally, a "standard" can be defined as a set of technical specifications adhered to by a producer either tacitly or as a result of a formal agreement. Standards are created in various organizations, which have their own rules about their work and environments. Cargill (1989)

differentiates standards according to the behavioral definition of participants in the IT standardization process from the motivation of the participant [provider or user].

The prime objectives of standardization for economic and social lives are the 1) promotion of quality products, processes and services by defining the characteristics which determine their capacity to meet given needs, i.e. their fitness for use, 2) promotion of economy in human effort, materials and energy in the production and exchange of products and 3) promotion of industrial efficiency through control variety (Nicolas 1994). These ease mass production and the interchangeability of components and products.

Understanding standardization processes has become important, because new technologies, new forms of business organizations, trade issues and new institutions are emerging. In addition, standards are under constant change. We can classify them by relating them to the process of developing or by business models. The formers are regarded as de facto, formal standards, and governmental standardization (de Vries 1999) and the latter as regulatory, business/market and operational (Cargill 1990). However it would all be beneficial to apply the standardization processes into generic standardization approach. This approach describes the globalization and standardization development, which sets the requirements for companies in the business; they are expected to be flexible, innovative, efficient, international, well-resource and cooperative. To achieve this on a global scale, many players - manufacturers, operators and developers - need to negotiate with regional standardization bodies.

2.1 Wireless Standardization

Technology in this paper refers to wireless telecommunication. Mobile communications or wireless communications usually refer to telecommunications, where an user/customer has an access, to the first communication link, in this case wireless and uses radio transmission by using the user mobile or more mobile compared to a situation in which the user is attached to a fixed network by wire. For mobile communications Bekkers and Smits (1998) propose the following definition:

"Mobile communications is a form of communications in which a radio connection exists among a communications station whose location is not restricted and a fixed communications station in which the communications stations may be transmission, reception and transmission/reception stations."

The telecommunication system is based on compatibility and interoperability, these are enhanced by standardization. The literature offers several definitions of compatibility and interoperability. Bailey et al. (1995), define compatibility as the ability of two components to work within one system line e.g. mobile phones. Compatibility among components can be achieved by creating standards. Operations and connections in telecommunication networks and software need commonly created rules, standards.

The compatibility of products brings benefits for several standardization actors, in the form of network externalities. These actors are comprised of users, manufacturers, operators and regulators. The capabilities create demand-side economies of scale: there are benefits in doing what the others do. Three main sources of these benefits here are: 1) interchangeability of complementary products, 2) ease of communications, and 3) cost savings (Farrell 1986). Thus the compatibility is achieved by software which provides the compatibility between different technologies/interfaces. The market requirement is also that new products must also be backwards compatible, ensuring efficient usability in e.g. software version updates. To differentiate products, companies channel them into conventional dimensions, such as services, prices and product features e.g. colours, user interface. Thereby telecommunication standardization seeks to achieve compatibility between products and thereafter yield

"increasing returns" (Arthur 1990) and interoperable systems that achieve these effects. For example, Bluetooth¹ provides compatible, flexible, and high data rate links between any types of system components thus creating huge lock-in effects and "increasing relations".

Interoperability is defined as follows: information and services can be reached by a user of system while the services may reside on other systems. Interoperability is found within a heterogeneous communications environment e.g. Internet. Non-interoperable products operate only within the limits of their own system.

3. Institutional Theory

Scott (Scott 1995) defines *institutions* as follows:

"Institutions consist of cognitive, normative, and regulative structures and activities that provide stability and meaning to social behavior. Institutions are transported by various carriers - cultures, structures, and routines - and they operate at multiple levels of jurisdiction."

Institutional theory roots go back to the 1950s. Institutional theory makes us aware of the importance of the wider social and cultural contexts surrounding and supporting organizational forms as the ground in which organizations are rooted. Excellent reviews of recent institutional theory can be found in (Scott 1995; Tolbert 1996). Institutional theorists (Meyer 1977; Zucker 1977; DiMaggio 1983; Scott 1983) noted organizations confront either technical or institutional environments, each exerting different types of pressures. *"However, institutional theorists realized that viewing organizations as confronting either a technical or institutional environment at any given time creates a false dichotomy (Scott 1995) "*. Garud and Kumaraswamy (1995a) have proposed that we can understand and better shape the evolution of technological systems by coupling their institutional and technical environments. *"This dualistic relationship between the institutional and technical environments create a dynamic setting in which it is difficult for a dominant design to emerge"(ibid. p. 227).*

Many organizational perspectives emphasize the importance of materialist forces - technology, resources, and production systems. Wireless telecommunication shows technology standards as playing pieces in real organization networking. In Scott and Christiansen (1995) the institutional perspective gives priority to the roles of cognitive processes and symbol systems.

Organizations are important sources of institutionalization of new action. Institutional elements (structures, actions, roles) are easily transmitted to newcomers, are maintained over long periods of time without further justification or elaboration, and are highly resistant to change (Zucker 1977; Nelson and Winter 1982; Zucker 1987). The resulting stability increases effectiveness when it is linked to the goals of the organization by creating "routines". On the other hand, stability decreases effectiveness if more efficient ways of organizations are ignored.

Process and property variable approaches are a rule-like and an embedding in formal structures identify two defining processes (DiMaggio 1983). These processes are [ibid.] a) *imitative* or *mimetic*, adopting others' successful elements when uncertain about alternatives, and b) *normative* transmission of social facts, generally external sources such as professions. According to Zucker (1977) the third defining process, *coercive*, is central to state legitimation in the environment-as-institution approach, but it is explicitly considered

¹ Bluetooth is a global specification for wireless technology. It is designed for short-range wireless connectivity within three areas: data and choice access points, cable replacement and ad hoc networking. The Bluetooth specifications define a system solution comprising hardware, software and interoperability requirements. More information is available at www.bluetooth.com

deinstitutionalizing interorganization-as-institution approach, since any use of restricts indicates that other attractive alternatives exist.

4. Research Methods

We can find various IT standardization process models, but very few of them describe the wireless telecommunication standardization process as an interplay between various stakeholders. This assists an analysis of the social dynamics of standardization. To meet the need for all participants in the standardization process to understand their role in the process more thoroughly and recognize important relations between components, we try to explain it through institutional theory. By understanding the wireless technology standardization process as a techno-social variable organizational change we will gain a deeper understanding of such issues as structures and cultures of organizations, the role of R&D, technology and market strategies, and the importance of networks and boundaries, and define more clearly the type and the depth of specifications and standards. To pursue the approach we have combined inductive and deductive methods to develop the proposed model. In the first stage of the research we studied the processes of the standardization creation and institutional theory in a institutional environment. A qualitative method was chosen as the best way to arrive and encompassing model of standardization creation in wireless standardization organizations (Yin 1994).

In the second stage of the research we relied on wireless standardization environment and applied to institutional theory. Greenwood et al (1996) discuss that institutional theory is not usually regarded as a theory of organizational change. This is explained by isomorphism and stability of organizational arrangements in a given population or group of organizations. Greenwood [ibid.] showed that to understand institutional change, the external processes of deinstitutionalization have to be understood (organizations-in-sectors) together with the internal dynamics of interpretation, adoption, and rejection by the individual organization.

The field of interest is the standardization process in wireless telecommunication standardization environment. This environment is occupied by several organizational communities, including manufacturers, operators, 3rd party developers, standardization organizations, and regulators, of which the standardization community is our primary concern. Due to the limits of this paper, wireless standards have been framed on a general level like (Hughes 1986; Robin 1994; Jakobs et al. 1998; Jakobs 2002).

By building on wireless standardization theory, we sought to go beyond the descriptive standardization model, and develop a theoretical model based on existing concept from the literature. At the same time, by framing the model within an organization and profit maximizing environment to stable and utility maximizing environment perspective, we hoped to benefit from both organizational change and demonstrate the explanatory power of this perspective.

5. Research Approach

In this paper, we examine the standardization process through the lens of institutional theory to reveal standardization organizations. We focus on a wireless standardization community. The data for the research was gathered from the several different sources. The first source of data was written documents and scholarly articles from the standardization processes and institutional theory. This research is a part of PhD research of the wireless standardization process from the SME point of view. However, in this article we do not discuss SME's role, but in general the wireless standardization process.

In this paper, we do not differentiate among standard making mechanisms, whether it is de jure, de facto, strategic alliance, sponsored, unsponsored or firm-led initiatives. Our focus is on these characteristics of standardization communities which make particular standards succeed or fail in the standardization process.

6. Contextualizing the Theory

In order to reveal the reasons for the success of a complex networked technology, we have to think of it as a standard, as a complex socially and technically constructed phenomenon (Pinch and Bijker 1986; Lyytinen 1997). In this section we apply institutional theory to the standardization process.

6.1. Dynamics in Institutional Theory

An important work for institutional theory dynamics is Greenwood (1996) and change is Greenwood et al (2002). They [ibid.] specify that institutional theory neither denies nor is inconsistent with change. Greenwood et al (2002) presented a model of the "Stages of institutional change" which outlines a model for non-isomorphic change. As DiMaggio and Powell (1983) emphasize, there is great pressure on organizations engaged in the same types of activities to look and act alike, to become isomorphic. In the next paragraph we apply and follow this model.

According to this model (Greenwood 2002), Stage I occurs when events, or "jolts", destabilize established practices. These may be caused by social upheaval (see e.g. Zucker 1987), technological disruptions, competitive discontinuities or regulatory change (see e.g. Powell 1991). These changes precipitate the organization into Stage II, "Deinstitutionalization", in which new actors enter the field, existing actors ascend, or local entrepreneurship takes place (Suddaby 1999). The effect of this is to disturb the socially constructed field-level consensus by introducing new ideas and thus the possibility of change. Stage III is "Preinstitutionalization", which is referred to by Tolbert and Zucker (1996). In "Preinstitutionalization", organizations innovate independently, seeking technically viable solutions to locally perceived problems. Tolbert and Zucker argue that institutional theorists have paid very little attention to conceptualizing and specifying the processes that move innovations beyond preinstitutionalization into "full institutionalization". Stage IV, known as "Theorization", reflects this development. Strang and Meyer (1993) have suggested that for new practices to become widely adopted they have to be "theorized". Such theoretical accounts simplify and distil the properties of new practices and explain the outcomes they produce.

According to scholars, this "theorization" consists of three points. Tolbert and Zucker (1996, p.183) suggest that it involves "two major tasks": the specification of a general "organizational failing" for which a local innovation is "a solution or treatment", and the justification of the innovation. According to Strang and Meyer (1993, p. 495), "*models must make the transition from theoretical formulation to social movement to institutional imperative*". This transition is achieved either by nesting and aligning new ideas within prevailing normative prescriptions, thus giving "moral" legitimacy (Suchman 1995), and/or by asserting their functional superiority, or "pragmatic" legitimacy (ibid.).

Successful theorization is followed by diffusion. Davis (1991) has explored the patterns and mechanism by which ideas are transported within organizational communities. As innovations diffuse, they become "objectified", gaining social consensus concerning their pragmatic value; thus, they diffuse even further. Finally, Stage VI, known as "Reinstitutionalization", consists of full institutionalization and occurs as the density of

adaptation provides ideas with cognitive legitimacy (Suchman 1995) and the ideas themselves become taken for granted as the natural and appropriate arrangement.

6.2 Applying Institutional Theory to a Standardization Process

A critical determinant of the standardization process is how – and how well – actors bridge the institutional distance between them, and the foregoing discussion clearly shows that institutional theory has the power to deepen our understanding of the standardization processes. In Figure 1 we adapt and extend the dynamic model proposed by Greenwood et al. (2002) in order to better appreciate the process. Greenwood et al.'s "Stages of institutional change" model presents a nonisomorphic change. Greenwood et al. developed the stages to describe the regulatory agencies, such as professional associations, endorsing local innovations and shaping their diffusion. Parkhe (2003) adapted and extended the model in order to take into account the processes underlying the integration of values, practices and systems in international alliances. In this research we apply the stages to the standardization process to better understand the change of the standardization process and environment. We have also followed and combined standardization organizations and procedures as such as those presented by (Molka 1992; Habara 1994; Irmer 1994; Oksala 1996; Jakobs et al. 1998; Jakobs 2002; Jakobs April 2001) and (Robin 1994).

As Figure 1 shows, the early jolts in the lifecycle of the standardization process may lead to a shock to the institutionalized norms of each actor. Jolts may take the form of business, technological, regulatory, or globalization change. From Stage I ("Jolts") to Stage II ("Deinstitutionalization"), the impact may move business interests to foreseeable technological or regulatory changes. The greater challenge is to recognize the end users' requirements at this Stage. This would be important to further reduce the number of wrong choices in the technology development process.

These changes may, in Stage II ("Deinstitutionalization") with the emergence and number of new actors, lead to the ascendance of some actors, local entrepreneurship, or the possibility of institutional changes. These may destabilize and weaken current institutions, as each of the actors face the prospect of institutional change arising from the injection of new innovations, ideas or technology. At this Stage the very first drafts of the standard may be launched. The expectations of implementation of new innovations are high at this Stage. The impact to move from Stage II to Stage III ("Preinstitutionalization") becomes visible when technological workgroups or committees are established, often informally.

The shock and the resulting weakening of current institutions leads to tension between the actors who are forced to search for new solutions (Stage III, "Preinstitutionalization"). The effect of the new actors is to disturb the socially constructed field-level consensus by introducing new ideas and thus creating the possibility for change. In Stage III there might be a battle of technological innovations due to multiplicity of technology options, which should lead to a commonly adopted standard. However, the target of actors is to find new, innovative answers that meet the actors' need in the standardization process. The impulse towards Stage IV ("Theorization") is visible when formal technological and organizational networks are formed. IPR issues are discussed at the latest at this Stage. This leads to standardization proposal discussions in the field.

This search for new solutions enters the "Theorization" phase (Stage IV), as abstract categorizations/typifications of the standardization process outcomes are developed (such as *de facto*, *de jure*, formal/informal standardization), a technological solution is chosen, and the search for a legitimization of the chosen solution begins. The developed new practices have to be "theorized". Actors' behavioural issues, habits and values might be foreseeable at this Stage. The depth of the standard is also under discussion. At this Stage some actors might

have political interests to follow, such as interests concerning market or technological solutions. At this Stage, the standardization process might be cancelled or accepted for further discussion. This leads to the diffusion of innovation becoming “objectified”. In this case, ‘standardization’ means the gaining of social consensus concerning the pragmatic value of standards (Suchman 1995) and thus the standards are diffused even further (Tolbert 1996, p.183).

The movement from Theorization to Diffusion of the standards takes place when the standardization approval process and legitimating solution for frequencies begin. The steps between IV and V (“Diffusion”) occur when each actor undertakes to “sell” the new innovation or standard among the internal organizations of the actor and thus facilitate the adoption of a new solution and quicken the achievement of legitimacy (Stage V). In this Stage the innovations, the technology standards, become “objectified”, gaining social consensus and coordination among actors. The pragmatic legitimacy of standards is gained through networks of different actors, experience and acceptance. This is the final Stage in the implementation of a standard among actors. However, the critical question to answer at this Stage is: why is a new technology not instantaneously adopted by all potential actors? This may lead to a categorization of actors into early or late actors. This has an impact on organizational efficiency and innovation. The preventing factors can include business possibilities, technological development, and organizational or political conflicts.

We add the new Stage, Stage VI Reinstitutionalization, in which standards are revised and updated to meet the changed integration requirements. This Stage creates continuity for the process. The movement from Stage V (“Diffusion”) to VI (“Reinstitutionalization”) occurs through various standard lifecycle revisions. The maintenance revisions of technology standards enable the common usage of standards. Stage VI (“Reinstitutionalization”) enables and ensures diffusion, adoption and achievement of legitimacy for the standards, through constant updating and maintenance. This is organized through formal standardization organizations such as ETSI, or semi-formally such as UMTS Forum in the form of recommendations, or informally in OMA published as recommendations.

In addition to Parkhe’s (2003) and Greenwood et al.’s (2002) models, we add the connecting arrow “Reimplementation” between “Reinstitutionalization” (Stage VI) and “Precipitating Jolts” (Stage I), to ensure a continuous technology standardization process and development continuity.

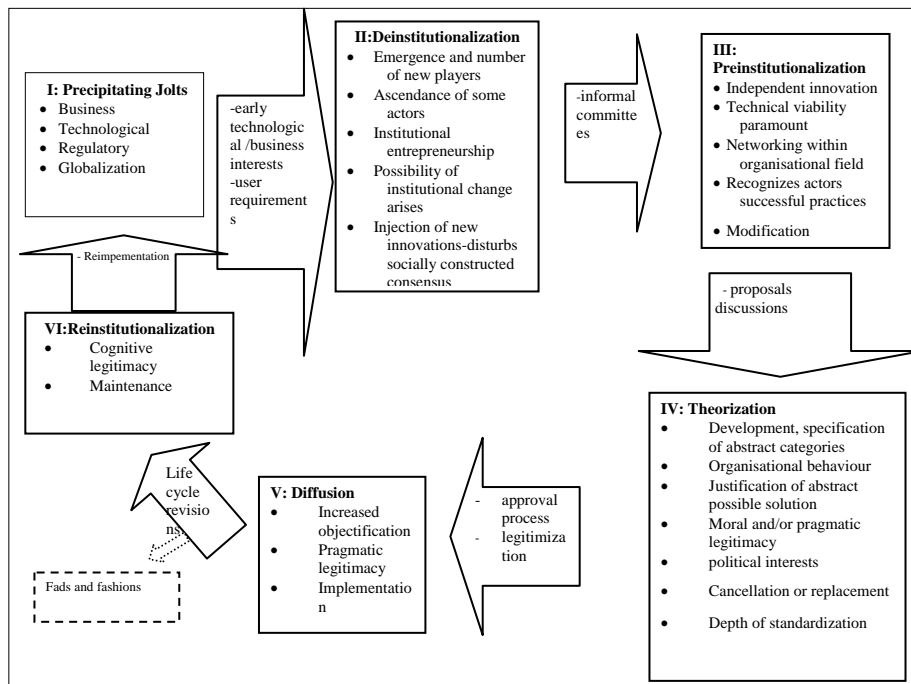


Fig. 1. Stages of Standardization change, adapted from Greenwood et al, 2002.

The model shows clearly that different organizations and actors, which might be nonisomorphic, are involved in the standardization process. However, in creating an efficient wireless technology standardization process, the more isomorphic different organizations are, the more efficient the theorization, legitimization, increased objectification and diffusion of various standards. The model also validates Greenwood et al.'s (2002) proposition that institutional theory either denies or is inconsistent with change.

Organizations mimic because they anticipate similar benefits, and thus legitimacy is mainly gained at Stage V. Similar benefits, commonly accepted standards and possible visible economic benefits are gained at stage V. This results in standard creation being time consuming process.

Institutional theory provides an explanation for the legitimization of new ideas through the process of mimicry. It shows that ideas achieve legitimacy if and when they are adopted by others and are thought to have economic benefits (Scott 1995). An example of this is the use of film and pop stars in advertising. Generally "legitimate" means a position in a hierarchy that gives the holder the power to make a decision. Organizations mimic each other because they anticipate similar benefits and thus legitimacy is mainly gained in Stage V.

One important insight associated with institutional theory is that there will be differences between early and late adopters of an organizational innovation with respect to determinants and consequences (e.g. Dobbin 1993). Early actors tend to exhibit different characteristics from late adopters. Research has shown that networked organizations or relational ties (e.g.

common board members) to other organizations that have adopted an innovation make an organization more likely to adopt innovations (Burns and Dietz 1992; Davis 1997). Tolbert and Zucker (1996) and numerous theorists have suggested that early actors will be more likely to embrace new practices because these practices are viewed as improving their effectiveness and efficiency. Later actors will adopt new practices because they seek to be in conformity with prevailing norms. This indicates that the creation of a standard is time consuming process. However, the development of the actors in the process depends on their political, technological, financial and organizational interests in the field.

7. Conclusions

Institutional function ensures an appropriate balancing of commercial and public interests and has a crucial role in promoting a region's economy and competitive capability. The institutional function promotes legitimacy, social welfare and national interests. Thus, it is a topical issue in the standardization field to understand the effects of changes in the standardization process.

This approach has enabled us to identify new issues in the process such as the difficulty of recognizing the final user requirements, the timing aspect, the depth of standardization, efficiency, number and size of organizations, and technology/standard multiplicity. The recognition of final user requirements is significant for example to reduce the product development costs. The timing aspect is important for example manufacturers to launch new product to market. The organizational point of view the numbers of organizations and actors have more created mimicry than opposite behavioral. The depth of standardization and technology reduce the costs for example in the interface level, when the minimum requirements are standardized. These issues all affect the standardization changes throughout the process. At the beginning of the process, the idea of a standard might be rather simple, whereas at the end of the process the standard is more complex and integrates various technologies and media and has gone through discussions at various levels of the organization.

The standardization environment has changed during successive technological generations, standardization has become global. There are more players in the standardization process: for example, regulators, multinational manufacturers and operators and the new "3rd party developers". At the same time, the markets have become heterogeneous. However, the early adopters in the global environment are expected to gain best benefits of the standardization process dynamism.

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Office:

Sprouts
University of Amsterdam
Roetersstraat 11, Room E 2.74
1018 WB Amsterdam, Netherlands
Email: admin@sprouts.aisnet.org