

# Standards setting processes in ICT : the negotiations approach

***Citation for published version (APA):***

Lim, A. S. (2002). *Standards setting processes in ICT : the negotiations approach*. (ECIS working paper series; Vol. 200219). Technische Universiteit Eindhoven.

***Document status and date:***

Published: 01/01/2002

***Document Version:***

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

***Please check the document version of this publication:***

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

***General rights***

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

[www.tue.nl/taverne](http://www.tue.nl/taverne)

***Take down policy***

If you believe that this document breaches copyright please contact us at:

[openaccess@tue.nl](mailto:openaccess@tue.nl)

providing details and we will investigate your claim.



Eindhoven Centre for Innovation Studies

## **Standards Setting Processes in ICT: The Negotiations Approach**

**A. Lim**

Eindhoven Centre for Innovation Studies, The Netherlands

Working Paper 02.19

Department of Technology Management

Technische Universiteit Eindhoven, The Netherlands

November 2002

# **Standards Setting Processes in ICT: The Negotiations Approach**

Andriew S. Lim<sup>1</sup>

Eindhoven Centre for Innovation Studies  
Technische Universiteit Eindhoven

Abstract:

Standards process is seen as an important determinant of innovation within the ICT sector. However, not many studies have focused on the mechanism at work within the standards-making process. Therefore, to find out how the standards selection process work, this paper tries to describe the negotiations occur between different players during the standards setting process, which influence the outcome of the process itself. The analysis primarily focuses on the pre-standardization stage. The negotiations are classified into three main phases with different activities at each phase.

Keywords: standardization, standards, process, negotiation

---

<sup>1</sup> Eindhoven Centre for Innovation Studies, Technische Universiteit Eindhoven, Faculteit Technologie Management, Postbus 513, 5600 MB Eindhoven, Netherlands. Phone: +31-40-2474236; Fax: +31-40-2474646; E-mail: [a.s.lim@tm.tue.nl](mailto:a.s.lim@tm.tue.nl).

## **Introduction**

Standards processes are seen as an important determinant of innovation within the Information and Communication Technology sector. Many believe that standards are the tools in global and open markets. This is the reason why stimulating technological innovation and the use of communication networks are high on the agenda of both national governments worldwide and the European Union. In order to stimulate technological innovation, the goal is to provide such conditions for firms that it is relatively easy for them to develop and sell new technologies. However, the standards processes are complex and dynamic among parties involved. Therefore, it is important for firms to understand the mechanisms at work in standards processes and the factors that determine and/or influence their outcomes.

Most studies either focus on the formal procedures of how the standards are developed within a certain formal standards body, or on building economic models for standards selection processes in which such organizations fulfill a purely functional (and therefore efficient) role. These studies mainly focus on market processes and the roles of formal standards bodies in them are mostly regarded as efficient solutions to a functional need, which is the way institutions are generally treated within economic analysis.<sup>2</sup> As a result, the mechanisms that drive the interaction between formal structure (make-up of standard bodies), formal rules (procedures), tacit rules (culture), regulation (government strategy), globalization and firms' strategies remain largely unknown. These circumstances lead to a question of how the mechanisms of the real standards processes might be. Therefore, this paper tries to elucidate a number of important mechanisms at work during the standards setting process.

The standardization process is more like a negotiation process rather than merely a technical discussion, which involve players with different strategies for a same achievement (return on investment). Ostrom (Schmidt & Werle, 1998, p.85)

---

<sup>2</sup> See David, P.A. & Greenstein, S. (1990), *The Economics of Compatibility Standards: An introduction to recent research*, Econ. Innov. New Tech. Vol.1, pp. 3 – 41; Matutes, C. & Regibeau, P. (1996), *A Selective Review of the Economics of Standardization: Entry deterrence, technological progress and international competition*, European Journal of Political Economy Vol 12, pp. 183 - 209.

called it an “action arena” where institutional organizations can be analyzed, predicted and explained behavior by all involved players. Besides technical debates, economic and political interests are seen as the primary motives to the negotiation in standards process (Egyedi, 1996, p.61). All actors step carefully in order not to make any mistake, like choosing the unwanted partner or adopting a misleading standard. Thus, the most critical stage in standards-setting processes is the early period, where any initial movement from each actor might influence another’s consideration and point of view.

In this paper, the following point is taken: there are two stages in the standardization process. The first one is the pre-standardization stage, where the process only involves the representatives of the manufacturers and co-producers as the players. Discussion between vendors and manufacturers regarding whose and what technology should be chosen and proposed as the standard happens in this stage. The topic of standardization could be raised from existing standards from the market, or new technology, which is new for a particular firm. The second stage is the standardization stage, where the representatives of manufacturers and co-producers have to deal within the technical committee of formal standards bodies, where in some regional political issues and government policies demand attention.

### **Methodology**

Since the early period of standardization processes is believed to be the most important stage, this paper only focuses on the early stage, i.e. the pre-standardization stage. Deeper analysis will be conducted regarding the process at work during this stage. This also includes how the negotiations process is happening during the pre-standardization stage, why they have to end up with negotiations processes, and what elements might be utilized in the negotiation process. Therefore, some negotiations theories are used to analyze the mechanisms of standards-setting process. This is meant to gain the understanding of the structure and dynamics of the process in the early stage, and to appreciate the importance of that early stage. The basis for this

analysis is gained through literature studies about the standards-setting processes. Negotiations theory has only been applied rarely in this pre-standardization stage.

### **Standardization in ICT**

There are two factors in standardization studies, i.e. 'knowledge' factor that brings the standards to technological perfection, and 'interest' factor where standards are determined by the interests of influencing parties (Egyedi, 1996). Knowledge factor is indicated by technological development in standards improvement or new standards development. Firms with intense R&D might be the most important actors behind knowledge factor. Thus technological excellence is the most important achievement and basic requirement. On the other hand, technological performance is less important in interest factor.<sup>3</sup> Economical and political issues play important role in this factor. For instance, some adjustments on specification are needed in order to gain market share in certain countries.

### *Background*

Stimulating technological innovation and the use of communication networks are high on the agenda of both national governments worldwide and the European Union. In order to stimulate technological innovation, the goal is to provide such conditions for firms that it is relatively easy for them to develop and sell new technologies. On the other hand, governments are also there to defend the public interest, for example, by measures to stimulate coordination of the various communication network technologies into a limited number of standards. Both for firms and for governments, an improved understanding of the mechanisms at work in standards processes and the factors that determine and/or influence their outcome would be of considerable importance.

---

<sup>3</sup> Lassner (1995) claimed that the quality of negotiated standards, particularly in the political setting of international forum, might be technically sacrificed to the pragmatic need for agreement and political considerations unrelated to the standard or technology under study (Rose 1990).

The role of communication networks has increased considerably in the past decade, which means the role of technology for communication networks, and more importantly, the role and importance of technical standards have become larger as well. However, the liberalization and technological convergence cause the complexity and dynamics in standards processes, with the increase number of players involved. These factors put into question the extent to which the standards processes can be controlled, both for firms trying to push their technology in order to recoup their investments, and for formal standard bodies pursuing a dual policy of trying to maximize utility in serving the public interest (Smits, 1993). Some negotiations approaches between players are used to revise the process in the pre-standardization stage.

There are a number of strategies firms may try in order to influence the outcome of the negotiation process in standards committees. They may dispatch a large number of delegates to committees, take part in several committees and/or standard bodies at once, or carefully select the standards body that is most favorable to their standard because of its procedures (Heywood et al., 1997; Egyedi, 1996). They may also become more careful in devising their Intellectual Property Rights strategy (Bekkers & Liotard, 1999) or enter into alliances with other firms (Axelrod et al., 1997).

Governments or the official standards bodies are likely to react to or anticipate possible negative consequences of these firm strategies by introducing new procedures or reconsidering the role of certain standards bodies. Examples are the way industry players have been allowed a more influential role in the European standards body ETSI, and even more telling: industry players have very recently been allowed to become members in an international treaty organization, the traditional key player in this field, the International Telecommunication Union (ITU), which is a specialized agency of the United Nations.<sup>4</sup>

---

<sup>4</sup> The members of ITU-T (Standardization Sector) contain of players from the public and private sectors, i.e. telecommunication policy-makers and regulators, network operators, equipment manufacturers, hardware and software developers, regional standards-making organizations and

### *The role and characteristics of standards in ICT*

Lassner (1995) claims that standards-making processes vary according to the organization developing the standards, the nature of the standard itself, and the state of development of the particular technology in question. Therefore, to empathize such mechanisms at work in standards processes in ICT industry, it is imperative to consider how all actors behave within the group where they work on the pre-standards. For instance, decentralized decision-making can result in too much standardization (David, 1995, p.25). On the other hand, the rapid and dynamic technological developments in ICT industry require concise and efficient processes.

Basically, there are two ways of determining standardization mode in information and communication technology industry. The first one is *de facto* standards, which are determined by their existence in the market. In this market selection, dominant technology is automatically chosen as the standard in many cases, and other firms have to adopt that chosen standard. Market standards come up as the result of firms' strategies with complexity and dynamic influences. It is dynamics because of the rapid technological development, and complex as competition due to market demands. The other determination is known as *de jure* standards, which are established and registered at official standards bodies. Most of the time, this negotiated standard selection mode originates and rules binding standards to related firms with the involvement of governments.<sup>5</sup>

### *Negotiation chronology*

As mentioned earlier, this paper only focuses on the pre-standardization stage. This means deeper discussion of negotiations processes during the pre-standardization is conducted. In the pre-standardization stage, informal meetings occur between engineers from different firms. They might have same ideas about a particular standard topic to discuss with each other. For instance, during a conference, some

---

financing institutions. (See ITU Website, <http://www.itu.int/highlights/overview/>, last updated on 8 October 2001).

<sup>5</sup> depending on regulation



engineers from different firms get acquainted and start talking about their current interests in standardization. It is predicted those engineers with same interest and idea agree to discuss particular standards topics further and arrange the possible next meetings. An agenda is set up with one or more particular topic to follow up their previous discussion. It is not clear yet, but those engineers' initiatives might be part of strategic movements of firms, and it is very common to find a lot of lobbying among several working groups of engineers from different firms' technical department in this early stage. Preliminary contacts might also occur between those engineers, since they are acquainted with each other from previous occasions, such as former colleagues or classmates. There are also possibilities for those groups of engineers to set up alliances in the standards-setting processes, as this has been a new trend (Lassner, 1995). Consequently firms have to make sure that they choose the right partners as their allies and not adopting a minority and unsupported standard. Of course with many other advantageous consideration as well, such at least reduce individual investment costs, switch competitors to partners and remove potential competing standards. Through alliances, firms are not only reducing competitive interdependence by absorbing competition, but also increasing the power of the resulting larger organization in its symbiotic relationships as well. In many cases, smaller firms try to get along with bigger firms that possibly have the strongest influence within the alliances. This can be found when smaller firms have adopted dominant standards from bigger firms, so that they may feel safe using the same technology for at least a while. Therefore, information gathering becomes one of the most important activities to examine the current situation. Another advantage of this ally is the acceleration of the standards-setting process due to the limited membership and area of work (Spring et al., 1995).

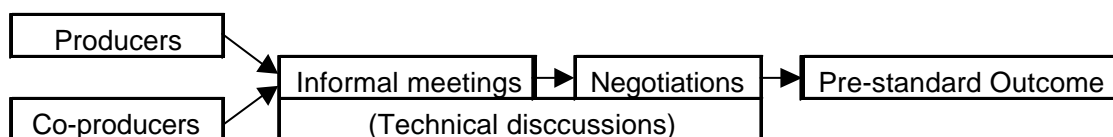


Fig. 1. Pre-standardization stage

Further on, a group of experts is set up as a working group or a technical committee that are working on the proposal of a project with a particular standard topic. This is where the negotiations process begins between those experts. Each one of them represents the firm to whom he works for. Hence, negotiation theories are used to analyze the stages of standardization process. Negotiation can be defined as a process in which two or more entities come together to discuss common and conflicting interests in order to reach an agreement of mutual benefit (Harris and Moran, 1991, p.56). In this negotiation process, those engineers sit together and discuss a particular technological content. Meanwhile, they also try to influence the outcome and come out as the winner instead of reaching a mutual agreement. This is one of their strategies, i.e. pursuing their technologies as the dominant standards, which should be followed by other firms.<sup>6</sup> Therefore, they come with different preparations and strategies to win the negotiation process.

For a deeper and more comprehensive understanding about the negotiation in each stage of standards process, particularly in the pre-standardization stage, a negotiation theory tries to divide each stage into three phases of negotiation process (Ghauri, 1999). First phase is the pre-negotiation phase, where all actors make an effort to understand each other's by gathering information and informal meetings. As described earlier, information gathering becomes one of the most important activities. These might turn out when those actors attend conferences and have their initial acquaintances. When they realize that they have same interests, they would proceed their ideas further to next meetings. It is also believed that the pre-negotiation phase is often more important than the formal negotiations, where all actors may create new networks or maintain the existing ones. A lot of lobbying between the engineers can be found during this phase. They try to foresee and take precautions against predictable events, and their action might be one of their firms' strategies as well. Particularly for smaller firms, they try to prevent becoming the party that suffers from an agreed standard.

---

<sup>6</sup> Mostly done by dominant firms.

The second phase is the negotiation phase, consists of face-to-face negotiations among the players. Basically, all parties believe that they are trying to solve the problem together. That means they have to be open minded and have several alternatives before they start negotiating. As the process continues, they have to explore the differences in preferences and get closer to each other. All the strategies prepared at the previous phase are being tested here, as they have to use the right strategy at the right moment and to the right persons. The last phase is the post-negotiation phase, where an agreement upon the specific issue is reached. Although all parties have agreed, but if it is summarized in negative atmosphere, there will be a big possibility that the face-to-face negotiation will be renewed.

In more detail, this theory is extended to apply a theory of project negotiations, where the three-phases process can be divided into five parts (Ghauri, 1996; Cova and Holtius, 1993). The first phase contains three parts, begins with the proposal preparation. It is started since the first contact related to the project and to be concluded at the time of submission. By this way, each party<sup>7</sup> also shows their concern to involve in the project. The second part is where informal meetings occur following the proposal submission to clarify the topic of the project. In these informal meetings, negotiations arise coalitions and finalize draft proposals (Schmidt & Werle, 1998). These meetings can be formal too, depend on how close their relationships have been developed.

Once the proposal is clear, all parties start formulating the negotiating strategy. They collect useful information and analyze all important factors, like their relationships with others, their own and others' strength and weakness, etc. This is the third part, where they also prepare themselves for the second phase, i.e. face-to-face negotiations. Unlike the previous phase, the second phase only contains face-to-face negotiations as one part. Through face-to-face negotiations, every party tries to have the strongest influence to win over the pre-standards outcome. Rising up and turning down offers of own technology to be accepted as the dominant technology and

---

<sup>7</sup> One firm can be represented by more than one engineer.

becoming standard happen in this phase. Multiway dialogues are more likely to come about rather than predominant dialogues by bigger firms who might have bigger influences as well. Smaller firms typically act as the supporters for bigger firms.

After long and tense dialogues, in the last phase that also contains only one part, the agreement between parties is set out as the outcome of the negotiations. In the case of the pre-standardization stage, the outcome of the negotiations is the pre-standards outcome. Part of the outcome is the decision whether they should carry on with the standardization project or not. However, the agreement is not always emerged through negotiations. It is possible when negotiations process comes to an end, no concurrence is achieved between parties and a new agenda is needed for re-negotiations process. This also means that the proposal needs to be renewed before they start over the negotiation. Figure 2 describes all phases and parts compared to the project stage (Egyedi, 1996, p.107) during the pre-standardization stage.

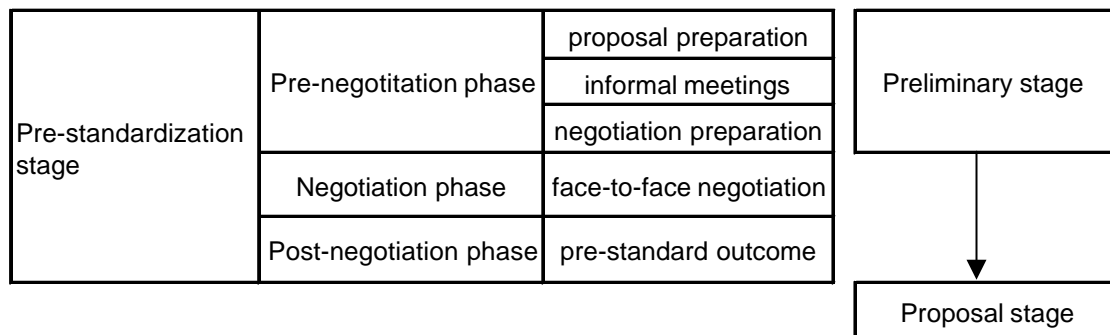


Fig. 2. Stages in pre-standardization process

When an outcome is achieved, following up the result of this pre-standardization stage, some members of the working group act as the technical committee of the project, represent and arrange meetings with the technical committee of formal standards bodies. They bring the outcome of their negotiations as a standardization project to the next stage, the standardization stage, where the standardization processes take place. And again, the negotiations process occurs with the same phases and parts but slightly different details. The atmosphere of the

meetings in this stage is more formal than in the previous stage, and the discussion contains less technical issues as well. Economic and policy issues also arise during the standardization stage.

<b>Realization of European or international technical standard</b>	<b>Phase</b>	<b>By</b>
Initial steps	Proposal	Member of EU Commission, or European Association
	Proposal submission	Original proposer
	Decision about proposal	CEN/CENELEC Technical Board, ISO/IEC Technical Committee
	Decision to absorb the project into the working program	CEN/CENELEC Technical Board, ISO/IEC Technical Committee
Standardization process	Choosing group experts	Technical Committee
	Definition and specification of the standard	Expert Group
	Extensive study of the standard's concept	Reviewers
	Definitive study of the standard's concept	Technical Committee
	Voting in the Technical Committee	Technical Committee
	Voting of the members	Members
	Publication	Members of CEN/CENELEC; ISO/IEC

*Fig. 3. Stages in the Standardization Process (Smits, 1993, p. 10)*

Since the working group representative is the party who comes with the proposal, they proceed more active in approaching the other party (technical committee of formal standards bodies). During the pre-negotiation phase, they try to build good relationships with the member of technical committee of formal standards bodies. They also try to match their proposal's contents with the requirements of formal standards regulations, as part of their preparation to the face-to-face negotiations process. This formal negotiation process also minimizes the possibility of adopting standards that are incompatible with each other (Spring et al., 1995). At the

end of the standardization stage, voting within the technical committee is conducted, and the positive outcome is the publication of standards by formal standard body (Smits, 1993). Figure 3 describes the steps of the whole standardization process.

#### *Other factors*

However, there is another feature that influences the outcome of standards negotiations processes. The technical quality of the negotiated standards, remarkably in political setting of an international forum, might be sacrificed to the pragmatic need for an agreement and political considerations unrelated to the standard or technology under study (Lassner, 1995). Some technical requirements are even deleted in order to suit political purpose of current situation where later the standards will be established. This means national political interests play an imperative part in international standardization (Schmidt & Werle, 1998, p.97).

According to Schmidt and Werle (1998, p.85), the standardization organizations do not directly affect the interests and strategies of the actors involved in standard setting. It is the actors themselves who explicitly bear political goals and economic interests into the institutional arena. They might proceed the negotiation processes with various motives and use the standardization issues as the masquerade to achieve their goals and interests. This can be seen from the diversity of members in the standardization organizations, which reveals an extensive scale of heterogeneity and an expansive scope of interests.

One of the firms' strategies in entering the standardization and winning the competition is their participation as active members in formal standards bodies. Firms try to apply as much delegation as possible sitting in the institutions memberships. This means they might have the strongest influence in decision-making.<sup>8</sup> Apart from the mentioned benefit as members, firms can also secure their stances from other officially established standards. Although the official standards are meant to serve

---

<sup>8</sup> Membership status in such organization offers an opportunity not only to initiate and influence, but also to monitor standardization activities and to keep abreast of technical developments (Schmidt & Werle, 1998, p.86).

public, other firms, who are non-adopter and softly compelled to adopt the standards, may object and stand up their intention. But to be able to do so, firms must be members of that formal standards body. Thus, they decide to apply for membership at formal standards bodies, where the arena related to the market for standards-making battle takes place. It is called “battle-arena”, particularly by dominant firms, where they have to anticipate other standards proposed by other firms. Those dominant firms do not want to lose their position as technological leader in the market standards.

Firms’ participation in formal standards organizations is considered a normal activity and often-compulsory aspect of organizational activity (Schmidt & Werle, 1998, p.87). Firms also maintain their reputation and updated regarding standardization issues through memberships in formal standards bodies. Schmidt and Werle (ibid.) also refer to the research done by US National Research Council in 1995, that the motivation in contributing to the standards process are prestige, curiosity, or a desire to positively influence future events. However, the possibility of exchanging information or acquiring knowledge of ongoing technology developments and evolving firm strategies appeal more to some members of standardization institutions, rather than straight forward influencing the standardization process.

Some important requirements in implicating standards process are expected from individuals joining the standards committee, i.e. technical expertise, participation in meetings, and negotiation skills (Spring et al., 1995). Technical expertise comes up as the most desired requirement as the majority of standardization participants are engineers from research and development or product development.<sup>9</sup> Participation in meetings and negotiation skills arise as the non-technical requirements, but are still considered as important skills. Networkings among actors are often begun through participation in meetings, and it would be less effective and efficient if firms send different individuals from meetings to meetings. The new delegation who join a meeting in the middle of the process does not certain in catching up with the others. Thus, not only the networking efficiency affected, but

also the efficiency of standards process is shaped by the impact, for instance longer period is needed for the process.

Along with meetings participation,<sup>10</sup> negotiation skills are essential for participants, remarkably for the chairperson of the committee (Spring et al., 1995). This confirms the earlier statement that standardization process is more to negotiation process rather than technical discussion, although the majority of participants are technical experts and the main issues are also technical matters. Therefore, negotiation process theories are appropriate to be applied to examine the standards-making process as well.

## **Conclusion**

The standardization process is not as simple as it seems. From the technological point of view, a standard is full of choices. This means numbers of technological solutions are available to be adopted as the standard. It is also possible that a mixture of different technologies includes among the options. Besides the technological point of view, there are some policies framing and regulating the development of standardization process. Formal standards bodies play an important role in determining the standards. They have the responsibility to control the pre-standards outcomes before they are launched as formal standards. As the result, negotiation processes occur in a couple of stages with different players composition and different atmosphere.

In the pre-standardization stage, negotiations occur in three phases, where each phase has different activities and strategic movements of each party. The parties, which almost all of them are engineers, deal mostly in technical topics. They negotiate how to nominate a certain technology as a standardization project and become an established standard later on. Thus, technical negotiations occur during this pre-standardization stage between technical experts. At the end of this stage, the result is

---

<sup>9</sup> Seventy-five percent of the respondents among standards committee members describe their job function as either research and development or product development (Spring et al., 1995).



the pre-standards outcome, whose quality is also influenced by the quality of the negotiations processes. This causes the pre-standardization stage, as the basis of the standardization process, the important part of the whole processes.

The pre-standards outcome is later brought to the next stage, the standardization stage, for further processes. This is where the negotiation process between those engineers with the technical committee of formal standards bodies takes place in more formal atmosphere. The result of this stage is a publication of standard by the formal standards bodies.

## References

Axelrod, R., et al. (1997), "Setting Standards: Coalition Formation in Standard-setting Alliances", in: Axelrod, R. (ed.), *The Complexity of Cooperation: Agent-based Models of Competition and Collaboration*, New Jersey: Princeton University Press.

Bekkers, R. (2001), *The Development of European Mobile Telecommunications Standards*, Ph.D. Dissertation, Eindhoven University of Technology.

Bekkers, R. & Liotard, I. (1999), "European Standards for Mobile Communications: the Tense Relationship between Standards and Intellectual Property Rights", *European Intellectual Property Review* vol. 21 issue 3, pp. 110 – 126.

Bekkers, R. & Smits, J. (1997), *Mobile Telecommunications: standards, regulation, and applications*, Boston: Artech House.

Besen, S.M. & Farrell, J. (1994), "Choosing How to Compete: Strategies and Tactics in Standardization", *Journal of Economic Perspectives* Vol. 8 No. 2, pp. 117 – 131.

Besen, S.M. & Saloner, G. (1989), "The Economics of Telecommunication Standards", in: Crandall, R.W. & Flamm, K. (eds.), *Changing the Rules: Technological change, international competition, and regulation in communications*, Washington D.C.: The Brooking Institution.

Bruin, R. de & Smits, J. (1999), *Digital Video Broadcasting: Technology, Standards, and Regulations*, London: Artech House, Digital Audio and Video Series.

Cargill, C.F. (1989), *Information Technology Standardization: theory, process, and organizations*, Bedford Digital Press.

---

<sup>10</sup> Both participation in meetings and negotiation skills acquire seventeen percent each of the respondents among standards committee members.

Cova, B., Mazet, F & Salle, R. (1999), "Project Negotiations: An Episode in the Relationship", in: Ghauri, P. & Usunier, J.C. (eds.), *International Business Negotiations*, Oxford: Pergamon, Elsevier Science Ltd.

David, P.A. (1995), "Standardization Policies for Network Technologies: The flux between freedom and order revisited", in: Hawkins, R., Mansell, R. & Skea, J. (eds.), *Standards, Innovation and Competitiveness: The Politics and Economics of Standards in Natural and Technical Environments*, UK: Edward Elgar Publishing.

David, P.A. & Greenstein, S. (1990), "The Economics of Compatibility Standards: An introduction to recent research", *Econ. Innov. New Techn.* Vol.1, pp. 3 - 41.

David, P.A. & Steinmueller, W.E. (1996), "Standards, Trade and Competition in the Emerging Global Information Infrastructure Environment", *Telecommunications Policy* vol. 20 no. 10, pp. 817 – 830.

Egyedi, T. (1996), *Shaping Standardization: A study of standards process and standards policies in the field of telematic services*, Ph.D. dissertation, Delft University of Technology.

Farrell, J. & Saloner, G. (1985), "Standardization, Compatibility, and Innovation", *Rand Journal of Economics* Vol. 16 No. 1, pp. 70 – 83.

Farrell, J. & Saloner, G. (1986), "Installed Base and Compatibility: Innovation, Product Preannouncements, and Predation", *The American Economic Review* Vol 76 No. 5, pp. 940 – 955.

Genschel, P. (1997), "How Fragmentation Can Improve Co-ordination: Setting Standards in International Telecommunications", *Organizations Studies* vol 18 no. 4 pp. 603 – 622.

Ghauri, P. (1999), "The Nature of Business Negotiation", in: Ghauri, P. & Usunier, J.C. (eds.), *International Business Negotiations*, Oxford: Pergamon, Elsevier Science Ltd.

Grindley, P. (1995), *Standards Strategy and Policy: Cases and Stories*, Oxford: Oxford University Press.

Hadden, A.D. (1995), *Personal Communications Networks: Practical Implementation*, London: Artech House Publishers, Mobile Communication Series.

Hanseth, O., Monteiro, E. & Hatling, M. (1996), "Developing Information Infrastructure: The tension between standardization and flexibility", *Science, Technology, & Human Values*, Vol. 21 No. 4, pp. 407 – 426.

Harris, P.R. & Moran, R.T. (1991), *Managing Cultural Differences: High-performance strategies for a new world business*, Houston: Gulf Publishing Company.

Heywood, P., Jander, M., Roberts, E. & Saunders, S. (1997), "Standards, the Inside Story: Do vendors have too much influence on the way industry specs are written and ratified?", *Data Communications* ed. March 1997, pp. 59 - 72.

Lassner, D. (1995), "Global Telecommunications Standardization in Transition", in: Jussawalla, M. (ed.), *Telecommunications: A Bridge to the 21<sup>st</sup> Century*, Amsterdam: Elsevier Science B.V.

Lint, O. & Pennings, E. (2000), "The Recently Chosen Digital Video Standard: Playing the Game within the Game", *Working Paper* 00.02, Eindhoven: Eindhoven Centre for Innovation Studies, Technische Universiteit Eindhoven.

Matutes, C. & Regibeau, P. (1989), "Standardization Across Markets and Entry", *The Journal of Industrial Economics* Vol. 37 No. 4, pp. 359 – 371.

Matutes, C. & Regibeau, P. (1996), "A Selective Review of the Economics of Standardization: Entry deterrence, technological progress and international competition", *European Journal of Political Economy* Vol 12, pp. 183 - 209.

Ojanperä, T. (1998), "Standardization Work and Future Directions", in: Ojanperä, T. & Prasad, R. (eds.), *Wideband CDMA for Third Generation Mobile Communications*, Boston: Artech House Publishers.

Paffen, T.J. & Janszen, F. (\_\_\_), *Management of Architectures and the Role of Standardization in the Telecommunications Innovation Process*, Department of Management of Technology and Innovation, Erasmus University, Rotterdam School of Management.

Schmidt, S.K. & Werle, R. (1998), *Coordinating Technology: Studies in the International Standardization of Telecommunications*, London: The Massachusetts Institute of Technology Press.

Schoechle, T. (1999), *Toward a Theory of Standards*, SIIT 1999 paper.

Smits, J.M. (1993), "Normalisatie: Recht of Techniek?", *Intreerede*, Eindhoven: Technische Universiteit Eindhoven.

Spring, M.B. et al. (1995), "Improving the Standardization Process: Working with Bulldogs and Turtles", in: Kahin, B. & Abbate, J. (eds.), *Standards Policy for Information Infrastructure*, Massachusetts: The MIT Press.

Stienstra, A.J. (1996), *Pre-Standardization of Digital Multimedia Systems*, Eindhoven: Philips Research Laboratories.



Eindhoven Centre for Innovation Studies

## WORKING PAPERS

Ecis working papers 2001-2002 (November 2002):

- 01.01 H. Romijn & M. Albu  
*Explaining innovativeness in small high-technology firms in the United Kingdom*
- 01.02 L.A.G. Oerlemans, A.J. Buys & M.W. Pretorius  
*Research Design for the South African Innovation Survey 2001*
- 01.03 L.A.G. Oerlemans, M.T.H. Meeus & F.W.M. Boekema  
*Innovation, Organisational and Spatial Embeddedness: An Exploration of Determinants and Effects*
- 01.04 A. Nuvolari  
*Collective Invention during the British Industrial Revolution: The Case of the Cornish Pumping Engine.*
- 01.05 M. Caniëls and H. Romijn  
*Small-industry clusters, accumulation of technological capabilities, and development: A conceptual framework.*
- 01.06 W. van Vuuren and J.I.M. Halman  
*Platform driven development of product families: Linking theory with practice.*
- 01.07 M. Song, F. Zang, H. van der Bij, M. Weggeman  
*Information Technology, Knowledge Processes, and Innovation Success.*
- 01.08 M. Song, H. van der Bij, M. Weggeman  
*Improving the level of knowledge generation.*
- 01.09 M. Song, H. van der Bij, M. Weggeman  
*An empirical investigation into the antecedents of knowledge dissemination at the strategic business unit level.*
- 01.10 A. Szirmai, B. Manyin, R. Ruoen  
*Labour Productivity Trends in Chinese Manufacturing, 1980-1999*
- 01.11 J.E. van Aken  
*Management research based on the paradigm of the design sciences: the quest for tested and grounded technological rules*
- 01.12 H. Berends, F.K. Boersma, M.P. Weggeman  
*The structuration of organizational learning*
- 01.13 J.E. van Aken  
*Mode 2 Knowledge production in the field of management*

- 01.14 A. Cappelen, F. Castellacci, J. Fagerberg and B. Verspagen  
*The impact of regional support on growth and convergence in the European Union*
- 01.15 W. Vanhaverbeke, G. Duysters and B. Beerkens  
*Technological capability building through networking strategies within high-tech industries*
- 01.16 M. van Birgelen, K. de Ruyter and M. Wetzels  
*The impact of attitude strength on the use of customer satisfaction information: An empirical investigation*
- 01.17 M. van Birgelen, K. de Ruyter A. de Jong and M. Wetzels  
*Customer evaluations of after-sales service contact modes: An empirical analysis of national culture's consequences*
- 01.18 C. Keen & M. Wetzels  
*E-tailers versus retailers: which factors determine consumer preferences*
- 01.19 J.E. van Aken  
*Improving the relevance of management research by developing tested and grounded technological rules*
- 02.01 M. van Dijk  
*The Determinants of Export Performance in Developing countries: The Case of Indonesian manufacturing*
- 02.02 M. Caniels & H. Romijn  
*Firm-level knowledge accumulation and regional dynamics*
- 02.03 F. van Echtelt & F. Wynstra  
*Managing Supplier Integration into Product Development: A Literature Review and Conceptual Model*
- 02.04 H. Romijn & J. Brenters  
*A sub-sector approach to cost-benefit analysis: Small-scale sisal processing in Tanzania*
- 02.05 K. Heimeriks  
*Alliance Capability, Collaboration Quality, and Alliance Performance: An Integrated Framework.*
- 02.06 G. Duysters, J. Hagedoorn & C. Lemmens  
*The Effect of Alliance Block Membership on Innovative Performance*
- 02.07 G. Duysters & C. Lemmens  
*Cohesive subgroup formation: Enabling and constraining effects of social capital in strategic technology alliance networks*
- 02.08 G. Duysters & K. Heimeriks  
*The influence of alliance capabilities on alliance performance: an empirical investigation.*
- 02.09 J. Ulijn, D. Vogel & T. Bemelmans  
*ICT Study implications for human interaction and culture: Intro to a special issue*
- 02.10 A. van Luxemburg, J. Ulijn & N. Amare  
*The Contribution of Electronic Communication Media to the Design Process: Communicative and Cultural Implications*
- 02.11 B. Verspagen & W. Schoenmakers  
*The Spatial Dimension of Patenting by Multinational Firms in Europe*
- 02.12 G. Silverberg & B. Verspagen  
*A Percolation Model of Innovation in Complex Technology Spaces*

- 02.13 B. Verspagen  
*Structural Change and Technology. A Long View*
- 02.14 A. Cappelen, F. Castellacci, J. Fagerberg and B. Verspagen  
*The Impact of Regional Support on Growth and Convergence in the European Union*
- 02.15 K. Frenken & A. Nuvolari  
*Entropy Statistics as a Framework to Analyse Technological Evolution*
- 02.16 J. Ulijn & A. Fayolle  
*Towards cooperation between European start ups: The position of the French, Dutch, and German entrepreneurial and innovative engineer*
- 02.17 B. Sadowski & C. van Beers  
*The Innovation Performance of Foreign Affiliates: Evidence from Dutch Manufacturing Firms*
- 02.18 J. Ulijn, A. Lincke & F. Wynstra  
*The effect of Dutch and German cultures on negotiation strategy comparing operations and innovation management in the supply chain*
- 02.19 A. Lim  
*Standards Setting Processes in ICT: The Negotiations Approach*