

# How Stakeholders View the Impacts of International ICT Standards

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## Abstract

Assessing the impacts of standards is a challenging task. Concerning ICT standards, mostly we have case studies of individual standards within specific impact dimensions rather than broader surveys of the impacts of standardization as a whole. Econometric studies also address mainly the network effects of individual ICT standards, whereas macro-economic analysis does not yet show the impacts of standards in specific industries. To bridge this gap, we developed a survey instrument aimed at assessing standards impacts from the point of view of stakeholders in the standards development process. We administered the survey to members of ETSI, ITU and CEN/ISSS standards committees. Many of our findings either countered the predictions of much current theory or otherwise raised new grounds to question many common assumptions about the economic and business impacts of standards. Although many variations were found according to whether the standards were formal, informal or proprietary, several strong general findings emerged also. Overall, we found that cost-related impacts (especially savings) are less relevant to stakeholders than various market shaping aspects. Stakeholders perceived the main positive impacts in terms of the ability to increase product variety, and to develop new global outsourcing opportunities for R&D as well as production. We found also that the impacts of formal standards were rated significantly higher and more positively than the other types of standards. Consortia standards showed a rather similar pattern of impacts to formal standards, but were associated by stakeholders with different roles in the market. Most of the impacts of proprietary standards were viewed negatively. We concluded that the changes in the institutional landscape of standardisation in the ICT sector represent a challenge both for the theory of standardisation and for the development of adequate methodologies to assess their impacts.

**Keywords:** formal standards, proprietary standards, consortia standards, impact dimensions

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## 1. Introduction

It is widely acknowledged that the information and communication technology (ICT) industries (including both hardware and software producers) are strongly dependent upon standards. The impacts of standards can be articulated both in terms of the technologies and processes to which they are applied and in terms of the economic issues that they may resolve in the market. While recognizing that the two types of impacts are closely related, we are concerned here mainly with how and where economic impacts occur and specifically how these impacts are perceived and anticipated by stakeholders in the standards development process.

In this regard, we note that standards can be categorized according to their economic effects: see for example the schemes developed by David (1987), David and Greenstein (1990) or Tassej (2000) and most recently by Blind (Blind 2004). Most existing empirical and theoretical work in such frameworks considers the impact dimension mainly in terms of *costs* (transaction costs and cost reduction), *competition* (using standards to organize markets) or *communication and coordination* (organizing the development of technology around agreed technical specifications). However, determining the specific impacts of specific standards or groups of standards – i.e. attributing an economic effect or outcome uniquely or primarily to standardisation – is a non-trivial task that can be understood differently at different levels.

At the level of firms, industries and markets, it is widely accepted that standards have complex impacts on technology selection and coordination. Swann (2000) argues that in the long run standards create selection efficiencies by pruning the tree of available technical solutions for any given problem. But (Schmidt, Werle 1998) show that impacts in terms of market coordination relate mainly to the degree of symmetry that can be achieved between standards and the technological environments in which they are applied. Existing work at the game-theoretical level focuses on network effects (i.e. positive returns to adoption) as the main impact of standards (Farrell, Saloner 1985; Farrell, Saloner 1986; Katz, Shapiro 1986; Katz, Shapiro 1985; Katz, Shapiro 1994).

At the macroeconomic level, the studies of Jungmittag *et al* (1999), Temple *et al* (2005) and Blind & Jungmittag (2005) have calculated the general economic impact of standards on national economies. For example, under the assumption that the stock of standards represents a significant share of the stock of codified technological knowledge (in addition to the stock of patents), they estimated a macroeconomic production function for Germany and the contribution of the stock of standards to growth.

To summarize all of this work is beyond the scope and aims of this paper.<sup>1</sup> We note, however, that with the exception of many case studies, work focusing on the micro level generally lacks empirical proofs (Swann 2000). Moreover, existing work on the impacts of standards is focused at a very general level and does not take the dynamics of specific industries and sectors into account. Thus, although Blum *et al* (2000) conducted a survey of German companies to collect assessments on various impacts

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<sup>1</sup> For a theoretical overview on approaches regarding impacts of standards refer to Blind (2004)

of standards which differentiated between formal, industry and company standards, their results do not show specific sector impacts (as for example for the ICT industries).

Especially problematical for applying any of these frameworks specifically to assessing the impacts of ICT standardisation is that the situation has been complicated in recent years by a new division of labour. Industry consortia have assumed a major new position in the standardisation landscape (Blind, Gauch 2005; Jakobs, Wallbaum 2005). These consortia agree technical specifications outside of the formal standardisation system (albeit in many cases with links to the formal system). Moreover, their number has increased dramatically from perhaps 40 in 1990 to more than 300 at the present time after a significant decline due to the downswing of the so-called New Economy. Thus, it is conceivable that the range of motivations for standardisation in the ICT industries may have broadened considerably – especially in strategic directions – with inevitable implications for the kinds of impacts stakeholders expect from standards.

This paper aims to explore current stakeholder perceptions concerning the impacts of ICT standards by presenting some of the most significant findings of a recent survey of stakeholders in the standards development process. The overall findings of this study are much more extensive than we can discuss in one paper. Our aim here is to focus upon a selection of findings (many somewhat counterintuitive) that appear especially relevant to understanding how stakeholders perceive the impacts of standards and that may bring into question some of the established assumptions about how and where the impacts of standards occur.

The paper focuses on identifying and characterizing the impacts of ICT standards rather than trying to quantify them as such. This enterprise we refer for future work. Nevertheless, one of the major unresolved problems for assessing standards impacts at micro and meso levels is to determine firstly how these impacts actually are perceived by stakeholders. Our exercise is intended as a positive contribution to defining and refining impact indicators such that they take account of the structures and dynamics of the ICT product and service environment.

The study was based upon an online survey of participants in standards development committees of the European Telecommunications Standards Institute (ETSI), the International Telecommunication Union (ITU) and the European Committee for Standardisation/Information Society Standardisation System (CEN/ISSS).<sup>2</sup> The first two bodies are formal standards development organizations mainly oriented to the telecommunication industries, although their activities now span a broad range of ICT fields. CEN/ISSS is the 'ICT arm' of CEN, comprising both workshops and TC aimed at producing stakeholder 'agreements' about what will require standardisation in rapidly developing ICT markets.

The paper is structured as follows. First, we briefly describe the strategy and structure of the questionnaire. This is followed with a profile of the response we obtained, including the institutional distribution of respondents in the sample. We begin present-

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<sup>2</sup> These surveys were performed within the project NO-REST funded within the IST programme of the 6<sup>th</sup> Framework Programme. See the project homepage [www.no-rest.org](http://www.no-rest.org).

tation of the findings with a look at stakeholder views on the general relationship between formal standards and consortia standards. Then in the main part of the paper we look at stakeholder views about how and where the impacts of standards occur in this environment taking into account the different types of standards (formal, informal and proprietary) as well as variance between institutional sub-samples in the stakeholder group. The paper concludes with a brief assessment of new insights that emerged from the study.

## 2. Questionnaire structure and sample characteristics

The survey instrument was developed out of a comprehensive review of current theory concerning standards with an eye particularly to its impact implications. In other words, from the various currently dominant bodies of theory, we constructed hypotheses as to what kinds of impacts the most commonly referenced theoretical propositions should predict. From this exercise, we constructed a set of 38 hypotheses upon which an extensive questionnaire was modelled.

Table 1: Stakeholder oriented impact categories

<b>Impact category</b>	<b>Predicted impacts of standards</b>
variety of products and services in a company portfolio	standards increase production efficiency by reducing product variety
speed of development for new products and services (i.e. time to market)	standards decrease time to market by creating coordination efficiencies
speed of adoption of newly marketed products and/or services	standards encourage earlier adoption by increasing product information in the market
degree of adoption of new products (i.e. customers per new product)	standards enable critical market mass to emerge more quickly
on design costs for new products and/or services	standards reduce design costs by making component evaluation and coordination more efficient
on production costs for new products and/or services	standards reduce production costs by increasing procurement efficiency
facilitating market entry of new component suppliers	standards lower the cost of market entry, thus increasing the number of suppliers
on component prices in the supply chain	by encouraging market entry, standards place downward pressures on component prices
outsourcing opportunities	more production inputs will be outsourced

easing world-wide procurement	international sourcing of components and services will increase
globalizing the R&D process	R&D will be distributed internationally
globalizing the production process	more production will be transferred to lowest cost producers
quality of procured components	standards will improve production processes and quality assessment
market share of dominant companies	market share will be distributed among more companies
turnover	standards will increase the flow of goods and services
export sales	standards reduce information asymmetries across national boundaries
profitability	standards lower production and coordination costs, raising profit margins

This paper presents findings related only to those questions that directly or indirectly solicited stakeholder views about the nature, extent and location of impacts from standards. Accordingly, the questions upon which this paper is based were associated firstly with the new division of labour in ICT standardisation and thus with the different types of standards that pertain to ICT, and secondly with stakeholder-level experience concerning where and to what extent impacts from standards were observed.

As many of the hypotheses were relevant in several impact contexts, or indeed complemented and reinforced one another, we incorporated them into 'statements' or 'scenarios' to which respondents were asked to indicate degrees of agreement or disagreement. Especially with respect to exploring stakeholder views about the nature, location and relative significance of standards impacts, several key hypotheses were embodied in a set of seventeen impact categories. An indication of the hypothetical basis of these categories is given in Table 1.

Respondents were asked first to indicate what they viewed the general impacts of standards to be, and then again to indicate the impacts of specific standards that they themselves were involved in developing or applying. All of the questions were oriented to impacts at the *firm and/or industry* levels. We did not include questions about macroeconomic impacts or about impacts outside of the ICT industries under the assumption that we could not expect stakeholders active in standardisation to be able to assess these types of impacts.

The main part of the questionnaire focused on the qualitative assessment of impacts relevant to these categories. In order to take the different types of standards into account, the survey differentiated between

- *formal standards* released by CEN/ISSS, CEN, CENELEC, ITU, ISO, IEC, UN-ECE, ARIB, ATIS, CCSA, TIA, TTA, TTC and national standardisation bodies,<sup>3</sup>
- *informal standards* as developed in consortia (i.e. IETF, W3C, OASIS, IEEE<sup>4</sup> etc.) and
- *proprietary standards* like Microsoft Windows.

Respondents were asked to assess impacts on a 5-point (-2 to +2) Likert scale ranging from very negative (i.e. no impacts at all) to very positive (i.e. highest impact).<sup>5</sup>

Apart from these core questions, the survey also solicited stakeholder views on evolution in the standards development process – specifically concerning the relationship between formal and informal development processes. For calibration purposes, the survey collected anonymous general information on the institutional affiliation of the respondent – e.g. the type of company with which they were affiliated, generic product and business groupings, standards participation profile and so forth.

The target group of the survey included stakeholders with a bias in the conventional ICT supply sectors (represented by participants in ETSI and ITU standards committees), and also stakeholders who are more active in specific application areas (represented by CEN/ISSS participants). As the companies and organizations represented by our respondents are known to be active also in consortia and as few current formal ICT standardisation initiatives do not involve interaction with the informal environment in some respect, we made the assumption that the stakeholders we surveyed were cognizant also of consortia activity.<sup>6</sup>

However, we did not assume that individual respondents from each institutional grouping were also participants in the other groupings (although in some cases they may have been). We assumed nevertheless that CEN/ISSS, which is an initiative to explore early stage standardisation requirements in specific application environments (i.e. not at the infrastructural level), was more likely to involve participants who may not be active in either the ITU or ETSI. In all cases, however, as the subject areas being explored in each of the organizations were different (although sometimes complementary), we assumed that respondents from each institutional grouping were

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<sup>3</sup> The respondents were asked to assess both formal standards as developed by the committees in which they participated and other formal standards released by other formal standardisation bodies.

<sup>4</sup> We categorise IEEE as consortia, whereas other authors perceive IEEE as formal standardisation body, because it is accredited by ANSI.

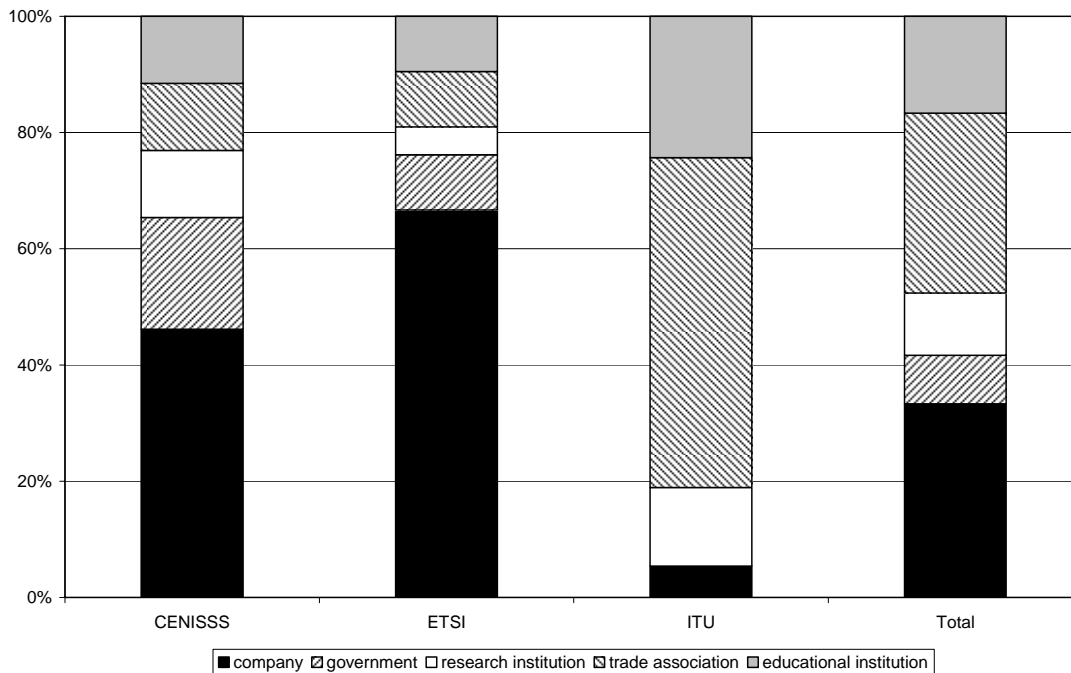
<sup>5</sup> Only the endpoints of the scales were provided. Based on insights of survey methodology, we therefore can assume that the distances between the categories are equal to allow for calculation of means and other measures.

<sup>6</sup> That stakeholders are active in consortia as well as formal standardisation bodies can be established empirically by comparing the membership lists of key consortia with committee participation lists of the standards bodies. The relationship is verifiable also by the high incidence of cross-citation in the respective work plans and outputs of both consortia and standards bodies.

commenting on the basis of standards developed or administered by the institutions under whose auspices they responded to the survey.

The survey was placed on-line between February and November 2005. Distribution was facilitated by the cooperation of ETSI, the ITU and CEN/ISSS. Potential respondents were approached first via a general invitation to participate that was placed in digital newsletters published by these organizations. Links directed interested respondents to a detailed statement of the objectives of the study and to the on-line survey instrument. As the response rate from this first approach was rather low, potential participants whose contact details could be identified from publicly available information or committee membership directories (as was the case of ITU and some ETSI members) were approached via a personalised e-mail. The response rate from this second approach was high enough (about 10%) to permit meaningful analysis of the data at a descriptive level.

Presentation of the main results of the survey is based on 104 responses (ETSI: 26; CEN/ISSS: 33; ITU: 45). This allows descriptive statistics and correlation analysis, but no sophisticated multivariate regression analysis. The responses by affiliation show an especially wide variety of stakeholders involved in standardisation activities (see Figure 1), including companies, governmental organisations, research institutes and educational institutions (i.e. universities). All of these institutions are involved actively in standardisation processes in the three standards development organizations. The main difference is that ETSI and CEN/ISSS respondents were situated predominantly in companies, whereas in the ITU case most of the responses came from representatives of industry associations. To an extent, this difference can be explained by the different membership characteristics of these bodies. However, given the now much greater incidence of interaction between standards initiatives in different organizations, we tend to view the average distribution ('total' in Figure 1) as a reasonably definitive of the stakeholder composition of a typical ICT standardisation initiative.

**Figure 1: Composition of the sample (by primary institutional affiliation)**

Source: Fraunhofer ISI NO-REST Survey 2005

### 3. Opinions on the relation between formal and informal standardisation activity

Given the new distribution of labour in ICT standardisation, our first order of business was to determine some general stakeholder perceptions about the dynamics of this complex regime. Figure 2 indicates some general stakeholder opinions on the current relationship between formal standardisation (as carried out in ITU, ETSI, CEN, CENELEC, ISO, IEC and in various national standardisation bodies) and the development of informal standards as carried out in various consortia (i.e. IETF, W3C, OASIS etc.).

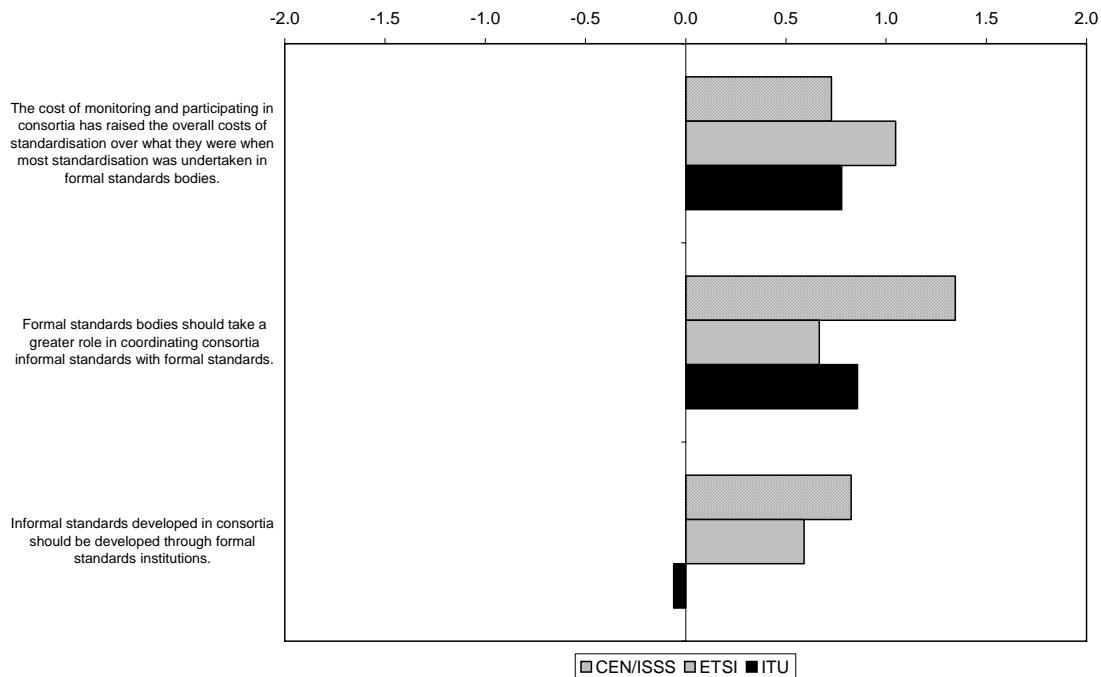
The conventional wisdom regarding consortia is that they arose in response to the inability of formal standards bodies to respond quickly enough to ever shorter time-to-market schedules and that the 'streamlined' development process in consortia would yield cost savings over formal standardisation processes. However, as shown in Figure 2, our respondents across all three organisations overwhelmingly were of the opinion that the consortia phenomenon actually had increased standardisation costs.

Strong positive responses to scenarios proposing a stronger role for formal bodies in the standardisation system imply strongly that such cost savings as may be realized in individual consortia may be wiped out by higher coordination costs associated with the proliferation of consortia. Stakeholders advocated a stronger role for formal standardisation bodies in coordinating informal standards with formal standards. This would seem to be especially true for CEN/ISSS participants whose main purpose is to define emerging standardisation requirements – essentially acting as a link be-



tween the consortia and the formal standardisation system. The majority of CEN/ISSS and ETSI respondents were of the opinion that at least a significant portion of informal standards currently being developed in consortia should be developed through formal standards institutions. The ITU respondents alone were ambivalent regarding this option, which probably can be explained by the rather different composition of the ITU sample (see Figure 1).

**Figure 2: Stakeholder views on the new division of labour between formal and informal standards organizations**



Source: Fraunhofer ISI NO-REST Survey 2005 (-2 = strong disagreement to +2 = strong agreement)

## 4. Assessments of the impacts of standards

In this section, we turn our attention to outlining stakeholder assessments of where the impacts of standards occur and what the nature of these impacts might be. We first discuss the impacts of standards differentiated only according to the type of standard involved – i.e. formal, informal or proprietary. This discussion begins with the impacts specifically of formal standards (i.e. those having more continuity with the traditional division of labour in standardisation) and concludes with a discussion of all three types of standards within the context of the new division of labour. We then take a second look at these impact dimensions, taking into account the different institutional settings in which the stakeholders in our sample develop standards.

### 4.1 The impacts of standards according to type

#### 4.1.1 The impacts of formal standards

Figure 3 indicates respondent rankings of the relative significance of our seventeen impact categories for formal ICT standards. Respondents rated all impact categories

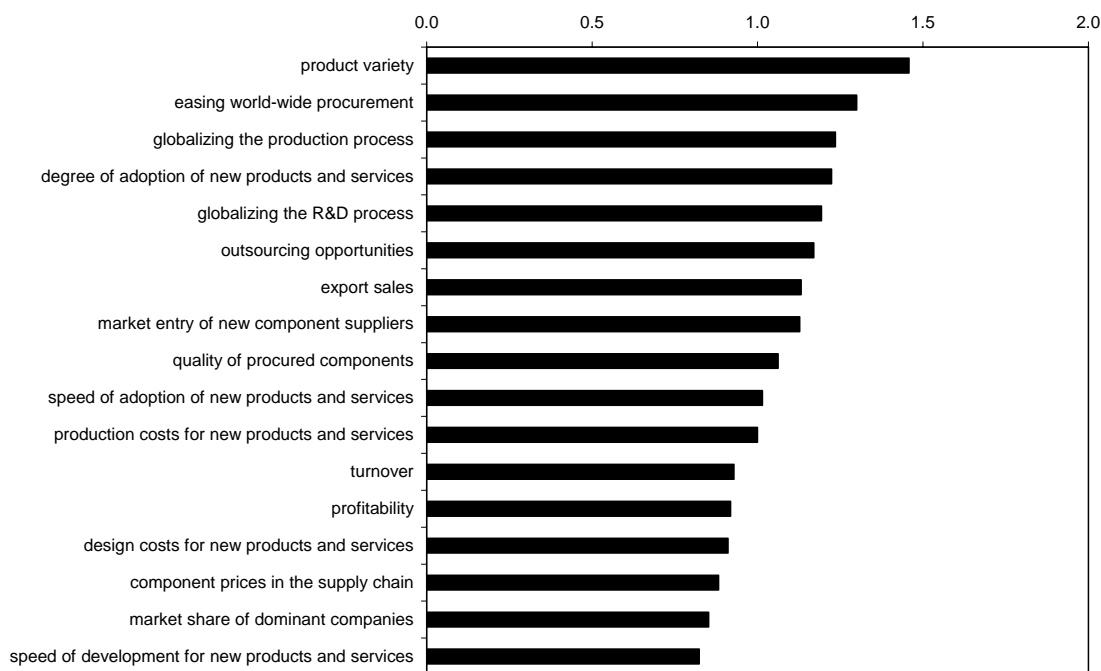
positively (i.e. they noted that in their experience impacts occurred in all of them), but some categories were rated more positively than others. The rankings indicate three more-or-less coherent impact clusters, some of the categories obviously being relevant in more than one cluster. In order of overall strength, these are:

- impacts on the development and combination of products and services
- impacts on global industry structures and markets
- general economic impacts at the firm and industry level.

We interpreted rankings of +1.0 and above to indicate impact categories in which stakeholders observed significant to very significant impacts. Ten of our seventeen impact categories were ranked between +1.0 and +1.5 by respondents, all of them related to the first two clusters. Although most of the prevailing theory about the benefits of standards at micro and meso-levels is oriented to general economic effects on prices and costs, stakeholders identified these factors to be of least significance.

The highest ranking cluster overall is that revolving around products and services, both in terms of how formal standards impact product and service characteristics and in terms of how standards impact the processes by which these products and services are produced, combined and marketed. The impact categories that are most relevant to this cluster include product variety, the degree and speed of new product and service adoption, outsourcing opportunities and the quality of procured components. Most of these were identified as being the arenas in which standards had significant to very significant positive impacts.

**Figure 3: Stakeholder ranking of general impact categories for formal standards**



Source: Fraunhofer ISI NO-REST Survey 2005 (-2 = very negative to +2 = very positive)

Most obviously, and seemingly contrary to the accepted theory, stakeholders indicated strongly that ICT standards actually *increase* variety in the product and service portfolios of ICT firms. There are several possible explanations for this apparent discrepancy. The effect may be due simply to the characteristics of ICT systems and applications which typically are made up of components from different manufacturers, many of which are subject to frequent upgrading or replacement. Where standards exist, components or services from different suppliers can be combined or replaced more easily, which can lead to a condition of more choice in the market. Also, standards may make the division of labour within the value chain easier. If specific parts of the value chain can be provided by different companies, variations in the end product or final service can be expected to increase. The strong stakeholder indication of impacts in terms of more outsourcing opportunities reinforces this interpretation, bolstered by apparent confidence that standards increase the quality of procured components. Another explanation is that platform standards, like the GSM mobile communication standard, provide the basis for numerous value-added applications and services, which again increases product and service variety.

All of these factors likely contribute also to impacts noted by stakeholders in terms of the degree and speed of new product and service adoption. It is of interest nevertheless that stakeholders did not perceive formal standards to have as much of an impact on the speed of product *development* as they do on the degree and speed of *adoption*, indicating perhaps that the primary impacts of standards occur in the application environment rather than further upstream in the R&D phase.

The second impact cluster revolves around industry and market structures, particularly concerning the issue of globalisation. According to our respondents, international standards have impacts not only upon the ability of firms to procure ICT goods on a world-wide basis and thus to boost export performance (clearly related also to new outsourcing opportunities), but also upon the world-wide distribution of R&D and production processes. Furthermore, although formal standards are related positively by stakeholders to creating favourable conditions for market entry by new suppliers, they were noted nevertheless also to have a slight impact in terms of maintaining or perhaps even slightly increasing the market share of dominant firms. This may indicate that new entrants are concentrated in various new niche markets, adding further ambivalence to claims that standards act to level the playing field for new entrants.

The impact dimensions with the lowest scores all fall into the cluster of general impacts on costs, prices, turnover and profitability. Here respondents told us that ICT standards have only a modest impact on component prices and product development costs and likewise modest impacts in terms of turnover and profitability. According to stakeholders, the cost-reducing effects of standards on components as gained by exploiting economies of scale are limited, which may explain also that they are not very effective in increasing turnovers or profits via cost reduction. On the other hand, the rather lukewarm indications of impacts regarding these economic factors may simply indicate that standards are only one of many factors that may lead to growth at the firm level, and perhaps a more ambient factor than often supposed.

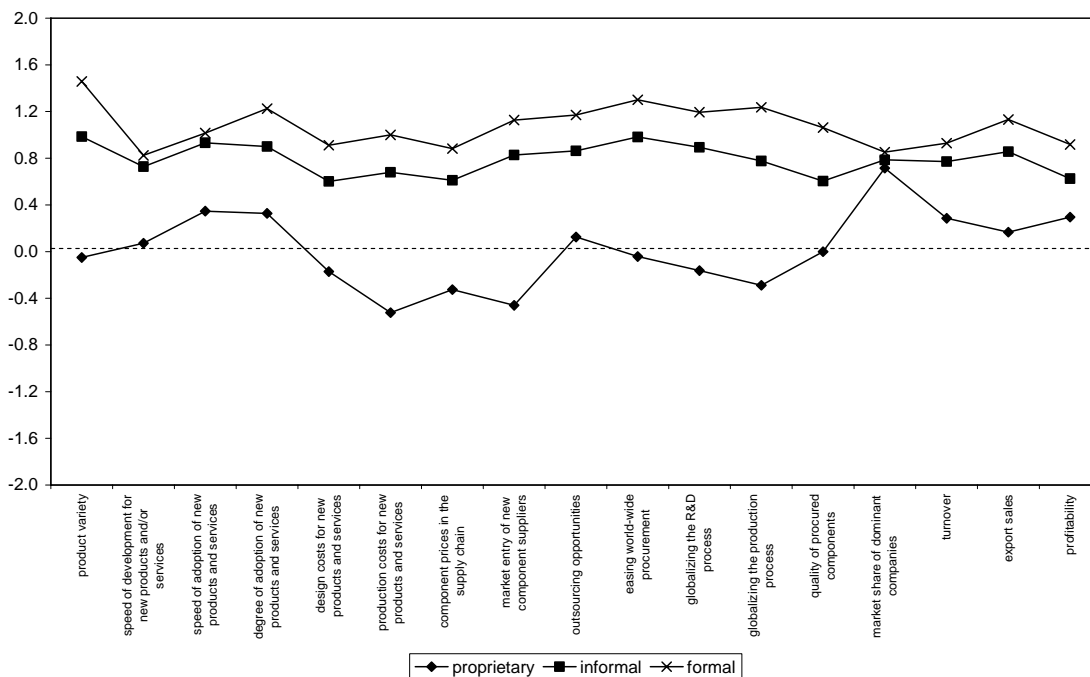
Certainly the primary sources of impacts would appear to reside at the industry-wide level; in other words not where firms have to compete, but where they see advan-

tages in cooperating. This is entirely consonant with the general thrust of most basic theory about why firms decide to develop formal standards, but dissonant with expectations often expressed at the policy level that individual firms may gain strategic advantages (which normally are measured in terms of profitability and market share) by participating in formal standards development.

#### 4.1.2 Impacts of standards within the new division of labour

The new division of labour involving both informal and proprietary standards adds a different dimension to the longstanding debate about the relationship between formal standards and those selected by the market. In some ways, consortia activities provide a link or perhaps a buffer between formal and proprietary strategies, but in other cases they can compete directly with formal standards bodies for the attention and resources of stakeholders.

**Figure 4: Comparison of stakeholder impact attributions between formal, consortia and proprietary standards**



Source: Fraunhofer ISI NO-REST Survey 2005 (-2 = very negative to +2 = very positive)

Figure 4 illustrates some of the possible dynamics by comparing stakeholder impact rankings of formal standards with the impacts of informal and proprietary standards. Most obviously, our stakeholders considered generally that formal and informal standards have highest overall positive impacts in all categories whereas proprietary standards yield generally low positive impacts in only a few areas along with many negative impacts. To some extent, the especially low ranking for proprietary standards can be explained by the fact that all respondents were participants in committees that were active in developing alternatives to proprietary standards. However, as many of the firms and organizations represented by a majority of respondents are known also to promote proprietary standards in various application areas, we tend to

interpret the ranking as given. We cannot assume, for example, that because some proprietors receive advantages from maintaining control over key standards that all proprietors receive similar advantages.

On the whole, assessment of the impacts of formal and consortium standards is rather similar in structure. This may be caused by the often very similar rules and processes of consortia and formal standardisation bodies and/or by strengthening linkages between the two. But it may indicate also that in many areas there are no longer any general preferences for formal or informal standards; that the choice of which standardization approach to pursue is determined more by individual application contexts or perhaps by the relative maturity of different ICT markets.

Nevertheless, discrete factors may influence some of the more notably wider spreads between formal and informal standards. For example, the differences regarding impact on product variety might be explained by the fact that payment of license fees to owners of "essential patents" in formal standards is subject to fair, reasonable and non-discriminatory (FRAND) conditions that may be preferable for patent-intensive technology providers in contrast to royalty-free conditions and for small and less patent-intensive companies and users in contrast to discriminating profit-maximizing royalty schemes of cartel-like consortia. However, several consortia have also implemented FRAND and even royalty-free schemes. That formal standards also have a higher impact regarding the globalization of production may reflect a positive reputation effect for formal ICT standards in global markets.

It is noteworthy however that the most strongly negative impacts that were noted in any of the categories concerned proprietary standards. The variance per category in positive and negative stakeholder evaluations was greatest by far concerning standards of this type. Proprietary standards were ranked as having overall (if not extreme) negative effects in nine of our seventeen impact categories and only minimal positive impacts in all but one of the other categories.

The point of greatest convergence between the three types of standards concerned the market share of dominant companies, where respondents appear to concur that no type of standard exerts enough influence to alter the market share of an established company, one way or the other, to any significant extent. It should be remembered in this respect that dominant firms in the ICT marketplace are also the most active participants in standardisation of all types in all of the institutions represented in this study.

Interestingly, the most negative impacts of proprietary standards were noted to occur mainly in the cluster of impacts revolving around costs, prices and sales. Formal and informal standards were noted above to have minimal but positive impacts in this cluster. But particularly in areas like production and component costs, globalization of production and market entry for new suppliers, proprietary standards were deemed to have significant negative effects. Respecting these particular categories, stakeholders would appear to have a clear preference for any type of formal or informal standard over any form of proprietary standard.

## **4.2 Impacts seen from different institutional perspectives**

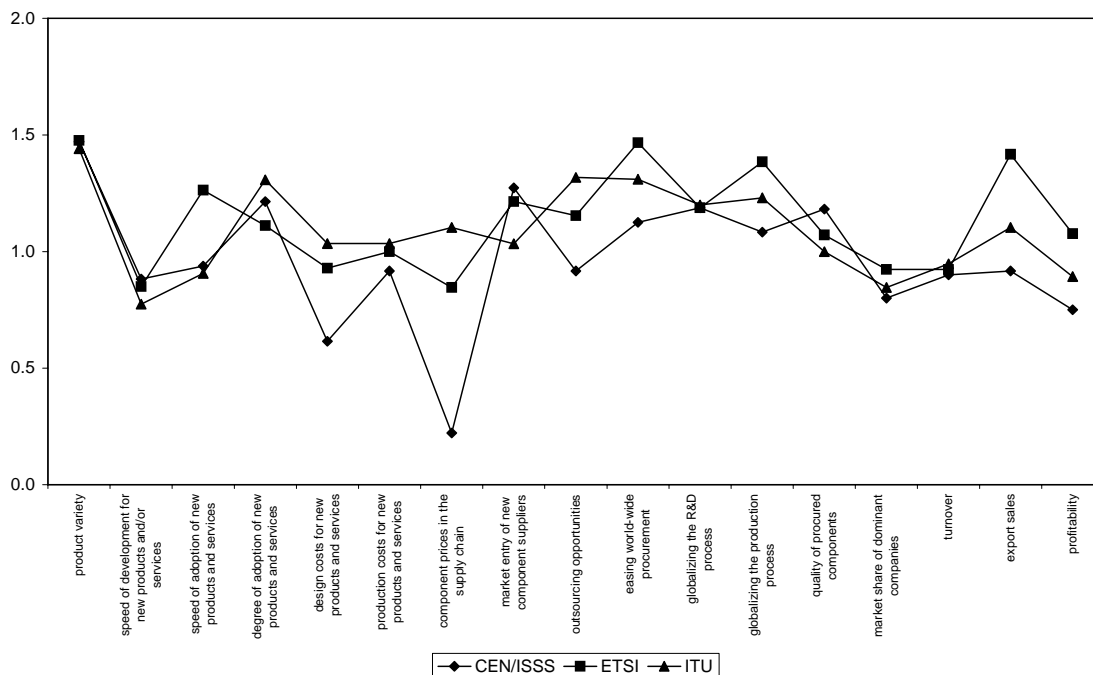
Our survey was administered to stakeholders in three different institutions, each with different histories, rules and, to some extent, objectives. For example, CEN/ISSS is

more exploratory and application oriented than either ETSI or the ITU, but ETSI also has a specific functional role in the harmonisation of ICT markets in the European Union. Our survey instrument allowed us also to detect possible differences between the impacts of standards for the different standardisation institutions, especially regarding the differences between the two telecommunication-oriented organisations and CEN/ISSS, which is more actively involved in specific application areas.

Figure 5, indicates stakeholder assessments of formal standards differentiated according to the particular standards development organisations in which respondents were active. In this case, however, we find no consistent or systematic differences in the three sub-samples, although respondents within the standardisation orbits of ETSI and the ITU ascribe a slightly more positive role to formal standards than do respondents in the CEN/ISSS orbit.

The area of strongest convergence concerns product and service variety, the particulars of which have been discussed already. That only the ETSI and ITU communities perceive any beneficial impacts from standards on design costs and component prices may simply confirm that such reductions are more significant in designing and constructing large infrastructures. They may be much less significant for the firms active in the kinds of specific application areas encompassed in the CEN/ISSS orbit.

**Figure 5: Comparison of the impacts of formal standards differentiated by the institutional affiliation of respondents**

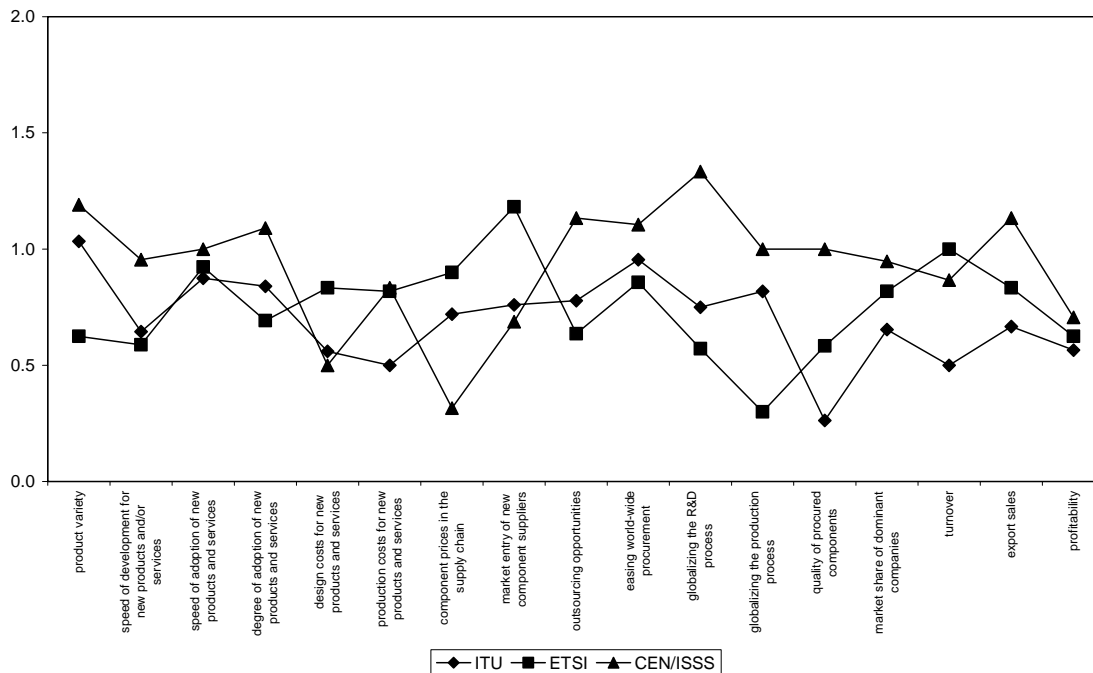


Source: Fraunhofer ISI NO-REST Survey 2005 (-2 = very negative to 2 = very positive)

Much more interesting are the differences between the three communities specifically regarding the assessment of informal consortia standards. As shown in Figure 6, we find in this case that the CEN/ISSS community attributes significant positive impacts to informal standards in many more categories than do either the ETSI or ITU com-

munities. We might conclude from this finding that consortia standards are more relevant in application contexts than in hardware-related infrastructural contexts and this would be supported by an examination of the work areas for many consortia which certainly are predominantly oriented to applications. Furthermore, ITU is the longest-standing SDO by far and still influenced by the traditional strong role of the former telecommunication monopolists.

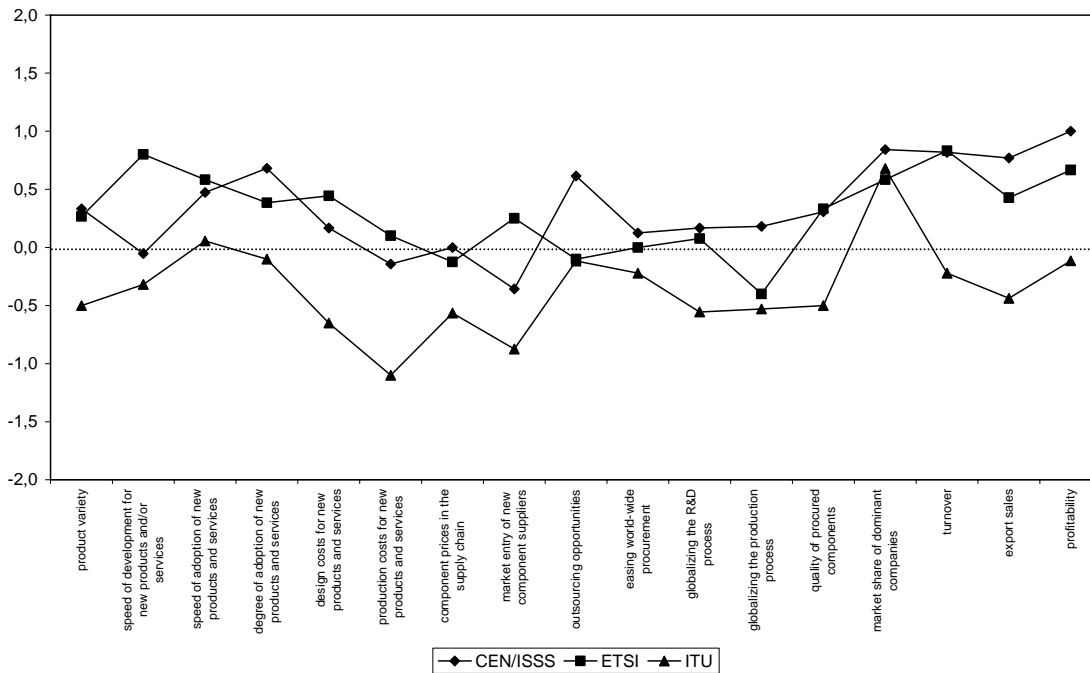
**Figure 6: Comparison of impacts of informal standards differentiated by the institutional affiliation of respondents**



Source: Fraunhofer ISI NO-REST Survey 2005 (-2 = very negative to 2 = very positive)

However, the specific impact categories highlighted by the CEN/ISSS community are likely relevant also. The CEN/ISSS sub-sample perceives impacts from informal standards much more strongly in areas like the degree of new product adoption (i.e. critical mass issues) and on issues related to the globalisation of product and services environments – procurement, outsourcing, production, exports and in particular the globalisation of R&D. This global dimension, especially concerning R&D, turned out to be much more significant for the CEN/ISSS group than it was for any of the others, who indeed did not perceive the impacts of informal standards to be significant at all in these categories. There are several possible explanations for this variance, but the most likely would be that the ITU and ETSI communities are focussed more on infrastructure, which has already an inherent global dimension and in which regard informal standards are less significant. The CEN/ISSS community, on the other hand, clearly regards informal rather than formal standards as having the largest impact in terms of building international product and service markets.

**Figure 7: Comparison of impacts of proprietary standards differentiated by the institutional affiliation of respondents**



Source: Fraunhofer ISI NO-REST Survey 2005 (-2 = very negative to 2 = very positive)

Divergence between the CEN/ISSS, ETSI and ITU communities is even stronger regarding their assessment of proprietary standards. Figure 7 shows that the CEN/ISSS and ETSI communities, although generally lukewarm about proprietary standards overall, are significantly more positive about them than the ITU community in almost all impact dimensions. The ITU community views proprietary standards as the source of especially negative impacts in terms of production costs and market entry. The ETSI community considers that proprietary standards have a slight but positive impact on the speed of development for new products, a view not shared by CEN/ISSS participants. On the other hand, the CEN/ISSS community has a more positive view of the impacts of proprietary standards on outsourcing opportunities.

Overall, however, as none of the impact attributions concerning proprietary standards is significantly positive, the general message we take from Figure 7 is that none of these communities advocates proprietary standards in any situation where standards are required. It is of particular interest nevertheless that as with formal and informal standards, proprietary standards likewise are considered not to have significant impacts on market concentration by any of the sub-samples.

## 5. Summary and conclusions

The thrust of much prevailing theory about formal standards focuses on the economic effects of standards at firm and industry levels – especially cost savings and production efficiency. However, our stakeholder respondents observed that the most significant impacts of ICT standards were seen to occur at much more upstream levels: in product development and in coordinating the structure of industries and mar-



kets. ICT standards were seen to have minimal impacts on procurement and production costs or on turnover and profitability.

Somewhat counter-intuitively, formal standards were seen actually to increase product variety by facilitating a greater number of value-added combinations. However, confirming prevailing theory, formal standards appear to have their greatest impacts at *downstream* application levels. Formal standards were seen to have major positive impacts on the globalization of markets and on market entry, but no overall impact in terms of changing market structure. Contrary to claims that standards level the competitive playing field, stakeholders perceived that formal standards may even increase the market share of dominant firms.

Regarding standardisation under the new division of labour, informal standards were seen to display similar impact patterns to those of formal standards. The criteria for selecting either environment for standards development would appear to be contextual rather than procedural; based upon the market characteristics and perhaps by the maturity of the technology, rather than by any determination of the relative costs or efficiency of developing formal or informal standards.

On the other hand, proprietary standards were regarded overwhelmingly in a negative light. On the whole, stakeholders expressed a clear preference for virtually any formal or informal standard over any proprietary standard. Moreover, we detected an emerging preference that a greater share of standardisation activity be undertaken in formal bodies.

Looking at impacts from within different institutional orbits, the stakeholder view of formal standards showed no particular variance according to the primary institutional affiliation of the respondent. All stakeholders confirmed that the main impacts were connected with product and market criteria, although respondents from ETSI and ITU committees (strongly oriented to the public telecommunication network) perceived a greater impact upon design costs and component prices than did respondents whose main areas of activity do not relate directly to large infrastructures.

Differences in impact perceptions according to institutional perspectives showed up most prominently concerning the impacts of informal and proprietary standards. Perhaps consistent with their applications focus, the CEN/ISSS group perceived the impacts of informal standards to be generally more positive in more areas than did the ETSI/ITU group. Also, they saw the impacts of informal standards more in terms of *upstream* effects connected with globalization of R&D functions and creating critical market mass around new products and services. Also, although the overall assessment of proprietary standards by all groups is negative, the CEN/ISSS group viewed proprietary standards as also having positive impacts on outsourcing opportunities.

We conclude overall that that the strategic impacts of standards are more positive than the traditionally assumed cost or price impacts based on the exploitation of economies of scale. On the supply side, ICT standards are important for structuring relationships by facilitating world-wide procurement, outsourcing, production and even R&D. This is certainly positive for product and service variety. In contrast, the relevance of the traditional argument of the cost-reducing effects of standards is rather low and therefore also the related impact on the profitability and on the turnover of companies.

The results of our study indicate that what are generally referred to in the literature as impacts or effects of standards do not necessarily reflect the subjective evaluations of stakeholders as to which impacts are the most strategically important and highly valued. Research that takes the impacts of standards as a topic and focuses on strategic aspects of standards must also take into account the micro-motives of organisations (similarly to current research on patents as strategic instruments) and also take into account that there may be differences between the motives to participate in standardisation and the macro-level impacts or effects that standards may have.

Our findings indicate that micro motives do not concern only short-term turnover and profit, but stress also long-term gains from opening new markets. They suggest also that there are grounds to re-examine assumptions that any of the market impacts normally associated with standards in the analytical literature go so far as to encompass market concentration. Also, changes in the institutional landscape of standardisation in the ICT sector represent a challenge both for the theory of standardisation and for the development of adequate methodologies to assess their impacts. Without proper distinctions between these various economic and institutional factors, assumptions about why companies participate in standards may become blurred and produce misguided approaches to impact assessment.

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