Research into standards and standardisation in the field of Information and Communication Technology (ICT) continues to fascinate me, and the collection of papers in this volume may give you an impression why. For one, it is an extremely heterogeneous and multi-disciplinary field. There are papers written by lawyers, political scientists, and social scientists; by mathematicians, computer scientists, information systems people, and engineers. The list could go on for quite a while, but this gives an idea of the breadth of perspectives in this book alone. The breadth is extremely helpful, if not downright necessary, if you want to get an at least reasonably complete picture of what is going on in ICT standards and standardisation research. It also helps you to broaden your own perspective, to take on board tools, methodologies, and approaches from disciplines other than your own. I guess I am a rather good example for that – in an earlier life I was trained to become an electrical engineer, these days I’m entitled to call myself a computer scientist (although I rarely ever do that) and am with a Computer Science department. Yet, the work I’m trying to do could also easily be associated with a department of Social Sciences or of Information Systems. Working in this field definitely helps to avoid tunnel vision.

Of course, there’s no such thing as a free lunch, and the benefits you get from working in such a multi-disciplinary field also come at a price. For one – as those of you who have chosen to at least more or less abandon mono-disciplinarity will have noticed – it is becoming increasingly difficult, for example, to publish your findings or to get funding for your research ideas in the first place. Today, the vast majority of journals have a strong mono-disciplinary focus and an equally focussed Editorial Board. And they will (have to) evaluate your findings accordingly. Sadly, few of us are e.g. excellent enough engineers and competent enough sociologists to publish in journals from both disciplines. Perhaps even worse, judging by my own experiences as well as by stories I’ve heard from others funding for project proposals in standardisation research is very hard to get. I remember a fairly large German proposal in which basically all senior figures with a background and an interest in ICT standardisation research were involved. It was rejected and until today I wonder where on Earth the funding organisation had found competent evaluators.

Be that as it may, and despite all the downsides, ICT standardisation research remains a fascinating field. And unlike the more technical disciplines (where I come from) where the shelf-life of most findings is measured in months rather than years, insights and findings in our field remain valid for quite a while (I quite regularly consult books from the 1980s and 1990s). Likewise, the papers in this book have probably been written in 2009/2010, but remain highly relevant until this day (and will probably stay so for another couple of years).

Yet, this is not to say that the field is static – quite the contrary. Here in Europe, for instance, the European Commission has recently published a Communication’ on a strategic vision for European
standards. If accepted by Parliament and Council it will quite massively change the current situation in a number of respects. Among others, the Communication addresses the aspects of the need for an improved awareness of and education about standards and calls for an increased participation of consumers and other members of what I quite like to call the third estate in standardisation (these aspects are also addressed in Sections 3 and 4 of this book, respectively). What exactly it takes to implement the proposed changes and to meet the requirements laid out in the document is a most interesting topic and will attract researchers’ attention for a while. The same holds for the likely implications to be expected. Specifically, the foreseen use of consortium standards poses the question of how to maintain the contradiction-free European standards system (the issue of competing standards is discussed in Section 2).

The new proposed regulation not least aims to strengthen the role of Europe in the ICT standardisation arena. One of the crucial recent developments there is the increasing importance of the emerging markets of, for example, China, India, and Brazil. Especially China has well understood the importance of standards and the associated Intellectual Property Rights (IPR) and has for a while been strengthening its position in various standards bodies. What the traditional incumbents can do not to lose out and how to mutually beneficially co-operate with the new players are other highly relevant and timely questions (IPR issues are addressed in Section 1).

The policy developments in Europe outlined above are to no small extent based on findings of the research community. This is another benefit of the work we are doing – there is a very realistic chance that its outcome will find its way into policy making, even if it may occasionally take some time.

Yet, in addition to the grand’ topics like IPR and standards battles there a number of perhaps less obvious aspects that frequently escape public and research’s attention. These include, for example, the various external and internal factors that shape the standardisation process in a more, say, informal’ way. My hobby horse – the influence of the individual – would fall into this category. While this specific aspect is only touched upon in this book, two papers of section 5 look at other such shaping factors).

But now over to the papers.

All papers included in this compilation have gone through a thorough review process. My normal policy is to have at least three reviews per paper; quite frequently I’ve got four. I try to assign not just specialists as reviewers to a particular paper, but try to also have a multi-disciplinary review process. That is, I normally try to have at least also one “layperson” review a paper (i.e. someone with a general background in standardisation but from a different background). I have found that this adds another valuable dimension to the review – the average computer scientist, for example, may neither be able nor inclined to check the equations in an economist’s paper, nor may s/he be in a position to check the suitability of the approach chosen. But s/he may well be able to look at, for example, underlying assumptions from another discipline’s point of view and thus highlight potential issues, problems, but also, of course, specific strengths.

I have grouped the papers into six topical fields.

1. IPR issues
2. Competing standards
3. Standards education
4. Consumers in standardisation
5. Shaping factors
6. Standards for Learning Technology

Out of these, five are quite natural choices. Only the Shapers’ heading may be a bit far-fetched; I hope not overly much so.
SECTION 1: IPR ISSUES

The discussion about how to best incorporate IPR into standards and about the ramifications of the different approaches has been high on the agenda for a number of years now. The three papers of this part also address these issues but have one common characteristic – they challenge widely held views and perceptions.

The first paper, *Innovative or Indefensible? An Empirical Assessment of Patenting within Standard Setting*, by Anne Layne-Farrar (Compass LexEcon, USA), starts off with the observation that co-operative standard setting frequently suffers from over patenting. It discusses problems and issues many claim to be associated with a specific form of what may be called strategic patenting – ex-post patenting. This occurs once the first versions of a standard have been published. Concerns have been raised over this form of patenting as it allegedly only serves to acquire or increase market power, without actually contributing anything to the value of the associated standard. In contrast, the author argues that also such ex-post patenting may be driven by genuine innovation. To try and answer the question which form can be observed more frequently, she analyses the case of UMTS (Universal Mobile Telecommunications System). She shows that around 91% of US patents and around 82% of EPO patents were filed before 2002, i.e. prior to the commercialisation period of UMTS. The analysis suggests that a vast majority (up to 70% - 80%) of the remaining patents – that have been applied for ex-post – represent at least incremental innovations and, therefore, contribute value to the standard. Accordingly, the claim that ex-post patenting is entirely driven by strategic motives has to be rejected.

The second paper was written by Anne Layne-Farrar (Compass LexEcon, USA) and A. Jorge Padilla (LECG, UK), and is entitled *Assessing the Link between Standards and Patents*. It has a closer look at the question whether or not its inclusion in a standard has an effect a patent’s importance? This is done against the background of policy makers, courts, and academics having expressed concerns about the increasing importance a patent acquires once it has been incorporated into a standard, and about the resulting significantly increased market power of the patent holder that can be abused if and when the standard is commercialised. The authors’ findings suggest that a patent does not necessarily increase in value because of its inclusion in a standard. If it does, frequently the value gain is very small. Especially the values of those patents that cover a highly valuable innovation do not gain much through standards, as they are valuable in any case. Moreover, the authors find that patents included in a patent pool tend to be less important than otherwise comparable patents. The authors rely on proxies to capture a patent’s importance or value.

The third paper of this section is *Interpreting and Enforcing the Voluntary FRAND Commitment*, by Roger G. Brooks (Cravath, Swaine & Moore, USA) and Damien Geradin (Tilburg University, The Netherlands). It discusses one of the currently most contentious issues in ICT standardisation research, i.e. the legally precise meaning of a commitment by the holder of patents essential’ for a standard to license such patents on fair, reasonable, and non-discriminatory (FRAND) terms and conditions. The authors argue that any FRAND agreement is a private contract between a patent-holder and a standards body, and that a FRAND commitment on the one hand and the limitations that competition law may impose on IPRs on the other are two separate things each of which needs to be considered in its own right. Accordingly, any attempts to e.g. cap royalties or to apply certain algorithms to calculate maximum acceptable royalties are without basis. Nonetheless, the authors review how courts can enforce a contractual obligation to offer licenses on FRAND terms – consistent with both contract principles and established judicial method – without becoming IPR price regulators.
SECTION 2: COMPETING STANDARDS

Standards wars or battles have attracted researchers’ attention for quite a while now. Probably the most popular case is the competition between VHS and BetaMax standards for Video Cassette Recording systems, which is still frequently cited today (not least by both papers in this section).

In the paper *The Standards War between ODF and OOXML: Does Competition between Overlapping ISO Standards Lead to Innovation?*, Tineke M. Egyedi (Delft University of Technology, The Netherlands) and Aad Koppenhol (Sun Microsystems, The Netherlands) argue against the belief that competition between de-jure standards (i.e. those negotiated inside a committee) stimulates innovation and benefits consumers because it drives down the costs of products as competition between de-facto standards (i.e. proprietary ones owned by a company) does. Using the example of the two ISO standards on document formats – ODF and OOXML – they maintain that competition between two de-jure standards eliminates the advantages of de-jure standardisation. They claim such competition to result in a non-transparent market, raise transaction costs, and hamper interoperability. They observe that the objective of ODF, the first of the two competing standards, was to ease interoperability between different office suites, increase supplier independence, and improve accessibility and digital sustainability of documents. The approval of OOXML, the second standard (originally developed by Microsoft), is said to not add extra value. Rather, they say, it will hinder innovation and impede supplier-independent information exchange between government and citizens.

The second paper of this section is entitled *The Battle Within: An Analysis of Internal Fragmentation in Networked Technologies Based on a Comparison of the DVB-H and T-DMB Mobile Digital Multimedia Broadcasting Standards*, and was written by Håkon Ursin Steen (University of Oslo, Norway). The author argues that having a standard is not a guarantee for interoperability. Rather, it is just a step in this direction. One major reason for this is the possibility of what he calls internal standards fragmentation. This may happen in two ways – configurational fragmentation will occur if a standard is not 100% non-ambiguous; for instance, it may offer some flexibility through e.g. functional options. This way, two implementations may be fully standard-compliant, but not interoperable. Competitive fragmentation may occur if a vendor or service provider enhances’ a standard, thus locking-in customers. A case study of the DVB-H and T-DMB mobile digital multimedia broadcasting standards is used to highlight both variations of internal fragmentation. The author argues that this form of fragmentation has the potential to undermine the effects of interoperability and economies of scale expected to follow from the adoption of a single standard. He discusses the implications of this observation for research, policy, and practice are discussed, and offers advice for further research.

SECTION 3: STANDARDS EDUCATION

Education about standardisation has become a fairly hot topic. Especially standards bodies, including among others ISO, the ESOs (CEN/CENELEC and ETSI), and IEEE have developed in interest in the field and have launched numerous initiatives, from a repository of teaching material to model curricula to an eZine on standards education.

The papers in this section look at various aspects relating to standards education, from its implementation at a national level to accreditation issues to a practical application to strengthen consumer participation in standardisation.
The first paper, authored by Henk J. de Vries (Erasmus University, The Netherlands) is entitled *Implementing Standardization Education at the National Level*. Looking at the developments in standards education in Korea (the world leader in the field) and the Netherlands, the author shows that any initiatives to implement standards education in a national education system requires policy support at the national level, a long term investment in the support of the initiative, and co-operation between all major stakeholders – industry, standardisation bodies, academia, other educational institutions, and the government. In industry, the lack of awareness of the strategic importance of standards needs to be improved. Along similar lines, the desirable professionalisation of standardisation call for better educated technical officers in the standards bodies. The analogous argument applies to many civil servants, e.g. those who work on innovation or technology policy. Accordingly, especially universities need to incorporate standards education in the technical, business oriented and legal curricula. The barriers to be overcome here include making the topic of standardisation more appealing to students, to stimulate teachers’ willingness to include the topic in their courses, and to raise the awareness of the importance of standardisation education for industry and government representatives. The author outlines ways how these barriers might be overcome.

Focussing on the engineering sector in the US, the paper by Todor Cooklev (Indiana University – Purdue University Fort Wayne, USA) on *The Role of Standards in Engineering Education* looks at the relation between accreditation criteria and education about standards and standardisation. The author argues that the relation between accreditation requirements and engineering, computing, and technology education on the one hand, and standards education on the other is not fully recognised, not even by accreditation bodies and educators. In the US, accreditation requirements on engineering programmes cover both hard skills and soft skills. The author claims that teaching standards is one particularly efficient way to achieve the integration of soft skills and design thinking in the engineering curriculum. He also states that through standards education both the hard skills and the soft skills can be taught at the same time. Specifically, he claims that the education about standards leads to several important benefits, including the motivation to learn in other engineering science courses, an enhanced performance in capstone design courses, a likewise enhanced student interest in engineering, the encouragement and support of collaborative work, and an enhanced design thinking.

**SECTION 4: CONSUMERS IN STANDARDISATION**

Consumers are probably the weakest part of the third-estate in standardisation. From my point of view their participation is not necessary in some cases (discussing the finer technical points of, for example, a new version of the Internet Protocol will be beyond both the technical expertise and the interest of most consumers) but crucially important in others, like in the standardisation of e.g. user interfaces, smart cards, or many aspects of the Internet of Things.

The paper *Where Are You? Consumers’ Associations in Standardization: A Case Study on Switzerland*, by Christophe Hauert (University of Lausanne, Switzerland), is looking for consumers in standards setting. One of their roles would be to increase the legitimacy of a standard; to this end, participation of all stakeholders, including the weakest ones (unions, NGO, consumers’ associations) is crucial. Yet, for consumers the question of their representation is important – individuals will hardly go to the lengths of becoming active members of standards committees. In this article the author explores the evolution of consumer representation in Swiss national mirror committees between 1987 and 2007. It probes the
extent to which their participation is determined by issues supposedly related to consumers’ concerns and by their own use of standards. The empirical findings clearly demonstrate the weakness of consumer representation, resulting from both a lack of material resources and – perhaps especially – their lack of technical expertise. On the other hand, the actual deployment of standards by associations (e.g. for testing and certification) offers a fairly strong incentive for participation.

The paper about *The INTERNORM Project: Bridging Two Worlds of Expert- and Lay-Knowledge in Standardization*, by Jean-Christophe Graz and Christophe Hauert, (University of Lausanne, Switzerland) presents a pilot project that aims to strengthen participatory practices in standardisation by better enabling civil society to take part in this process. To this end, the project creates an interactive knowledge centre that enables sharing of academic skills and experiences accumulated especially by consumer associations, environmental associations, and trade unions to strengthen their respective constituencies’ participation in standardisation. At the same time, it provides a useful research tool to develop a better understanding of the role of these stakeholders in the setting of the technical specifications that govern globalisation. The authors identify three incentives which explain the dynamics of association’s (non-) involvement in standards setting. These include an operational incentive that is related to the use of standards in the product and services provided by associations to their members. A thematic incentive, which is provided by the setting of priorities by strategic committees created in some standardisation organisations, and a rhetorical incentive, related to the discursive resource that civil society concerns offers to stakeholders. These three incentives are illustrated using the case of the consumers association as a precursory civil society association. The paper also shows that lack of technical expertise is not necessarily such an overriding issue,

**SECTION 5: SHAPING FACTORS**

Standards are shaped by a variety of actors and influences. Very subjective aspects like, for instance, preferences and abilities of individual members of a standards committee may play a role, as may highly objective aspects like new technical developments and corporate strategic interests. The first two papers of this section look at the shaping power of government in standards setting, albeit from very different perspectives. In contrast, the third paper analyses the factors that shape the adoption of a standard.

In their paper *Beyond the Point of No Return: Constructing Irreversibility in Decision Making on the Tetra Standard in Dutch Emergency Communication*, Anique Hommels, (Maastricht University, The Netherlands) and Tineke M. Egyedi (Delft University of Technology, The Netherlands) analyse the role of irreversibility in the decision-making process for a standard for the national Dutch emergency communication network. In the 1990s, a decision had to be made between Tetra (standardised by ETS) and Tetrapol (a proprietary system favoured by France) had to be made. The authors show that the official political decision to implement the Tetra-based network was more of a rubber-stamping of the outcome of an innovation process that had grown irreversibly long before. They argue that irreversibility did not occur because of any characteristics of the technology or because of investments of individual actors. Rather, this was a constructed irreversibility, shaped by the actions and interactions of several key governmental actors. For one, reports, correspondence, and actions of Dutch government officials revealed a strong commitment to Tetra and to the idea of a common European standard from the early 1990s onwards. Moreover, strong personal commitment of the Dutch officials further contributed to the attractiveness of Tetra. The authors provide arguments pro and con irreversibility in their case. Sticking
to a choice even if the subsequent implementation may be problematic. Moreover, an early irreversibility of large scale projects may undermine the democratic nature of the underlying political decision process. On the other hand, path dependence may also create new possibilities. In this case, the persistence of some key players led to the eventual nationwide implementation.

In the above paper government referred to the role of individual civil servants. In the paper *The Significance of Government’s Role in Technology Standardization: Two Cases in the Wireless Communications Industry*, by DongBack Seo (University of Groningen, The Netherlands) it actually refers to the *entity government*. The author observes that governments, like companies, can bet on the wrong standard. This paper illustrates the importance of the government’s role in standards setting through two cases: the choices of South Korea and Japan, respectively, for a national technology standard for wireless communications. In the late 1980s, both governments decided to upgrade their respective telephone networks to a 2G standard. However, the largely home-grown Japanese specification PDC was only implemented domestically but never became an international success. Eventually, this lead to the decline of the Japanese wireless communication industry. In contrast, CDMA, the proprietary technology selected by the Korean government subsequently fared very well internationally and gave Korean manufacturers a head start in the wireless handset market. The paper offers two explanations for this outcome – for one, it was known that CDMA was technologically more advanced than PDC. More importantly, CDMA offered a natural migration path to third generation (3G) mobile communication technology.

Rubén A. Mendoza (Saint Joseph’s University, USA) and T. Ravichandran (Rensselaer Polytechnic Institute, USA) are the authors of the paper *An Exploratory Analysis of the Relationship between Organizational and Institutional Factors Shaping the Assimilation of Vertical Standards*. The papers focus on the adoption of vertical standards. Such standards define industry-specific vocabularies for product and service descriptions, operating and interface system parameters, and semantic data definitions for specific industries. Their adoption has generally been treated as a single event indicated by a public announcement of the acquisition or first deployment of these technologies. However, the authors note that wide-scale industry acquisition of new technologies is sometimes followed by sparse deployment within the acquiring firms, resulting in a gap between reported adoption and internal deployment of the technologies. The authors explore the assimilation of vertical standards as a progression from first awareness through complete deployment in production environments in order to reduce the effect of assimilation gaps. They develop scales for 11 constructs based on concepts from different theories such as diffusion of innovations theory, organisational learning theories of technology adoption, institutional theory and network effects theory. An investigation of relationship patterns between the 11 constructs using data cluster analysis shows that a low fit between vertical standards and existing organisational business processes and data formats, low levels of anticipated benefits, and inadequate momentum with critical business partners contribute to slower vertical standards assimilation. However, organisational involvement with influential standards-development organisations, and the right set of technologies, skills, and structures to readily benefit from vertical standards spur their assimilation.

**SECTION 6: STANDARDS FOR LEARNING TECHNOLOGY**

Standards in the Technology-Enhanced Learning (TEL) domain, also denoted as Learning Technology Standards, have over the past decade been the subject of increased attention. As the education and training sector gains importance and technologies are ubiquitous within educational processes, it is natural that these standards are located within the conversation. However, the adoption and deployment of standards
in education is not meeting the expectations of the learning technology standards community, this is in marked contrast to other vertical industries.

What is the current status of development in Learning Technology standardization? What are the main developments and how are these developments adopted, or not, by the TEL-community and what is the future potential of this field? The papers in this section represent an attempt to answer these questions.

The paper *Analysis and Validation of Learning Technology Models, Standards and Specifications: The Reference Model Analysis Grid (RMAG)* by Jan M. Pawlowski and Denis Kozlov (University of Jyväskylä, Finland) addresses how standards, specifications and, more general, reference models can be evaluated and assessed. As there is currently no widely accepted assessment framework, this paper provides an insight into potential categories and criteria for assessment. It should be noted that there will be no one-fits-all framework. The outlined framework provides a basis, to be adapted for the purpose of evaluations and assessments in different contexts.

Is the learning technology domain unique in going through standardisation, or does it differ? This is a crucial question posed by Adam R. Cooper (University of Bolton, UK) in his paper on the *Key Challenges in the Design of Learning Technology Standards: Observations and Proposals*. His observations are compared to a business enterprise; he argues that the workings of the education system as a whole are rather more complicated than other domains. Consequently, you require more than the engineering heritage to deal with the complex challenges presented. Further he argues of the need to account for the inherent complexity of the domain. Therefore, LT standards should be developed to accommodate diversity and change and to be part-of the systemic processes from which learning technology emerges. Both the organisational aspects of standardisation and the technical aspect of how standards are written need to be addressed.

One approach to this challenge is pragmatic *Community-Driven Specifications: XCRI, SWORD, and LEAP2A*, described in the paper by Scott Wilson (University of Bolton, UK). He analyses three UK projects developing specifications independent of the traditional governance processes of either industry consortia or formal standards organisations. From a technical perspective, these specifications there are inspired by open web standards and semantic technologies, rather than repository vertical standardisation. From an organisational point of view, even though they are anchored in specific user communities and nursed by project funding from the educational sector, they are fed into formal standardisation as part of a broader sustainability strategy.

Two of the specifications Wilson explored are related to a new field of interest for ITLET standardisation, areas related to skill and competence. This is the starting point for Simon Grant and Rowin Young (JISC CETIS, UK), entitled *Concepts and Standardization in Areas Relating to Competence*. They offer a common conceptual model to guide the discussion towards the kind of useful specifications and standards that can enable the many real services that may well be demanded in this area. The aim is through collaborative modelling involving educators, trainers, employers, learners, assessors / evaluators, professional bodies, awarders of licenses or certificates, customers / clients, careers advisors, and any other stakeholders to come up with agreed concepts. The advocated approach consistent with the increased diversity in this field is to recognise quite small units of ability, and to be able to build these up in different ways to express the needs of different roles and positions. Grand and Young point to semantic web technology, in particular W3C’s Simple Knowledge Organisation System, SKOS, as an enabler for this kind of standardisation work.

While Grant & Young start where concepts need to be negotiated to gain a clear meaning, the point of departure for Ingo Dahn’ and Sascha Zimmermann’ (University Koblenz-Landau, Germany) paper
Application Profiles and Tailor-Made Conformance Test Systems is where we already have precisely defined and testable concepts, i.e., in mature specifications and standards. They discuss the potential of application profiles and domain profiles as means to adapt technical specifications of data structures to particular needs. Dahn & Zimmerman argue that application profiling may be better suited to increase the take-up of formal specifications than the creation of new specifications. They support their claim by referring to successful examples of conformance test systems for machine-readable application profiles.

Profiling, if not conformance testing, plays an important role in the paper of Jad Najjar (WU Vienna, Austria) et al., proposing a Data Model for Describing and Exchanging Personal Achieved Learning Outcomes (P ALO). This specification is a step towards a common model supporting the exchange of date about knowledge, skills and competencies, to enhance interoperability of personal learning outcome information between, for example, learning management systems, e-portfolios, social applications and recruitment systems. The model builds on the result of a European project that builds on the premises of the European Qualification Framework (EQF), extending and profiling existing standards and specifications as IEEE LOM, IEEE RCD, et cetera.

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ENDNOTES

1 In pre-revolutionary France everyone who was neither clergy nor aristocracy (i.e., about 98% of the people) belonged to the Third Estate. They didn’t have any say at all in state affairs. In standardisation, the ‘Third Estate’ comprises primarily SMEs, users, and consumers.

2 The following is an adaptation of the editorial preface to the special issue ‘Learning Technology Standards’ entitled ‘On the Status of Learning Technology Specifications and Standards’, by Tore Hoel (Oslo University College, Norway), Paul A. Hollins (University of Bolton, UK), and Jan M. Pawlowski (University of Jyväskylä, Finland).