Even today, many still consider Information and Communication Technologies (ICT) standards—and, even more so, standards setting—a necessary evil at best and a downright nuisance at worst. Typically, this is accompanied by the claim that standards represent a barrier to innovation and that they reduce to virtually zero the economic viability of any non-standard yet technically superior solutions. Indeed, the proponents of this view have got a point: standards do reduce variety and may hamper innovation. However, they conveniently ignore the fact that standards also enable innovation. After all, an ICT standard is also a widely agreed platform that provides a level playing field upon which innovations may be built.

Indeed, standards may assume very different roles and be used for equally different tasks. Perhaps most obviously in ICT, they provide for interoperability. This ranges from a simple and mostly technical “plug and matching socket”\(^1\) to the much more complex and still fairly technical interoperability aspects in the field of, say, mobile communication (covering, for example, power levels, frequency bands, communication protocols, encodings, error detection, etc.). Obviously, most ICT would not work without such interoperability standards. Yet, and in some ways much more importantly, standards have a number of non-technical dimensions, too. They:

- **May Create Markets:** Take the GSM\(^2\) standards as an example – without them, digital mobile communication would never have gotten off the ground. The same holds for the TCP/IP standards, the protocols that define the core of the Internet;

- **Are an Important Policy Tool:** Certainly in Europe, where standards have been used extensively to support the creation of a single market. Moreover, standards may be mandated by the European Commission in support of, for example, an industry policy in a certain area;

- **Support Innovation:** While standards are indeed potentially variety-reducing (and thus “innovation-unfriendly”), they also provide a common platform upon which innovations can flourish;

- **May Have Legal Ramifications:** In most countries, this holds primarily for health and safety standards.

This overall economic and policy importance suggests that the money at stake for an individual company may also be substantial, depending on, for instance, whether or not a standard actually materialises and if it has the desired characteristics and features. Obviously, a company can try to influence the process to achieve its goals.

From a firm’s perspective, success in standards setting may well have a significant impact on its economic well-being. This impact may materialise through different channels. For example, a proprietary technology may be “ennobled” by becoming a standard. This, in turn, may imply increased revenues...
due to, for instance, a faster diffusion of the technology. Likewise, a standard enables the emergence of complementing products or services. Alternatively (or additionally), an organisation may capitalise on IPR that has been incorporated into a standard and for which licensing agreements may be made.

The standards working groups in the ICT sector are (almost?) exclusively dominated by the big players – the Ciscos, Intels, Siemens, Ericssons, Huaweis, IBMs (you name them) of this world. Some highly specialised Small and Medium-Sized Enterprises (SMEs) may occasionally also play major roles (oftentimes due to capable and respected representatives). However, things look quite different for “normal” SMEs (i.e. those that mostly just use a technology [as opposed to develop it]). For them, the barriers to standardisation are manifold. For one, the knowledge about the importance of ICT standards is limited. This frequently comes hand in hand with a lack of resources; after all, standards setting is expensive, and without any clearly identified immediate business benefits (as opposed to perhaps less obvious but potentially much more important strategic goals) most SMEs will hesitate to spend serious money on active participation in standards setting.

Standardisation is as much about personalities, diplomacy, negotiation, and in-depth knowledge of the Standards Setting Organisations’ (SSOs’) policies and bylaws as it is about the technical nuts and bolts. Despite the fact that several SSOs (e.g. ISO, CEN) require their WG members to act in a purely personal capacity (as opposed to, for examples, national or company representative), there is ample evidence that this is not always adhered to. That is, WG members do frequently act in the best interest of their respective employer. To do so effectively requires an adequate level of education and training. This may well be assumed as far as the technical aspects are concerned but not necessarily for the more non-technical abilities. The need for the latter is further reinforced through the increasingly important role China has lately been playing in the international standards arena. In general, dealing with peers from different parts of the world requires a fairly high level of knowledge about, and sensitivity for, cultural aspects. Negotiating with, for example, a delegate from a Chinese company may be very different from negotiations with a representative from the US. Here, great oaks from little acorns may grow and insensitive behaviour may well thwart a promising compromise.

The variety of aspects I have touched upon above (and then some) are also reflected in the chapters of this book. Given this diversity of topics, I found it quite hard to come up with an at least semi-meaningful structure. The book is subdivided into five sections:

1. Standardisation and Innovation.
2. Looking at Standards Setting Organisations.
3. Focus on Individual Standards and Sectors.
4. Standardisation and Asia.
5. About People.

**SECTION 1: STANDARDISATION AND INNOVATION**

This section comprises two chapters that look at very different aspects of the very interesting—and at times hotly debated—link between standardisation and innovation.

The chapter “Infrastructural Innovation and Generative Information Infrastructures” was written by Ole Hanseth and Petter Nielsen. Here, “generativity” denotes a technology’s overall capacity to produce unprompted change driven by large, varied, and uncoordinated audiences. As such, it is a function of
a technology’s capacity for leverage across a range of tasks, adaptability to a range of different tasks, ease of mastery, and accessibility. By applying this concept, this chapter aims to disclose and to better understand the success and failure of attempts to create the Mobile Internet (as opposed to the “traditional” Internet). It shows that the move from closed (proprietary) mobile infrastructures to more open ones considerably increased the speed and range of innovations. However, it also shows how powerful players’ strategies may create barriers to innovation. To overcome such barriers, the chapter concludes that in order to enable more innovations in the realm of the Mobile Internet the programmability of the terminals needs to be improved.

The notion of “responsible innovation” has become increasingly popular. The underlying idea is that innovation should also consider the ethical and social aspects of new technology from the design phase onwards. Standardisation may well be considered part of a technology’s design phase. Accordingly, in the second chapter, “Responsible Innovation and Standard Selection,” Geerten van de Kaa looks at the process of “standard selection” (i.e. how and why a certain standard eventually reaches dominance). He identifies three dimensions of standard selection: socio-political acceptance, market dominance, and acceptability. In line with the responsible innovation approach, he argues that not just economic aspects (“market dominance”) should be considered when studying standard selection. Rather, ethical and consumer values should also be considered, as should functional ones. They will lead to a higher degree of a standard’s acceptability.

The two chapters address very different aspects of the link between standards and innovation. However, both highlight the importance of the flexibility of standards for innovations to be built upon them.

SECTION 2: LOOKING INSIDE STANDARDS SETTING ORGANISATIONS

Standards emerge through the cooperation of a group of individuals that together form a working group or a committee under the umbrella of an SSO. It is, therefore, no big surprise that the characteristics of this SSO play a major role in standards setting. These characteristics cover a wide range of aspects – from membership levels to IPR policies to types of deliverables and the speed of their development. The four chapters of this section cover an equally broad ground.

The ICT standardisation environment has become extremely complex and heterogeneous, with dynamic links between SSOs and with each SSO having developed its own governing structures, processes, and policies. These internal characteristics of an SSO contribute to different levels and types of tension among its members. Applying Giddens’ Structuration Theory, DongBack Seo’s chapter, “Analysis of Various Structures of Standards Setting Organizations (SSOs) that Impact Tension among Members,” reviews four influential SSOs (ETSI, IEEE, IETF, OMA). It shows how the different governing structures and systems of these SSOs influence tension among member organisations during the standardisation process. The chapter then offers propositions that can be used to formulate and improve a governing structure in order to decrease these tensions and encourage members to be more positively active in the standardisation process.

Under a government-led technology policy, governments aim to select and possibly enforce technology standards. The chapter “Industry-Led Standardization as Private Governance? A Critical Reassessment of the Digital Video Broadcasting Project’s Success Story” by Niclas Meyer analyses under which circumstances governance through industry-led standardisation may represent an alternative to this. The Digital Video Broadcasting (DVB) Project has been a great engineering and commercial success. Yet,
this industry-led project could not address many of the governance issues involved in the standardisation of television systems. Industry may not necessarily be willing to engage in a level of standardisation that is necessary to address a range of governance issues involved in, for example, television standardisation, such as the creation of fair competition or media pluralism and diversity. This case study demonstrates that important public interests, such as media pluralism and diversity, cannot and should not be left to industry standard-setters alone.

In the chapter “The Evolution and Specialization of IETF Standards,” Mehmet Gencer aims to improve our understanding of how systems of standards are organised, and how they change over time. It presents results of an exploratory, empirical, and longitudinal study on IETF standards and on the underlying collaborative processes. The chapter shows that over time the system of standards changes and assumes a structure comprising increasingly isolated subsystems focusing on relatively independent areas. This effect started in the 1980s. Since then, focus shifted from infrastructural issues to more growth-related problems in the 1990s to security aspects in the 2000s. These findings indicate the increasing complexity of the work on standards specifications and the development of specialisation as the system of Internet standards grows.

How SSOs deal with issues of Intellectual Property Rights (IPR) is one of the most important aspects in ICT standardisation. In the chapter “Assessing IPR Disclosure within Standard Setting: An ICT Case Study,” Anne Layne-Farrar analyses IPR disclosure patterns in ETSI. The chapter reveals that most official disclosures at ETSI are made ex post – often many years after the relevant standard components were published. However, the analysis also shows that these delays are shrinking, with a rather more modest improvement from 2G to 3G, but a significant drop from 3G to 4G. Since this drop occurred after ETSI’s IPR policy clarification, one may conclude that changes to policy rules can have a significant impact on members’ disclosure behaviour.

SECTION 3: FOCUS ON INDIVIDUAL STANDARDS AND SECTORS

The chapters in the previous section looked at various characteristics of SSOs. Regardless of their various differences, these SSOs are in the business of developing technical standards. Accordingly, the five chapters of this section look at a number of individual standards for different fields in the ICT sector.

In fact, the first chapter by Vladislav Fomin and Arturas Medeisis looks at the pre-standardisation phase, which may be placed between R&D and standardisation proper. Their chapter on “Co-Evolutionary Analysis of Cognitive Radio Systems” examines the technology innovation process for Cognitive Radio (CR) from a co-evolutionary perspective. To cover all relevant stakeholders, it does a multi-domain analysis of the CR innovation context covering the three domains: market, technology, and policy. The major conclusion of the chapter is that the policy domain and its stakeholders—primarily the telecommunication regulatory agencies, national/regional governments, and large international standardisation bodies—should assume a more proactive role at the current stage of CR technology development.

ICT is often hailed as a means to achieve sustainability in other sectors, whereas the lack of sustainability of the sector itself is typically neglected. The chapter “Standards for ICT: A Green Strategy in a Grey Sector” by Tineke Egyedi and Sachiko Muto argues that compatibility standardisation has the potential to become a green strategy. They show that all three economic function of standards—information, compatibility, and variety reduction—have effects on sustainability. The case of the standardisation
of mobile phone chargers—triggered by an intervention of the European Commission—illustrates how compatibility standards can help reduce energy consumption as well the generation of e-waste in the ICT sector.

The chapter, “The Rise of MP3 as the Market Standard: How Compressed Audio Files Became the Dominant Music Format,” by Simon den Uijl, shows how a disruptive technology—the MP3 audio compression technology—can significantly change an industry and offer opportunities to new entrants, but may also cause problems to inattentive incumbents. It gives an account of the events surrounding the development and eventual market success of the MP3 standard and explains why competitors like Apple’s AAC and Microsoft’s WMA did not succeed in breaking its dominance. The case shows that technological superiority is only important if it is in line with consumer needs, that the first mover advantage is only relevant when it targets the key applications, and that it is next to impossible to identify the killer application of a new technology up-front.

The subsequent chapter also looks at the factors that contribute to the success of a standard, albeit from a completely different angle and for an entirely different technology. Simone Wurster discusses the “Development of a Specification for Data Interchange between Information Systems in Public Hazard Prevention: Dimensions of Success, Related Activities, and Contributions to the Development of Future Standardisation Strategy Frameworks.” Deploying six dimensions to describe the success factors of a standardisation project, she describes a standardisation initiative that successfully linked research and standardisation. The project’s success was supported by the small size of the working group and by the virtual absence of competition inside the group. Appropriate marketing measures were also important, as was the view towards future developments of the specification.

Perhaps somewhat in contrast to the previous success stories, Stefan Henningsson’s chapter on “Achieving Standardization: Learning from Harmonization Efforts in E-Customs” describes an attempt on standardisation that has thus far been only partly successful. The fact that e-customs standardisation needs to address, and accommodate, both social (organisational processes and practices) and technical (network hardware and software) aspects is identified as the main underlying reason. The chapter highlights the importance of moving from research on IT standards to research on IS standards. IT standards compliance is a necessary but not sufficient condition for leveraging the benefits that are typically expected from standardisation.

SECTION 4: STANDARDISATION AND ASIA

Over the past couple of years, the ICT standardisation landscape has changed due to the increasingly important role that Asian countries, most notably China, have assumed. With a clear standardisation strategy, quite a number of large and internationally successful companies and a huge internal market, China clearly has the potential—and the desire—to play a leading role in ICT standardisation.

In the chapter “Standards Development as Hybridization and Capacity Building,” Xiaobai Shen, Ian Graham, and Robin Williams provide a socio-technical analysis of the 3G environment in China. They argue that the competition between the “indigenous” TD-SCDMA technology and the globally implemented W-CDMA and CDMA2000 platforms should not be seen as a standards war. Rather, all systems are largely based on the same Intellectual Property (IP). This interrelatedness implies that the global standardisation processes will become more fluid, and that IP and expertise generated during local or national standards development (like TD-SCDMA) will be fed back into the international process.
Looking at the four Asian Tigers (Hong Kong, Singapore, South Korea, and Taiwan) and China, DongBack Seo explains how some Asian countries (most notably Korea and China) have been transforming themselves to ICT standard-setters. In the chapter “Are Asian Countries Ready to Lead a Global ICT Standardization?” she argues that Asia as a whole may well have the clout to lead global ICT standardisation, but that none of the individual nations has all of the necessary characteristics to go it alone. To overcome this limitation, the EU might serve as a role model. Even then, however, it will be necessary to cooperate with the EU and the US rather than try and fight these regions through regionally developed standards.

SECTION 5: ABOUT PEOPLE

At the end of the day, standards are developed by people. Unfortunately, those who actually populate the SSOs’ working groups, or may do so in the future, are perhaps the most frequently ignored group of stakeholders.

The chapter on “The Role of the Individual in ICT Standardisation: A Literature Review and Some New Findings,” by yours truly, aims to at least slightly improve this situation. Through a brief literature review and a case study, it highlights the fact that these individuals’ views, ideas, preferences, hidden agendas, etc. exert a significant impact on the development of a standard. It also argues that these people, whether knowingly or unintentionally, act as “shape agents” during the process – typically on behalf of their respective employer. This is due to the fact that they are influenced by the corporate environment within which they work, including any technical, strategic, and economic goals or preferences as well as corporate values or beliefs.

To do their job properly, these people need an adequate level of education and training. To this end, the final chapter, by Henk de Vries, discusses “How to Implement Standardization Education in a Country.” It identifies three barriers for the implementation of standardisation education: the lack of the topic’s appeal to students, the limited willingness of teachers to include the topic in their courses, and the lack of awareness of the importance of standardisation education for industry and government representatives. Experiences from the APEC countries (who are leaders in standardisation education) shows that the national standards bodies play an important role in overcoming these barriers.

Kai Jakobs
RWTH Aachen University, Germany

ENDNOTES

1 Well, perhaps not that simple and technical. It took the (European) mobile phone industry about two years to agree to the introduction of a standardised charger based on the micro-USB plug.
2 Global System for Mobile Communications, originally Groupe Spécial Mobile, a set of standards for second generation mobile communication. It succeeded a number of standards for analogue mobile communication that never became popular to any extent worth mentioning.