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# Deliverable 16

# Report analysing implications for China and European policies

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## Description

This report summarizes the findings from the case studies and workshops of the partnership, drawing policy implications for China and EU Information and Communication Technology (ICT) standardisation processes. It summarizes the discussions and finds on the dynamics of standardisation in innovation in different technological areas and between the EU and China, and examines the relationship between intellectual property and standardization.

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## Tables

# 1. Introduction

The People's Republic of China has recently begun to be remarkably active in many areas of Information and Communication Technology (ICT) interoperability standards as part of an effort to promote Chinese innovation capability and 'indigenous technologies'. This poses challenges for China which, despite possessing strong manufacturing capabilities, has limited experience in international standardisation and in ICT innovation.

These developments also have important consequences for the European economy and the global ICT market, especially those related to technology platforms such as mobile internet, next generation networks and audio-visual products. For example, will the outcomes be open standards and alignment between regional economies, or competitive standards processes leading to so-called "standards wars" and the fragmentation of global markets? Some US commentators have even warned of "Chinese techno-nationalism".

How should European Policy makers respond to these challenges, in developing a standardisation policy oriented to innovation and in developing relations with China? How can European single market, competition, employment and industry policy respond to the growing importance of China and Chinese firms as global players in many areas of ICT innovation?

European policy makers are currently working to modernise the standardisation regime in order to support innovation and meet the challenges of globalisation.[1] A range of important initiatives to promote European standards practices in China have already been launched. However future policies need to systematically and strategically address China, which is emerging as a key global power in production and consumption of ICTs.

The China-EU Information Technology Standards Research Partnership has achieved important insights into the rapidly evolving policies and strategies of Chinese government and innovation actors. The Partnership built a multidisciplinary international knowledge network, conducted studies and held policy workshops to investigate China's increasing involvement in global standardisation processes, development of innovation capabilities and engagement with changing global markets. This report summarises the evidence collected though case studies, issues raised in the workshops and policy recommendations drawn in consultation with policy and industry partners.

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[1] See Report of the Expert Panel for the Review of the European Standardization System (EXPRESS) *Standardization For A Competitive And Innovative Europe: A Vision For 2020,* February 2010, and the European Commission White Paper *Modernising ICT Standardisation in the EU - The Way Forward,* July 2009.

# 2. Objectives of the China EU IT Standards Research Partnership

## 2.1. The Research Process

The China-EU Information Technology Standards Research Partnership has sought a deeper understanding of the rapidly evolving context of standards-related innovation in China and its implications for European policies and innovation strategies. This support action carried out five main kinds of activities:

*i)* *Research networking:* the partnership developed an extensive network of policy makers, practitioners and academics with an involvement and expertise in standards-related innovation in China and Europe.

*ii)* *Research workshops:* Research networking was facilitated by research workshops in Europe (*ICT2008*, Lyons, 26th November 2008) and Beijing (Tsinghua University, Beijing 17th April 2008 Mandarin/English and *I-ESA conference*, Youyi/Friendship Hotel, Beijing, 20th April 2009).

*iii)* *Case studies:* The European and Chinese research team undertook three case studies of technical systems that were standardised as a result of public policy initiatives in China to develop a China-centric standard (Mobile Broadband, Mobile Broadcasting and Audio Visual Codecs).

*vi)* *Policy workshops:* Additional inputs were secured through policy workshops in Beijing (Youyi/Friendship Hotel, Beijing, 8th December 2009) and Brussels, (CEN/CENELEC Meeting Centre, Brussels, 15th February 2010) at which policy and industry experts helped pull out implications for policy and practice.

*v)* *Dissemination:* Project findings were disseminated through wide circulation of a Newsletter (produced in a high quality format), through the project website, publications in academic journals, and through the creation – in the course of research and policy workshops and wide dissemination activities - of an extensive network of associates. Through regular electronic liaison these stakeholders received early project findings and provided valuable feedback about both findings and their implications

## 2.2. Conceptual Approach

The approach of this partnership project has been to explore the broader context of standardisation and its relation to policy and innovation. Here we suggest that an integrated and longitudinal approach is needed that encompasses three moments of standardisation: 1) objective setting, 2) standards making, 3) implementation, and examines the development of policy and strategy in these areas over the relatively long period of time that it takes from the initial proposal to develop a 'Chinese' standard, through to development of policy to eventual implementation. This approach captures the dynamics of innovation and standardisation, as priorities change and technical and commercial successes and failures shape participation and objectives.

Three cases allow differences and commonalities between sectors and technologies to be mapped. Comparison is also made between context, policies and standardisation activities in Europe and in China in order to

characterise system differences, but also points of common interest and similar tensions that can help inform policy recommendations at an EU level.

## 3. Standards and Innovation in ICT: the State of the Art[2]

Standardisation processes are key in catalysing and shaping ICT innovation, particularly for creating complex technological systems that require diverse technological inputs from multiple players. By standardisation processes, we refer not only to the work of Standards Developing Organisations (SDOs) in negotiating specifications and supporting testing, but also to policies and strategies involved in initiating standards development, and those involved in the implementation of systems based on standards

Worldwide, there have been significant shifts in the arenas and scope of standardisation practices and processes in recent years. First, we note that global standards bodies have become more important in response to the globalisation of markets and industry participation. While certain regional or national SDOs remain important foci for standards development, others have lost influence and importance. Second, participation in ICT standardisation has broadened globally, as governments and firms in industrialising countries with domestic and export markets gradually learn to use and contribute to standards. Third, there is an ongoing shift from formal public SDOs to 'hybrid' consortia-based approaches, containing supplier, user and regulatory members, which are widely considered to be able to be faster moving and more responsive than traditional formal SDOs. Traditional SDOs, such as the ITU or ETSI, have responded by reforming and accelerating their processes, attempting to maintain relevance in fast-moving and emerging technical fields. The proliferation of standardisation bodies in an increasingly globalised setting means that there is increased competition between standards bodies, which places a growing burden on firms that wish to engage with and participate in the standardisation of complex systems such as in telecommunications, that cross multiple standard bodies. Despite their espousal of a technocratic approach, that attempts to separate technical decision making and negotiation from business negotiations, there are subtle tensions within SDOs, as participants press for standardisation decisions that further their interests. The ability to operate successfully within standardisation bodies is becoming a core strategic competence of firms, and a focus of innovation policy.

ICTs are one of the most dynamic areas of innovation, not only in technology but also in services. There are important differences between hardware, software and online services in terms of the dynamics of innovation, as well as the scope and challenges for standardisation. The falling costs of hardware and the ability to implement multi-standard systems and devices has an impact on the importance of establishing single standards. Convergence of technologies, markets and industries is challenging the established structures of institutions of standardisation, notably eroding the boundaries between the Internet, telecommunications and broadcasting. The modularised

[2] Deliverable 3 provides a comprehensive literature review

architectures of modern ICT systems, as complex assemblages of simpler components/sub-assemblages enables greater flexibility in creating infrastructures with interoperable systems. However ICT infrastructures are also becoming much more complex and may require firms in the supply and implementation networks to invest considerable effort in coordination, much of which is done in standardisation fora .

Standardisation is a complex process of alliance building, shaping technical and market change with benefits for producers, customers and end users. It has been described as a form of *governance without government* in the process of innovation (Brunsson 2000). Currently the processes and requirements of standardisation, especially in ICT are in rapid flux. This offers policy makers and firms considerable scope for *Learning By Standardisation*, where attempts to drive and use standardisation processes leads to re-evaluation of policy and development of competences. Recently emerging outcomes include: establishing faster and more open processes for setting specifications; addressing complementary functions such as testing and compliance processes; addressing Intellectual Property (IP) and the operation of patent pools; and policies for the implementation of standards, e.g. through mandating standards, licensing policies, public procurement and infrastructure policies and investments.

### 3.1. Intellectual property rights

Underpinning many of the developments in standard setting is the issue of Intellectual Property Rights (IPR), particularly relevant to this project, now that China has signed up to the World Trade Organisation and TRIPS (Trade Related Intellectual Property Rights Protection). These may present particular difficulties for a developing economy like China. The growing volume of patenting activity threatens what have been described as ‘anti-commons effects’, arising from the increasing costs of negotiating access to intellectual property, as well as the licensing fees resulting. A commercial innovation that has been adopted widely in recent years is the patent pool. These are now common in complex ICT systems with multiple IP holders. Patent pools reduce the costs for implementers and system builders in negotiating access to all the ‘essential’ IPR needed to build a technology based upon a standard. They are often quoted as being as underpinning Europe’s success in mobile telephony.

However such mechanisms may still present problems for developing countries given the unequal distribution of intellectual property between nations. The typical patent licensing policy, mandating that royalties should be "fair, reasonable and non-discriminatory", may still cause conflicts of interest because "reasonable" can mean different things to a technology-owner and a technology-buyer (Blind and Thumm 2004). In particular, what may be seen as a fair rent in the EU may still present an obstacle in China and other developing economies where the licensing costs presents a significant contributor to product costs for consumers. These charges may present acute difficulties for Chinese exporters working in overseas markets with very slim margins (for example, one-third of the cost of selling a Chinese-built $60 DVD player in the U.S. market is paid as royalties to the DVD patent holders (Suttmeier and Yao 2004).

There is, therefore, an intricate relationship between standardisation, Intellectual Property Rights and innovation (Blind and Thumm 2004).

The picture is complex. As China's currently booming economy indicates, Chinese firms are doing well from the existence of dominant global technology architectures (Suttmeier and Yao 2004). Moreover, it is far from clear that standards led by China will reverse the global division of intellectual property. Even for the 3rd Generation Mobile standard, TD-SCDMA, China-based organisations hold under 10% of the core patent technology (e.g. Yan 2001).

The interests surrounding standardisation efforts are thus exceedingly complex, with static, linear models of standardisation and diffusion failing to capture the role of standards in innovation: objectives of standardization change, the interests of governmental and commercial players change, and market expectations built into standard processes fail to materialise (e.g. Jørgensen and Sørensen 1999).

# 4. Evidence from Three Standards-related Innovation Cases

## 4.1. Characterisation of the Cases

Three case studies were conducted, providing empirical examples of standardisation and innovation in technologies where China has led a high profile standardisation process that challenges or provides an alternative to a more established European and global standard. Each case focuses primarily on the Chinese-led standardisation efforts, with some comparison with the European or global efforts.

- Mobile Broadband from 3G to 4G: Specifically the TD-SCDMA 3G mobile standard (For full details see Project Deliverable D11)
- Audio Visual Codecs: The AVS standard and the challenge to MPEG-4 (For full details see Project Deliverable D12)
- Mobile TV/ Mobile Digital Broadcasting: CMMB, and the European DVB-H and T-DMB standards (For full details see Project Deliverable D13)

While particular technologies may not be fully representative of the large and diverse range of ICTs where there are specific Chinese standardisation efforts, they provide us with evidence of how and why China has promoted standardisation, and of the processes of *learning by standardisation* that governmental, and private sector players have engaged in during the periods of each case.

Mobile Broadband and mobile TV are infrastructure technologies, deployed by a few operators in any country, but with (potentially) millions of users requiring standardised interoperable devices and services. These require many components and subsystems to be interoperable, and, especially in the case of mobile broadband, they build on previous generations of technologies. While the technologies in these systems may be provided by many firms, they are often integrated and operated by a few in any market. Audio Visual codecs are different – they are components of larger systems – from stand-alone media players to internet mobile and broadcast media systems.

A common feature of each of each case is the importance of scale and interoperability to successful implementation, and the ability of China to create

and provide the conditions for large scale adoption within China that would not be possible in smaller markets.

None of these cases is closed history – each of the standards is at an early stage of deployment, and the standards themselves and the experiences of their development are providing a platform for future innovation and standardization.

### 4.2. Mobile Telephony and Broadband: from 3G to 4G

Perhaps the most high profile case is that of the Chinese TD-SCDMA standard for 3G mobile. In the 1990s, China imported 2G mobile phone systems, with little business going to Chinese manufacturers who had to pay high licence fees, and were even not considered 'credible' suppliers by Chinese operators. In 1998, the soon to be merged Ministry of Electronics Industry and Ministry of Post and Telecommunications proposed a 'Chinese' 3G mobile specification based on research coordinated by entrepreneurial engineers at DATANG research labs (Chinese Academy of Telecommunications Technology, CATT). Exploiting the fragmentation and confusion caused by ITU's IMT-2000 process, when a single global standard failed to be chosen, this 'Chinese' standard was formally recognised as one of the IMT-2000 'family', and known as TD-SCDMA. Despite being portrayed as a 'Chinese' standard, TD includes a majority of 'non-Chinese' technology, and the international standardisation route was chosen – through the 3GPP consortium process.

TD can be characterised as an international standard in creation, with the objective of implementation in the Chinese market. After initial resistance, TD attracted a range of major foreign telecoms vendors eager to invest in joint ventures in China, and involved the transfer and development of technology and IP from Siemens. Some of the main foreign investors, notably Siemens, but also Alcatel, were the original developers of techniques that TD-SCDMA was largely based upon, that were standardised as 3GPP TD-CDMA. This particular radio access system was almost completely ignored by the market as operators instead adopted the 3GPP WCDMA system.

In China however, the policy objective of 'TD' was to reduce IPR licensing costs for future mobile systems and develop national technological competence. However, while operators outside China were struggling to implement 3G systems in the early 2000s, China was still focused on building and consolidating fixed line and 2G infrastructures and markets (especially in the less-developed western provinces). There were several major reorganisations of state-owned operators and the regulator, MIT, resulting in the growth of China Mobile to become the world's largest GSM mobile operator.

Despite growing government investment and coordination, TD was not at the outset considered a 'serious' project, and was slow to attract high-level government support. However its existence may well have been the trigger for WCDMA and CDMA2000 suppliers to limit the licence fees applicable to Chinese manufacturers.

TD's fortunes changed with the arrival of the Hu-Wen government. With the 11$^{th}$ 5-year plan with its focus on independent technological capability and a

decision apparently based on national security concerns, TD became a priority national project. Deployment of non-Chinese 3G systems by China Mobile was blocked. Many predicted that TD would eventually be implemented as the sole national standard. However in 2008/2009 a reorganisation of the Chinese telecoms industry and regulation in an attempt to improve competition and efficiency created three full-service operators, each licensed to implement a different 3G standard. China Mobile, with the largest mobile market share was obliged to adopt the less mature TD system, despite public protests by the management about the costs/uncertainties involved, while the other two firms have pushed ahead deploying WCDMA and CDMA-2000 systems.

Government planning is clearly behind much of the investment in 3G networks: all three firms are state owned with much finance from state-owned banks. The picture is complex and turbulent. In 2010 China Mobile is running trial deployments of next generation TD-LTE which could supersede and avoid the constraints of 3G TD-SCDMA. In addition the wireless broadband market is being targeted by the media ministry SARFT, which is already deploying a competing system, WiMAX, in many areas.

Today, TD is considered a major Chinese success story, and it is now being spoken of as a 'standard for export', particularly to developing economies. Moreover it has paved the way for China's involvement in standards for future mobile broadband - particularly in 3GPP's Long Term Evolution programme (although TD-LTE is *not* a separate Chinese standard). This, coupled with the success of Chinese telecoms vendors Huawei and ZTE in international sales and their world-leading innovation capacity, have increased China's confidence and participation in 3GPP, ITU and other telecommunications SDOs.

The case of 'TD' development can be read as the attempted use of a standards process to further the strategic, economic and social aims of the Chinese government. However, as with the a range of Chinese government policies on industrial and social policy, this case shows that this is far from a simple story of a unitary government policy with clear predefined aims. The process unrolled at particular moment in history as China opened some of its previously protected markets by joining the WTO, and attempted considerable reform of government and regulatory policy and practice. The TD story illustrates the determination of the Chinese government to develop indigenous technological capability and a progression along the learning curve of standard making in the context of the technically, commercially and politically dynamic telecommunications market. It also highlights the evolving goals and interactions of Chinese ministries, and the changing strategies of national and foreign commercial players, as they redefine technical 'success' and reconsider conceptions of what purposes mobile telecommunications can serve. However, these firms operate in global markets, and the Chinese government is not alone in attempting to balance the creation of markets in services with industry policy to support important national industries.

In summary the case illustrates the shifting objectives surrounding the development and deployment of TD, and the changing priorities and influences of industrial and governmental players. Foreign firms are also deeply implicated in the development of TD. The development of TD already

put pressure on IPR holders to limit licence fees, and major Chinese firms have built innovation capacity in spite of the TD policy. Now the focus is shifting from TD-SCDMA to TD-LTE as a Flagship policy, with pretensions to providing technological independence, and with export potential. For the future however it is not clear that the core telecoms infrastructure will remain a core economic driver. Emerging systems and markets in services, the 'Internet of Things' and software platforms are likely to emerge as key areas of standardisation, areas where Chinese policy is already signalling independent paths and strategies.

**Table 1 A six-layered summary of mobile broadband development in China and the EU**

| | China | European Union |
|---|---|---|
| A. Policy | • Indigenous technology policy to strength industry internally and in foreign markets<br>• Policy efforts, primarily by MII were not taken particularly seriously outside until top level government support provided<br>• TD promoted by Telecoms ministry/regulator (now MIIT)<br>• Role of media ministry not currently important (SARFT), but may become so with convergence.<br>• Policy to support national equipment industry through TD standard in tension with operators' desire to select technology and build 3G networks – led to delays in licensing. | • Harmonisation of market, and support of industry against foreign competition<br>• GSM seen as success of European Policy. 3G prompted the same way. 3GPP remains successful European dominated process<br>• EU selection of 3G (EC and Council of Ministers) not entirely successful with hindsight. Different approaches to licensing across Europe.<br>• Less commitment to 4G than previous generation – diverse approaches to spectrum release (e.g. UK backed spectrum trading)<br>• Industry policy supporting vendors in tension with regulatory policy on services |
| B. Regulator | • Regulation currently straightforward and national, through MIIT<br>• Not clear to what degree internal divisions in Regulator exist, and the degree of independence from other government bodies, and from the managers of the operators | • Nationally coordinated regulators, but no EU super-regulator<br>• Different national approaches, certainly dependent on presence of national technology champions, and political influence of operators<br>• Attempts to harmonise regulation ongoing |
| C. R&D and Vendors | • National vendors weak in 1990s, and with little national presence in supply of 2G.<br>• Still relatively weak Chinese research expertise, although strong in development<br>• Very strong growth in 2000s from local and expert markets. Huawei and ZTE now major international players with considerable IPR portfolios and presence in international standards processes<br>• Slow commitment to TD investment until top level policy backing<br>• Large and medium size firms dominating manufacturing in mobile equipment on all standards.<br>• National firms win majority of TD infrastructure contracts form China Mobile | • Range of National champions in mobile telecoms equipment.<br>• Some firms stronger than others, all have profited extensively from Chinese market for GSM systems<br>• EU and US firms still dominate IPR development in mobile telecommunications, despite recent developments by Huawei and ZTE<br>• European firms losing orders to Chinese firms across global markets, but still winning contracts in China |
| D. Operator | • China Mobile, the largest and most successful operator 'burdened' with the task of commercialising TD 3G.<br>• Other operators awarded licences for competing foreign standards, but unclear how they can successfully compete with China mobile, except by drawing on mature of supply of equipment and consumer devices | • Operators stung by technical problems, lack of cash and lack of market with early launch of 3G at peak of dot-com bubble.<br>• Continued consolidation of operators in European market<br>• Operators generally conservative, slow to introduce new services.<br>• Strong growth in wireless data market, but long-term profitability model unclear.<br>• Most operators still cautious about major investment in next generation equipment, especially with economic crisis. |
| E. Network | • Fast network built in 3G by all operators using 3 standards<br>• China Mobile Trials of LTE<br>• Plans for 4G spectrum not announced | • 3G networks established in most European countries.<br>• Many networks upgraded to HSPA standard for mobile broadband.<br>• Some trials with HSPD+ and LTE – first LTE in Europe<br>• Plans for 4G spectrum not announced, not harmonised |
| F. Device | • Devices must conform to standard.<br>• Operators can and do subsidise devices to attract customers.<br>• Relatively low supply of TD compatible devices leads China Mobile to attempt to stimulate supply<br>• Smartphones intended for high-income market expensive<br>• Development of lower cost smartphones from Chinese and international suppliers, based on open source software (Android, Symbian, other Linux) likely to open mobile broadband market<br>• Initial 3G market focused on laptop and netbook internet connectivity. | • Devices must conform to standard<br>• Devices generally selected and prompted by operators, with varying regimes of subsidy across Europe.<br>• Segmentation of mobile broadband into connections for laptops and netbooks, and handheld devices (phones, smart-phones)<br>• Continued struggles with business models for new consumer devices and content. |

### 4.3. Mobile Multimedia Digital Broadcasting (Mobile TV)

Mobile TV, that is, digital TV broadcast to a mobile device that may or may not also be a phone, has been a promising yet little adopted service during the 2000s. It is available in a limited number of markets, and there are multiple standards available globally. At least two systems based on different standards have been trialled or implemented in Europe, and whilst one of them is officially favoured by the Commission (DVB-H), there is in practice a continuing tension between the Commission and various national policymakers in this respect. As in the EU, policy makers in China have not in practice reached agreement as to who should or can set a market-wide standard: there is a 'national standard' (T-MMB), but another standard (CMMB) is the one actually being implemented. This case illustrates tensions between different parts of the Chinese government, notably the Ministry of Industry and Information Technology (MIIT), the recently enlarged telecommunications ministry which has control over network access licenses – deciding which standards are legal to deploy on handsets with telecommunications capabilities, and the State Administration of Radio, Film and Television (SARFT) which controls standards for broadcasting and national television programming. It also illustrates that "formally" selected standards will not always prevail, even in formal government standardisation processes.

The Standardization Administration of China (SAC) chose Nufront Tech's T-MMB as the national candidate standard over several alternatives. However, in parallel to this, SARFT had promoted their own standard – China's Mobile Multimedia Broadcasting (CMMB), developed by SARFT-owned Beijing TiMi Technologies and SARFT's Academy of Broadcasting Science. It was CMMB that was adopted as a key project in the 11th Five-Year plan. Despite the initial refusal by MIIT (because of the candidate selection of T-MMB) to allow CMMB on cellular handsets, it eventually conceded in late 2008. SARFT obtained spectrum, and has successfully promoted its own preferred CMMB standard to the extent of implementing it through a large-scale programme of investments across many Chinese cities, with the Ministry of Finance financing the network built by China Satellite Mobile Broadcasting Corporation (CSMBC). Additionally a 2009 agreement gives China Mobile the exclusive right to sell TD-SCDMA phones with CMMB mobile TV capabilities for the next 2-3 years. While T-MMB contains foreign IPR, CMMB has been promoted with initially free licensing, then low licensing costs. In 2009 a patent pool for CMMB was formed by SARFT under the CMMB Industry Alliance (which has over 100 members), with IP holders mandated to release their IP. However, even the licence fee charged was considered too high by manufacturers, and in 2010 this was dropped significantly, perhaps pointing to a weakness in the market in China.

Despite the central choice of CMMB however, there continue to be implementations of other standards as well as CMMB by regional broadcasters, although these of course may cease.

| | **China** | **European Union** |
|---|---|---|
| A. Policy | Tensions between institutions, including potentially overlapping policy domains:<br>• national standards regime (SAC)<br>• telecommunications (MIIT)<br>• media (SARFT)<br>• science and technology ministry (MoST) | Tensions between transnational institutions:<br>• European Commission's (EC) "light touch" policy in support of transnational harmonisation on DVB-H<br>• Council of the European Union (CEU) acknowledges Commission focus on DVB-H, but emphasises that standards choice should primarily be market driven |
| B. Regulatory | Is mobile digital broadcasting the domain of telecommunications or broadcasting regulation?<br>• Seemingly overlapping regulatory domains between MIIT and SARFT:<br>- SARFT controls standards choice and miscellaneous regulation at the broadcasting side (including content)<br>- MIIT controls standards choice and regulation at the terminal side | • No European "super-regulator" for telecommunications any time soon (reflecting the policy split above, the EC proposal was stopped by CEU)<br>• Standards, regulations (and potentially choice) in practice the domain of national regulatory authorities (or equivalent at national level)<br>• Potential conflict between interests of content, technology and frequency regulation within countries (depending on particular national configurations of regulatory regime) |
| C. Operator | Unexpected movements towards cooperation between broadcasters and telecommunication operators as a result of the 2008 Beijing Olympics cooperation:<br>• Reflecting the above divisions, the SARFT operator (CSMBC) was initially in strong competition with telecommunications operator China Mobile (e.g. streaming over TD-SCDMA; broadcasting over T-MMB)<br>• Unexpected alliance between CSMBC and China Mobile achieved for CMMB, however this locks out China Unicom and China Telecom (and others) entirely from the mobile digital broadcasting market | Entrenched divisions between broadcasters and telecommunications operators in most countries, and no known examples of cooperation within Europe. This fuels standards fragmentation:<br>• Telecommunications operators tend to prefer DVB-H (or merely point-to-point streaming within existing cellular networks)<br>• Broadcasters tend to prefer T-DMB and DVB-SH |
| D. Network | So far, few problems relating to network deployment. SARFT/CSMBC has rolled out China's CMMB network fairly independently of other national actors and without conflicts. | • Problems with free radio network capacity.<br>• Spectrum availability in many places dependent on shut-down of analogue television broadcasts.<br>• "Must-carry"-rules may interfere, depending on national media regulations (so far no issue, and the European Commission advices to abolish "must-carry" demands on mobile television services until services are well established (European Commission 2008)). |
| E. Device | For devices that are to connect to Chinese telecommunications networks, MIIT decides what technologies are permitted. This means that any telecommunications device that is to support a mobile digital broadcasting standard has to have prior approval by the MIIT. However:<br>• Plain, receive-only devices (like MP3-players, portable TVs etc) are not subject to MIIT regulation<br>• Unlicensed telecommunications devices may hit the market implementing given standards regardless of MIIT regulation | For the member nations of the EU (plus members of the European Economic Area - EEA), all devices are principally permissible as long as they conform to the Radio and Telecommunications Terminal Equipment (R&TTE) directive, and are not subject to special national rules where applicable with regards to e.g. criminalisation of reception of emergency signals. Receive-only devices (terminals without radio transmission capabilities) are exempt from the R&TTE directive, and subject only to the Electromagnetic Compatibility (EMC) directive. |

**Table 2 - A five-layered analysis of convergence in China and the EU for Mobile TV**

### 4.4. AVS Audio-visual codec standard

Audio-visual codecs - which govern the encoding and compression of digital signals - play a vital role with the convergence of digital media, allowing compatibility across different components, networks and applications. Codecs are used as a component of a range of systems, including digital media, telecommunications, broadcasting and the Internet. The current *de-facto* global standard is MPEG4/H.264 – developed under the Next Generation Networks (NGN) initiative of ITU-T. It is built on the success of MPEG2/H.262, used in digital broadcasting and DVDs. It is currently implemented in digital media (BluRay), telecommunications (video-conferencing), TV/Sat (DVB), & Internet (YouTube, QuickTime Player, Media Player, etc.)

The Chinese AVS standard was developed as an alternative to MPEG-4/H.264. The AVS Workgroup[3] was founded by the MII in 2002. The primary objective was to reduce IPR licensing fees, which had become higher than manufacturing costs for competitively priced products like Digital set-top boxes, and were a considerably higher part of the sale cost in China than in developed economies. However an attempt to introduce a Chinese alternative standard to DVD, the EVD failed in the market in 2003. AVS was standardised in China in 2005, and work continues on extensions. In the 11th 5-year plan an independent codec was included as a goal. AVS however was not a purely Chinese effort: the initiative attracted foreign firms, and efforts were made to introduce AVS into the international standardisation process through the ITU. Formal, international SDOs were seen as important in creating AVS. The AVS workgroup has over 100 members, largely Chinese. Its stated aim is to operate an open, international development processes, with independent IPR policy. The goal of reducing licensing costs with AVS involved developing a Patent Pool that tries to balance Chinese Law and cultural values with global practices. The creation of AVS thus involved an explicit learning process on the part of Chinese standards players attempting to develop expertise in this aspect of standardisation: probably the greatest benefits of AVS to China are the expertise gained in the international standardization arena, and the entrance of Chinese companies/experts to international standardization committees

In terms of implementation, though the standard is included in some systems, so far no clear implementation policy is in place in China, such as mandatory inclusion in IPTV systems. The goal of 1Yuan licence fee per set-top box may not have been achieved, but the existence of AVS may have encouraged DVB to adopt a €1 per MPEG4/H.264 codec based set-top box – an outcome which goes some way towards meeting the initial goals of the AVS project.

So far AVS does not appear to have been adopted by online video sites, though it is implemented in a Chinese high definition video disk standard, China Blue High-Definition (CBHD). CBHD is based on the 'unsuccessful' HD format HD-DVD, and has been developed as a joint venture of Optical Memory National Engineering Research Center (OMNERC), based at Tsinghua University and the DVD Forum. It uses AVS and other standards owned by the Chinese government, and licensed at lower cost than MPEG4

[3] http://www.avs.org.cn/

and other component standards. The format was launched in 2009 and is apparently outselling Blu-ray in China, benefiting from the significantly lower licensing costs.

### 4.5. Observations on the case studies

These cases illustrate some of the diversity of standard development by China. For example, system technologies that are a crucial part of the national infrastructure are subject to policies related to the infrastructure as well as the industry that will produce it: this is the case of Mobile TV and TD. This will lead to tensions between ministries with different interests. AVS currently does not appear to be subject to this type of diversity of interests. However, many other technologies that might have a security component may well be.

As well as differences there are also a number of commonalities. First, China has been going through a period of considerable change in innovation capability and policy direction that has changed the objectives of these projects and their implementation. Second, those who propose a particular standards-based innovation have to build support for it. This is done among government players, and industry, both Chinese and foreign. Foreign support has not been hard to find: in the AVS and TD cases the companies behind 'failed' standards developed elsewhere, such as TD-CDMA and HD-DVD, have become active supporters of a Chinese 'rebirth', giving access to platforms and technologies developed and standardised in global fora. The size of the market in China means that all major multinational enterprises are willing to engage in standards development in China, even if they may object to some of the terms. Building support in government circles has been difficult without top down leadership – which came for all these projects in the 2006 11$^{th}$ 5 year plan. However tensions between Ministries can continue to undermine the transparency of implementation, even when formal standards-making procedures have been followed – as in the CMMB case.

National policies have been linked to global innovation and standardisation in each case, even if the outcome at the present stage has led to implementation only within China. At present we cannot tell if there will be export of any technologies based on these standards – though there are expectations that TD-SCDMA will gain markets in developing countries.

Comparing China with the EU, the central government (or parts of it) is able to mandate adoption of standards, but only after a considerable period of negotiation. In the case of 3G, despite much of European standardisation being voluntary, the EU has a history of mandating mobile standards too. These cases illustrate that formal standardisation procedures can easily be subverted by political agendas. However, bringing them to the implementation stage still depends on concerted political will, as well as commercial interests. This is not necessarily wholly different from the situation within the EU. However the Chinese state was able to coordinate large-scale infrastructure investments through direct funding and control of state-owned enterprises at a radically different scale and more directly than the national-level infrastructure developments in European member states.

# 5. The evolving context of Standardisation and Innovation in China

Chinese ICT sectors are the most dynamic sectors in China's economy today. They have been staffed with energetic and educated professionals, young and experienced, since the economic reforms. Many of today's major companies emerged out of the nation's prestigious S&T research and higher education institutions. Although some have subsequently become private enterprises, they have kept the strong intellectual and/or business link with their "parent" institutions. With "new blood" pouring in from a wave of "returned overseas students" during the last one and half decades, new technologies and investment have also been injected into their businesses.

A key driver in this process was China's accession to the WTO in 2001, and the adoption of a timetable for liberalisation during the 2000s, including the opening of markets in goods and services to foreign firms, opening to foreign investment, the creation of regulated markets, anti-monopoly legislation (Li, 2008), intellectual property law, the introduction of consumer protection, and the development of more transparency. The WTO accession process had lasted many years in often acrimonious negotiation with the USA (Nakatsuji, 2001), the resolution of which specifically included deals of such as allowing American companies entry into the telecoms equipment market and taking-up US mobile standards. While infrastructure markets have nominally been opened to foreign players in 2006 according to the WTO accession agreement, they still remained in the hand of a limited number of large Chinese players. However, the nature of these former state-owned companies has evolved over time, and their ownership become more complex. Business decision-making is now largely independent of the many government interests, although they are still subject to top level strategic policy decision.

While creating and opening national markets brings many benefits, including foreign investment, knowledge transfer and access to global markets it also upsets 'orderly' development and exposes strategic domestic industry to more efficient foreign competition. Industry policy, theoretically (if not in practice) attempts to maximise the advantages and minimise the disadvantages. However policy also attempts to strengthen the ability of national industry to compete globally, not just on items low on the value chain, but also with high value innovation in order to increase competitive advantage (Ure 2007). Technology policy, and in particular standards policy, can be interpreted from this perspective. This development of this policy, and the tendency towards 'technonationalism' or to 'technoglobalism' in Reich's terminology (Reich 1987, quoted in Lee, Chan & Oh 2009) is perhaps most clearly demonstrated in telecommunications. More recently scholars have introduced the concept of 'neo-techno-nationalism', to describe the policy balancing that emerges when trying both to protect national industry via national standards, and encourage integration in global markets though global standardisation processes. (Suttmeier et al 2004; Yan 2007; Lee, Chan & Oh 2009) .

During the last 10 years, government policies toward the control of the domestic players and the manner of making use of foreign technologies and

investment have changed at various times, however the main objectives remain, that is to strengthen the ability of national industry to compete globally and to enhance domestic innovation capabilities. The most notable statement of this policy came in the 11th Five Year plan in 2006 which highlighted both independent technological capacity and the integration of the Chinese economy more deeply with the international economy. These two goals produce an important tension (identified both by scholars and policy makers) that is played out in policy decisions on standardisation: should standards be used to protect and nurture national innovation capabilities, but risk isolating industry from global markets, or used as a way to build bridges to global markets.

On the issues of some standards, even many of these independent companies are coming together again around state-coordinated efforts to gain access to standard making processes and organisations and in addition for building Chinese-own standards, to end the current position in which China is a net importer of foreign developed standards (Zhao and Graham 2006). The initial stimulus to developing indigenous Chinese ICTs, including China-initiated standards, was a heightened concern, following WTO accession, about relatively high licensing fees for 'foreign' Intellectual Property (IP) and the problems for Chinese firms to compete in manufacturing without a stake in the standard and the IP it returns.

However the situation has changed radically – even in the course of this two-year project. Since 2000 China has embarked upon an intensive learning process, including efforts to improve national standardisation processes, to develop an IPR regime and enhance innovation capability, for example by strengthening industrial R&D capability and its linkages with public sector research institutes. The success of Chinese firms in manufacturing in the ICT sector has been striking. A number of successful Chinese multinationals, such as Huawei and ZTE, have grown through export, and are gaining global innovation expertise and market share worldwide, as well as consolidating positions in China. These have helped change China's standardisation and innovation orientation. They and a number of other Chinese firms are playing an increasing role in international standardisation, for example sending representatives to SDOs such as the International Standardization Organization (ISO), the International Telecommunication Union (ITU), the Third Generation Partnership Project (3GPP), and taking on positions of responsibility. Growing Chinese participation has the potential to change the balance of power in these organisations. Most Chinese firms, particularly Small and Medium-sized Enterprises (SMEs) however still lack the skill, confidence, experience and resources to participate.

There is a surprising similarity of perspectives from Chinese and European industry: the creation of indigenous standards by China my be seen by outsiders as creation of new barriers and protections to China firms, but the view from China is similar – foreign standards, especially where IPR is involved, are seen as a barrier to participation in global markets (Table 3).

| | |
|---|---|
| The view from Europe is generally that standards and standardisation processes in China are barriers to market entry due to:<br>1. Unknown and difficult regional and sectoral standards;<br>2. Some Standardisations processes appear to be controlled or shaped by public policy and links between government and Chinese firms;<br>3. Mandatory standards regime can be difficult ?for firms used to voluntary standards in Europe.<br>4. After China's accession to the WTO and TRIPS, Chinese standards have been seen as levers to force IPR transfer or make entry into Chinese markets more difficult for foreign firms | The view from China is that standards and standardisation processes in Europe are a barrier to trade, both to enter foreign markets, and to compete within China. Usually standards are seen as reducing trade barriers – however contemporary standards that include significant essential patents make it :<br>1. Complex and difficult to enter standardisation process without expertise.<br>2. Are seen as an "unfair advantage" and a barrier to Chinese entry and implementation.<br>3. They include IPR regimes that are too expensive for Chinese markets, and failure of some patent pools make it hard for Chinese firms without established IPR portfolios to strike necessary IP agreements the enable them to compete effectively. |

**Table 3 Contrasting Views from China and Europe of each other's standardisation system**

## 5.1. The Evolution of China's Standards policy

In recent years the Chinese government has been very active in the promotion of standardisation activities. Standards and related regulation seem to be used as methods to align supply-side players and promote markets in an immature market environment (Bach et al. 2006). Our cases reviewed a number of attempts by China to elevate national standards to global ones. Despite the concerns that technonationalism that would allow China to exploit its market size and other advantages to exercise technological leadership (Naughton and Segal 2001), we find a more complex political economy of standards-setting, as Chinese regulatory agencies and markets are reformed, and tensions between ministries and firms with different historical remits and approaches to national development and global participation are tackled.

### 5.1.1. Standards capability

In the domain of international standards making, some stakeholders have better knowledge of the process, and are better represented in standardisation committees. Such situation renders standards development a *political process* "that selects whose goals will be addressed and whose will not, and determines the means by which the goals will be reached" (Bergman, King et al. 2002, p.159, original emphasis). In this respect, it is important to note that China redressing its historical lack of expertise in international standard development. To use the example of AVS standards, today, experts from two "competing camps" – that of MPEG4/H.264 and AVS – are jointly working on the future generations of codec standards.

While China has been a member of ITU almost a century, represented by the Ministry of Post and Telecommunications and latterly the Ministry of Industry and Information Technology (MIIT), only recently has the country's representation seen a steep increase. Between 2008 and 2009, the number of delegates from Chinese ITU-T Sector Member organisations participating in ITU-T Study Group meetings more than doubled from 79 to 172 (Levin 2010).

By making inputs to the process, by giving "contributions" (i.e. input documents) at ITU-T Study Groups, Focus Groups and related meetings it is possible to shape future standards. The whole standardisation process is "contribution-driven", as these form the basis for virtually all

Recommendations. Contributions by Chinese Sector Members and Administration grew six fold, from 97 in 2006 to 583 in 2009 (Levin 2010). Even more important than contributions is nominating representatives, e.g., to serve as Study Group chairs, vice chairs, rapporteurs etc. These officials form part of the management team for each Study Group and help progress the work. Nomination is a sign of respect for the contributions made by individuals over a number of years. Today, one Chinese representative is acting as Study Group Chairman, while eight seeve as Vice-Chairmen (Levin 2010).

### 5.1.2. Changing policy objectives

In this rapidly evolving context, the objectives of Chinese standards policies appear to have changed. In the early 2000s key objectives were 1) to reduce the costs of IPR licensing for Chinese manufactures and consumers, and 2) to develop technological capabilities, often via technology transfer. However by the end of the decade other objectives appear important:

1. ***Technological independence:*** Programmes of technological capability development are aimed at facilitating independence, and furthering national security aims
2. ***Demonstration of national capability:*** Flagship standards, such as TD-SCDMA demonstrate national capability on a global stage
3. ***Standards Export:*** There are far greater global ambitions, with export of 'Chinese' innovations and standards, and participation in global markets.

The development of AVS and TD-SCDMA are seen as important steps in developing national competence, and giving Chinese firms and standardisation bodies confidence to operate within the global standards processes.

### 5.1.3. Standards Implementation Policy

China has demonstrated a great ability to create single markets, based on a single mandated standard, that bring the benefits of scale that are crucial for creating standards-based infrastructures. This reflects the authority of the state to coordinate the efforts of diverse private as well as public players and the substantial investments dedicated to planning a number of key technology infrastructure projects (and it should be noted that two of our case focused upon large scale infrastructures: mobile broadband and mobile TV. Service innovation may be less amenable to such centralised initiatives). However, while national standards can be mandated in China, unlike voluntary standards in Europe, this does not always mean that single standards are implemented, as illustrated by the cases of AVS and Mobile TV. In the former there appears to be no formal policy to promote the implementation and adoption of AVS, and in the second, while there is national investment in CMMB standard, there continue to be regional alternatives. The Mobile Telephony/Broadband case demonstrates a deliberate (and perhaps unprecedented) decision to promote and implement three globally-competing standards rather than encourage or mandate the adoption of a single standard. This outcome – emerging after a protracted process - appears to balance a range of internally and externally oriented policy goals and constraints

A notable feature of the standards studied in these cases is the shere size of the Chinese market. European markets are not small but infrastructure deployments and markets are fragmented at the national level (despite the European Single Market policy) in telecommunications and broadcasting.

However, as the marked differences between these cases show, China's policies are not monolithic – China also has strong regional development policies that produce diversity and fragmentation. We found striking differences in tradition and orientation between the national Ministries involved too. As well as reconciling the specific goals of different parts of government which are being brought in contact as a result of technology and service convergence, Chinese policymaking grapples with tensions between the development of a globally competitive industry and securing internal goals, such as cheaper infrastructure and national security.

### 5.2. Intellectual Property Rights (IPR)

In creating national markets, and entering the global economy, China has made considerable strides in embracing practices of Intellectual Property development and protection. There are a number of important features of this process relevant to Standards-based Innovation. A regime of intellectual property rights applying to technology has developed rapidly over the last 10 years to bring it in line with the global IP regime. However, the administration and enforcement of IP legislation remains weak – hampered *inter-alia* by the shortage of professional experience. These weaknesses will only gradually be resolved.

1. In the past, European firms have complained of 'forced' IPR transfer to Chinese industry through joint ventures and non-payment of licences fees. Chinese players counter that there is no evidence for this. Our case studies show that foreign firms are willing to enter into licensing deals and even transfer IPR in order to gain access to Chinese markets. Practices that encourage technology transfer and low licence fees are likely to figure in the future as a way to 'level the playing field'.
2. Cross licensing among established players who hold essential IPR (patents on core technologies required by a standard) in a standard disadvantages newcomers and outsiders. This is still seen as a problem and disadvantage for Chinese firms. However Chinese firms and other newcomers are increasingly able to use their modest but growing number of 'essential' patents to enter foreign or global standards processes on more equal footing with established players.
3. Chinese organisations have become very active in patenting. Despite a limited prior patent base, China has become No 5 in the world for new patent applications (though uptake of these patents remains relatively low). As Chinese firms gain more and more IP relevant in global markets, Chinese policy (and IPR enforcement practices and public attitudes) is likely to become more supportive of the global IPR regime.
4. Chinese industry/state initiatives to reduce costs of IPR to Chinese implementers are likely to prove attractive to firms worldwide. One way Chinese standardization efforts may helpfully diversify the innovation ecology, opening up alternative technology development pathways to established global standards that otherwise be locked out.
5. Chinese public policy response to IPR arrangements from outside China

that are apparently disadvantageous to China will continue to emphasise Chinese interests. This may include making sure there is competition between standards, and discouraging single standards with disadvantageous IPR conditions.

6. Patent pools are being devised for Chinese-led standards, as they bring together multiple Chinese and foreign firms with complementary IPR assets. However these may vary from Patent-pool models developed elsewhere, and may provide alternate models for managing IPR in global markets that include China.

Again, China is in a process of change. International firms are embracing the protection of technological innovation at a global level, government, firms and lawyers in China are learning how to implement IPR a various stages of the innovation and commercialisation process: considerable attention should be paid to supporting these efforts and analysing their implications.

# 6. Conclusions

## 6.1. Complex and changing objectives of Chinese standards initiatives

The motives underpinning Chinese policies for innovation related standardisation are diverse. There has been a policy shift from lowering IPR costs and stimulating indigenous innovation capability towards:

1. Flagships projects to boost particular industries and overall confidence
2. Independent technology capability, aligned to security interests
3. Export and integration with global markets

## 6.2. Standards Implementation capability

The Chinese government maintains strong influence over standards implementation, especially in the field of infrastructure, where it is able to mandate standards, channel investment and directly intervene with state-owned enterprises. The Chinese government seeks to exert greater control over content and connectivity than has occurred elsewhere. These cases illustrate primarily mass market services and technologies, where ultimately the market cannot be assured. In other cases, where government procurement can build the market, implementation policies can be influential. Though there may be little scope for Europe to emulate these practices, the European Union and member states may need to attend to the importance of standards implementation.

## 6.3. Alternative Standards path

A clear message from these cases is that China engages with international innovation and standardisation processes, and builds national projects around them. The way it does this however, is defined by the particular technology and market. China will always be able to attract ‘losers’ in global standards competition to build alternative standards that satisfy Chinese business and policy objectives, primarily for the national market (though using the global standardisation and IPR processes to give legitimacy and export potential).

### 6.4. China and EU standardisation Policies compared

While China and the EU are clearly at very different stages of economic development, policy makers, standards bodies and firms in the EU and China are both facing a period of change, as important parts of industry are increasingly global, and using global standardisation processes, while policy goals that could be pursued using standardisation such as employment, industrial development, security etc remain at national or regional levels. In the EU, where standards have been a key building block of the single market policy, there are barriers to EU wide implementation policies, and in key sectors such as telecommunications, and broadcasting, national governments maintain control. In China the national government has much more power to set and align national policies, including for implementation, but certainly is not free of political difficulties in implementing them. As the cases show, a policy of building up and protecting national capabilities is not necessarily in the interests of consumers or industry. Table 4 compares the EU and China

| | Europe | China |
|---|---|---|
| **Objectives** | • Strengthening Single Market internally and extending it externally<br>• Development of Innovation capability<br>• Promotion of Competition in Single Market<br>• Varying Industry/employment policies | • Indigenous capability in innovation<br>• Development of more efficient and professional standardisation system<br>• Adoption of standards and IPR to Chinese context<br>• Export<br>• Technological Independence and security |
| **Standardisation** | • Mature, high experience<br>• Tackling shift from European to global SDOs and consortia<br>• Voluntaristic approach | • Immature regimes,<br>• Fast learning internally and via participation in global/international standards processes<br>• Government led, mandatory and regional standards |
| **Implementation** | • Voluntary standards adoption for ICT, but may recommend certain standards ,<br>• Subsidiarity makes centralisation difficult in some industries;<br>• Little state investment or direct control of industry | • Formal ability to mandate standards, and block non-confirming standards<br>• State ownership of many key enterprises;<br>• State can invest and re-organise industry to considerable extent; |

**Table 4 Contrasting the European and Chinese Standardisation contexts**

## 6.5. Challenges and difficulties in China

The interests of Chinese consumers are not necessarily best served by seeking to develop Chinese-led standards which may be less well-developed or superseded by globally-developed solutions. There is evidence from these cases that China's initiatives in this respect may be sufficient to lower licensing costs of foreign IP. On the other hand, the time it takes to mature the technology and deliver an alternative may be so long that the licensing costs of the original standard will anyway have dropped considerably on global markets as the market matures are new generations of technologies are launched. Policy makers will have to think hard on a case by case basis whether the gains of industries in being protected for a period might not have been achieved in other ways, without closing a market temporarily. Nonetheless, given the peculiarities and huge diversity of the Chinese market, this type of policy may well generate benefits, by bringing more adapted or cheaper products to large sections of the Chinese population.

Unfortunately it unlikely that this sort of policy will be rationally or centrally led. There is clearly an appetite for strong defensive policies among certain policy makers, as in all countries or regions. The balance of influence is changing,

and will need continued engagement by outsiders with policy makers and industry to both understand why and how policies are being set, when they might change, and to seek to influence and participate in solutions.

### 6.6. Policy Learning

As the previous point emphasises, policy is changing, but not necessarily towards alignment with 'European ideal practice'. The use of standardisation to meet policy goals and gain concessions from foreign firms and governments has been seen to work for the US and the EU, and the Chinese government has seen it work for them. However each technology is different, and the longer term policy goals are changing: lessons have been learnt as to the benefits and drawbacks of a Chinese standards.

### 6.7. Future challenges

There are a number of challenges surrounding standardisation and standards-related innovation. Our cases offer some important lessons. As the 3G to 4G Mobile Broadband case illustrates, technologies and systems evolve, providing a changing landscape for innovation and standardisation policy.

#### 6.7.1. A clear challenge is the shift to global standards and innovation arenas

This brings us back to the debate about the respective benefits and drawbacks of local versus global standards. We note in particular the emergence if a single global consortium for standardisaiton of next generation converged mobile technologies through the 3GPP consortium (discussed in more detail below). However while in some cases global standards are beneficial, for other technologies and systems, global standards are not necessary: for example, the majority of people do not watch TV outside of their own country. Indeed standardisation of ICT applications and services remains largely national and often occurs through informal processes. There are various factors governing the importance of local versus global innovation including the importance of local conditions, expertise, and the subsidiarity of technology to other factors such as content in the case of TV. Policy makers and firms must evaluate systems on a case by case basis.

#### 6.7.2. Emergence of new field for ICT Standardistion and innovation – Internet Platforms, Internet of Things, Internet of Services

The leading domains of innovation and standardisation are changing as technologies mature and new fields open. The growth area is services and platforms that span infrastructures and business, moving away from the low level hardware-based infrastructures.[4] There is a huge need for standardisation in these new areas, and for research that can identify issues of public policy concern. It is suggested that many services are highly local, but the platforms and service on which they are based are eminently transferable. While China is not seen as leading in services yet, Chinese firms

[4] For example, in telecommunications, the £3bn profits of Apple in the 1st quarter of 2010 from their smart phone software platform, contrast with Ericsson's profits of $180m during the same period.

and consumers are very active, and standards development in China will certainly be closely interlinked with global standardisation efforts.

While some technologies can be left to the market, infrastructures have important public policy dimensions. Issues of security, privacy, trust etc involve standardisation, but are also closely related to national and European legal and cultural regimes. China is likely to take different paths to Europe and the USA.

### 6.7.3. China is no more likely than Europe to be coordinated as a single market, single standard regime?

While Chinese policy makers have learnt a great deal about how to develop national, standards based infrastructures and simultaneously deal with internal and external policy goals, policy is seldom made by a unitary body, and policy decisions are seldom aligned with market and technology developments. It is just not possible to argue that China has a consistent set of policies and a stable environment for innovation and commercialisation of innovation.

### 6.8. Future Research Needs

It is important that European policy makers engage closely with developments in China, both in the processes of redefining the European standardisation regime, and in being able to support the maturation of the Chinese development and use of standards in innovation. This requires the continual building strong networks of policy makers, policy advisors and standards bodies.

The attempts by China to use standardisation in innovation and industry policy provides a way to reassess what the way the European regime operates. The emergence of global standards fora and consortia such as 3GPP, and newer bodies in emerging areas of ICT standards that are less tethered to particular regions, countries and industries presents a challenge for business and policy. Complex infrastructures of the future may arise through the configuration together of components innovated and standardised elsewhere, rather than through globalised standardisation and innovation efforts.

SDOs need to examine long term trends, such as convergence, growing importance of software and service platforms, and the growing power of patent pool organisations in shaping innovation, and how this will shape innovation and participation in standardisation over the next 10-20 years.

The role of China in promoting alternative global standards, in a period when single global standards might appear to be a trend needs closer attention with qualitative and quantitative analysis of the overall benefits for competition, innovation and welfare.

## 7. Policy Implications

The China EU IT Standards Research Partnership has made a number of policy recommendations, which have been published as a separate Policy Brief to inform European policy makers. Our key conclusions are:

### 7.1. The EU needs to attend to innovation and standardisation by China

- China is taking an increasingly active role in international standardisation, not only within existing processes, but able to initiate new standardisation processes and promote alternative technology development trajectories. Europe must recognise this as a challenge and an opportunity and work with China to further Europe policy aims.
- The European approach to standards-related innovation has been promoted as an alternative to the 'US way' in terms of organisation and policy. China is developing the capacity to be an additional centre (and perhaps a third model) of standards-related innovation with potential global impact.
- Due to the huge size of its market, and its ability to coordinate state and private players, China can generate internal markets to implement standards and create critical mass for export.

### 7.2. The EU needs an Integrated Policy on standards, innovation, IPR etc

- Europe requires a 'joined up' standards and innovation policy. As the EXPRESS report highlights, this is not facilitated by the fragmentation of responsibility between various European Commission Directorates General (including Competition; Enterprise and Industry; Information Society and Media; International Development; Research) and the European Standards Organisations (ESOs, which encompass EFTA and other non-EU states). A more active standards policy is needed that addresses standards implementation and the European role in global standards processes, especially in relation to emerging technologies.
- European policy actions on standardisation for innovation must make explicit engagements with China. There has been a range of important initiatives by the EU and ESOs, such as the China EU/EFTA Standardization Information Platform (CESIP). Europe needs to sustain and expand this activity, building upon these foundations. This needs to include continued support to allow European firms to gain expertise and experience in Chinese standardisation processes.

### 7.3. The EU needs to engage China

- It is a paradox that European and Chinese players both see standards and standardisation processes (in China and Europe) as barriers to market entry – for slightly different reasons (see Table 4).
- The EU and ESOs needs to extend and further develop their existing programmes in China encouraging formal standard-process capability and education. As China develops capacity and a distinctive tradition this should be seen as a mutual search for best-practice in standardisation, rather than a simple transfer of European expertise.
- The EU needs to work with China in seeking common public interests around media and communications and in *setting objectives for global standardisation processes*
- China will continue to use international standards bodies and consortia to further Chinese interests; this should be encouraged. Consortia in particular provide fora that foreign firms can have confidence in.
- Research and Innovation (R&I) programmes provide the input to standardistion processes: increased cooperation on international R&I

collaboration will help align interests of corporate players and build consensus.

### 7.4. Issues for the EU and China: the changing global standardisation environment

- Some Chinese multinational organisations have become fully involved in global standards consortia. However smaller firms from China (and Europe for that matter) find it difficult to gain access. There is a need to make standards consortia more accessible.
- Strong global standards consortia can promote global alignment and reduce innovation uncertainties – and it may be beneficial for them to continue from one standards generation to the next (though existing standards processes and SDOs may not continue to be the most important in the future). The EU must support the development of standards processes for future Internet platforms and services that further European goals. This will include opening them up internationally and ensuring that they are attractive to China-based industrial players and Chinese policy makers.

### 7.5. IPR Policies

- There is a need to encourage the setting of IPR licensing levels differently in different economies, such that costs are appropriate to local markets.
- Patent pools are expected to have an increasingly powerful effect on innovation - both positive and negative. Attempts are being made in China to develop 'China-friendly' patent pools, and European policy makers must engage with this process.

### 7.6. Developing countries policy

- Europe must develop a better understanding of how developing countries could become engaged in global standardisation processes and help them move up 'the standardisation ladder. China could be an exemplar and a leader in the developing world, for example by e.g. supporting low cost standards.

## 8. Project Identity

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**For further information**

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