SPICE

Scanning the Potentialities for Future ICT Research Collaboration between China and the European Union

China - EU constituencies and potentialities for deeper strategic cooperation

SPICE consolidations and recommendations

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SPICE consolidations and recommendations

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The SPICE project partners are:

1	eutema	eutema Technology Management GmbH, Austria
2	CSTEC	China S&T Exchange Center, P.R. China
3	Skillnet	Skillnet GmbH, Germany
4	CATR	China Academy of Telecommunication Research of Ministry of Information Industry of P.R.China, P.R. China
5	CHTF	China Hi-Tech Transfer Center, P.R. China
6	Skill Sh	Skillnet Consulting (Shanghai) Co., Ltd., P.R. China

Content List

Introduction

This final report of the SPICE project summarizes the results and recommendations concerning Sino-European research co-operation in the area of information and communication technologies. These results were collected during the 21 months of the project starting in November 2007. The main objective of this report is to provide concluded insights into past co-operation experiences between Chinese and European ICT R&D players, introduce potentially attractive ICT topics for further joint research activities, as well as to provide a set of recommendations for future strategies, EC initiatives, and regulations regarding ICT R&D cooperation with China. The insights of this report are completed by several other reports that have been prepared within the SPICE project.[1]

In this report, we first introduce into the overall SPICE project, its aim, approach and process and into the consolidation presentation on July 9, 2008 in Brussels which was the final presentation before resuming the final results. The discussion and remarks have now been compiled into this final version of the report on the "China-EU constituencies and potentialities for deeper strategic cooperation".

Next, the ICT sub-areas with high potential for EU-Chinese research collaboration are listed and introduced. In a further step, a regional assessment of China's ICT R&D landscape is summarized and exemplary mapped organizations/constituencies are introduced. Naturally, for a country the size of China, only a crude overview is possible here. Finally, the SPICE recommendations for possible strategies and contents of future initiatives and regulations of the EC are consolidated based on the set of success factors and critical conditions that were identified throughout the project.

[1] For more information see www.ict-china.eu

1 The SPICE Project

Aim

The aim of the SPICE project was to identify and analyze potential topics of R&D cooperation within ICT between Europe and China in order to create a basis for future EU-China collaboration in information- and communication technologies and provide a basis for decision-making and inspiration to the European Commission (EC) for future R&D initiatives. Moreover, concluding recommendations for deeper strategic cooperation were to be identified to be considered for further proposals of the upcoming 7th Framework Programme to initiate and deepen research collaboration between Chinese and European organizations.

Approach

To create this basis and the recommendations, SPICE identified the most promising areas of ICT and mapped important players, cooperation and potentials in those areas. Moreover, hurdles, barriers and cornerstones that should to be addressed before European players engage in R&D cooperation with Chinese players, were analyzed to identify the needs and opportunities of cooperation.

Information was gathered through studies, analyses and benchmarking exercises and assessment and monitoring of the market; through consultation at conferences, workshops, seminars, and targeted interviews with Chinese and European industry players, academic representatives and authorities. Constant dissemination and transfer of the project results completed the bi-directional flow of information.

Process

The SPICE project started on November 1, 2006. The project duration was 21 months until July 31, 2008. The project was structured in five work packages (WP) which then again are each divided into several tasks. Despite the separation into several work packages, almost all steps of the SPICE project process have been closely linked e. g. interdependencies between tasks and tasks with bi-directional feedback loops and inputs. In the following, the five work packages are briefly introduced:

WP1 – Analysis & Mapping of ICT in China: In WP1 the methodology and requirements for the mapping of the Chinese ICT landscape were defined. Aside from the ICT areas, this work package mapped relevant and potential research intensive actors in ICT. At the end, the results will be consolidated into recommendations for the European Commission.

WP2 – Consultation in China: This work package focused on establishing communication with Chinese players and authorities to firstly gain insights and collect information (ICT strengths of Chinese players, potentials in the divers ICT sub-areas, opportunities in terms of collaboration, R&D funding programs, international cooperation issues) but also to inform them about the results of the SPICE activities.

WP3 – Information Collection in Europe: Similar to work package 2, this work packaged also focused on collecting information and spreading SPICE results, but in Europe and with European players. Overall objective here was to learn from previous and already existing research initiatives of European organizations with Chinese partners.

WP4 – Information Dissemination: Complimentary to the above mentioned work packages; SPICE disseminated relevant information throughout the project duration to relevant European and Chinese players. It was essential to reach high-potential Chinese industry players and research organizations as well as representatives from large European companies interested in research collaboration with Chinese players.

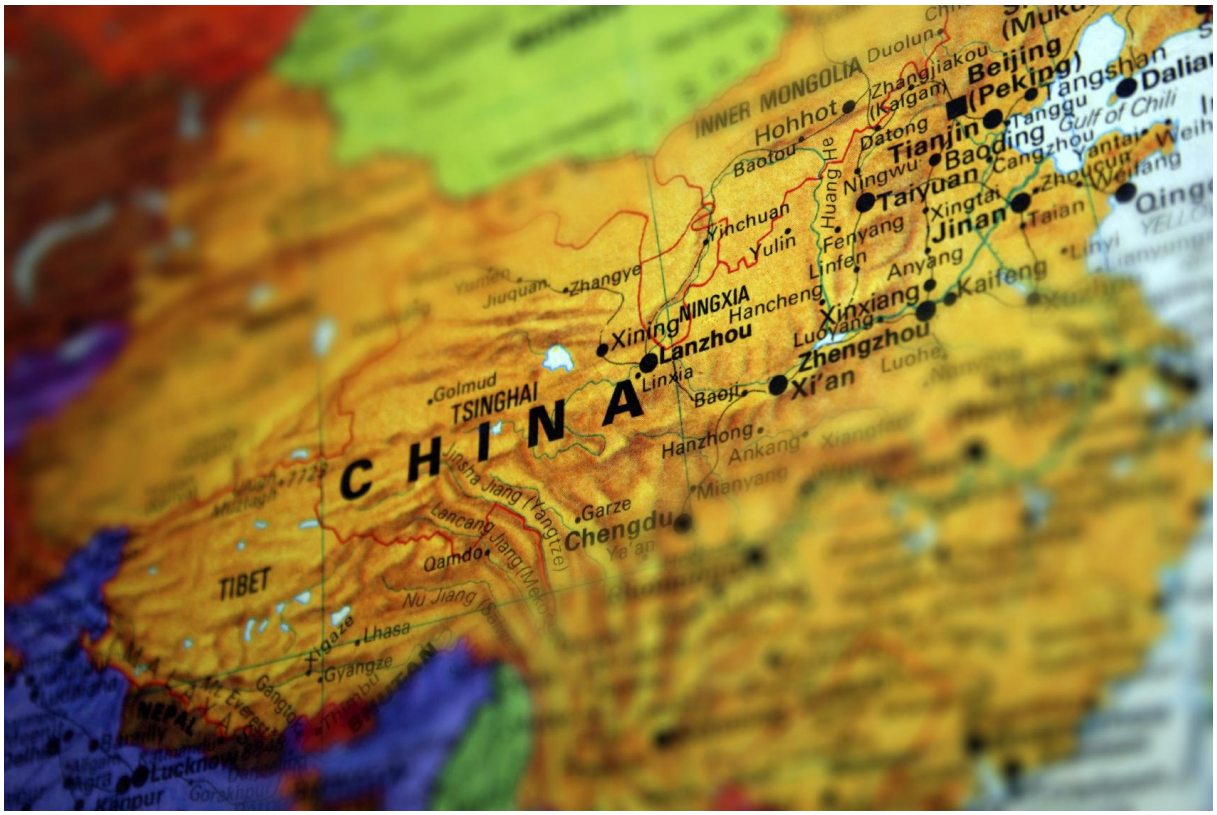
WP5 – Project Management: Work package 5 included the overall project management – control of overall project activities, ensuring quality, SPICE website set-up and maintenance etc.

Report on the consolidation presentation

During the project, numerous deliverables were prepared and handed to the European Commission. As a final step, results from the information collection and analysis were further consolidated and translated into more generic conclusions for the EC.

Those results have been presented to the EC and relevant officials for ICT R&D cooperation between China and the EU during the consolidation presentation on July 9, 2008 in Brussels, Belgium. It was organized jointly by eutema, Skillnet Germany, and the European Commission DG INFSO (Directorate General for Information Society). The purpose of the event was to inform about major results of the SPICE project and to stimulate a discussion about the recommendations to the European Commission. A large number of Commission representatives from DG INFSOand other DGs (RESEARCH and TRADE) as well as Chinese representatives attended. Interest was big and the European Commission appeared particularly interested in the role they play and could play in ICT R&D with China. They want to know, what outcome or benefit there is for the European players, the European RTD base, or the EC. The participants engaged in intense discussions about the project outcomes with the presenters but also with each other.

The outcomes of the consolidation presentation were then collected and compiles with previous project results into this final report on the SPICE report on the "China-EU constituencies and potentialities for deeper strategic cooperation". The two main topics are the ICT sub-areas with high potential for EU-Chinese research collaboration and SPICE recommended strategies and contents of future initiatives and regulations of the European Commission.



2 ICT sub-areas with high potential for EU-Chinese research collaboration

In some disciplines of ICT, China has been involved since the initial stage. For instance, the Chinese Society for Electrical Engineering was already founded in 1934. Originally, all technology development was initiated and guided by the government. For example, the development of several new technologies including computational technology (computer, programming, computational mathematics) was proposed by Zhou Enlai who guided the "10-year technology planning" in 1955. Following, the Institute of Computing Technology Preparatory Office then was established in 1956.

Today, the government maintains significant support for the ICT industry; e. g. since 2000, the IC industry is supported by the Ministry of Science and Technology as a major national project. Also, as an important example, the main projects of the 11th 5-year-plan (2007-2012) will focus on further research and development in mobile telecommunications such as industrialization and research of wideband wireless access, 3rd generation network, beyond 3G, next generation network, optical network, intelligent information processing, ubiquitous network, family network and intelligent terminal.

In other areas, China started relatively late and is still in a rather early stage, for example research on multi-modal interfaces or telematics. But although China has been lagging behind western countries in certain research fields, it tries to catch up and adapts to general international market trends. For example, in the field of artificial intelligence, China has achieved significant results and showed breakthroughs in some specialized fields in the last years.

As another example, China's embedded systems market has become a major driving force in the development of China's electronics industry, following for instance the growing importance of smart phones. Further aiming at international markets, some ICT areas such as software technology have become a key to take a leadership position in the international industry in the future. Hence basic research is an important component of the country's competitiveness.

In order to enable a timely and comprehensive assessment of the specific relevant ICT areas that would be analyzed during the SPICE process, the SPICE team broke the ICT-field down into 25 sub-areas based on established categorization in the area and expert opinions.

Throughout the process those sub-areas were identified, mapped and analyzed (reference: D1.3.1 and D1.3.2). In a further step to identify those areas with explicit strategic potential, SPICE applied 5 criteria (business potential, research potential in China, joint EU-China policy challenges, opportunities for joint standards, Chinese interest) to the sub-areas. Accordingly, SPICE narrowed down the list of ICT sub-areas to 11 areas that are recommended to the EC to focus on in the future and that were presented to the EC in the consolidation presentation.

Despite the categorization into sub-areas, the terminology and question of what sub-categories fall under which sub-area, always remain an issue for communicating and makes it difficult to find a common base of understanding as was also noted during the consolidation presentation. Naturally some EC officials requested more information about their specific areas. SPICE could only offer rather general information about the different areas in this event. More details are available in the voluminous project reports.

Following is the list of the ICT sub-areas which SPICE recommends for EU-Chinese research collaboration.

2.1 Electrical Engineering & Electronics – Nanoelectronics

There is a high research potential in the area of Nanotechnology in China. Nanoelectronics is also an area that is high on China's policy agenda, since it will be a priority topic area for international cooperation of the People's Republic until 2020. Nanoelectronics as a separate term should consequently receive special attention when scanning the Chinese potential in R&D around nanotechnology.

Nanotechnology/nanoelectronics thus could be an interesting area for joint research in selected nano-sub areas, e.g. medical fields, where RMB 620m funds are scheduled for 2006-2010 by the Chinese government. The business potential is estimated to be rather high.

2.2 Information Processing, Information Systems - IT Security

The IT security market in China is expected to grow about 20% annually, so there is a very high business potential due to the driving need for the society and companies to implement IT security solutions and the government's leading and promotional position. At policy level, IT security for core sciences is a declared a development priority in the People's Republic in the time period from 2006 to 2020. It has to be noted that R&D in IT security is potentially very interesting, but also politically sensitive in any cross-border R&D cooperation. Consequently the European players are especially concerned with the involvement of the Chinese government and would like to gain more insight in that.

2.3 General Informatics

General Informatics (i.e. mostly the area of standard software) is potentially interesting as a basis for accessing into Chinese markets, but there are huge challenges expected. At policy level, software will remain an area for international cooperation from 2006-2010 and software for modern industry development, e.g. finance, logistics, e-education, emedia, tourism, e-government, e-business etc. is a core business of the Chinese information industry and therefore a development priority in 2006-2020 as well. International R&D centers between multinational companies and Chinese players have already been set up.

2.4 Communication Technologies - Radio Frequency Identification (RFID)

China has become the world's largest RFID market by value and is actively promoting R&D in RFID. Sensor networks (using RFID for an example) and intelligent information processing is a development priority in 2006-2020. The SPICE workshops also confirmed that there is a strong interest in co-operation from both sides already and there is a wide range of co-operation opportunities from standards to interoperability, but also global value chain show-cases (e.g. in logistics) and joint international research cooperation on selected topics.

2.5 Mobile & wireless communication technologies

There is a huge market for this topic in China and strong interest from the EU side, e.g. on large-scale test beds. This has been also confirmed by EU and Chinese experts in the SPICE workshops. Joint research and standards appear as a good starting point for further cooperation in the market. Topics in China are New Generation Reliable Network and New Generation Broadband Wireless Communication as areas for international cooperation from 2006-2010. Also, key technologies and services for next generation networks is a development priority in the time period from 2006 to 2020.

2.6 Distributed systems

Within the field of Distributed Systems, especially Grid technologies are a promising area. There has been good co-operation already in the past on the basis of EU calls in IST. The Chinese government significantly supports Grid projects financially as well as politically. Grid is an area for international cooperation in the People's Republic from 2006-2010.

2.7 Telecommunication

Telecommunication (i.e. wireline telecom) is still a growing market in China. Although the government supports R&D in telecommunication and encourages domestic research institutes/universities and industry players to focus on R&D; the R&D potential is still rather unclear. Joint research and standards can be a good starting point for further cooperation in the market.

2.8 ICT for Energy Efficiency

SPICE launched a dedicated analysis into the area of ICT for Energy Efficiency as a potential topic of future co-operation. Rapid urbanization and industrialization – however with low-tech technology – are two of the main reasons, as to why this area is of increasing importance in China. It is a comprehensive topic and can be looked at from several ICT-relevant point-of-views (e. g. GRID focus, hardware focus, software etc.). Within the SPICE project, the focus was mainly on enabling technologies. Although it was rather challenging within the SPICE project to attract Chinese researchers in this relative specific field, there seem to be good collaboration opportunities based on the fact that this field really responds to a joint EU-China challenge. With the implementation of energy-saving and energy efficiency as a major task in the 11th Five-Year plan (2006-2010), this area is strongly supported (and regulated) by the Chinese government. The field will remain a major challenge in the EU and China for at least a decade and collaboration could also open markets for EU players.

2.9 Embedded Systems & real-time systems

This field is rapidly developing. Growth rates of up to 30% for the embedded market are predicted. Co-operation should be examined closely in areas with high growth rates such as automotive embedded systems or consumer electronics, e.g. in tools for embedded systems.

2.10 Microelectronics & integrated circuits

There is a high potential only in selected areas. At policy level, high performance CPU & computer, large scale integrated circuit design and manufacture are areas for international co-operation in the period from 2006 to 2010 in China. High efficient and reliable computers and high resolution LCD are development priorities in the time period from 2006 to 2020. The Chinese government is encouraging enterprises and research bodies to participate in R&D in internationally oriented joint projects to establish an international position.

2.11 Medical informatics

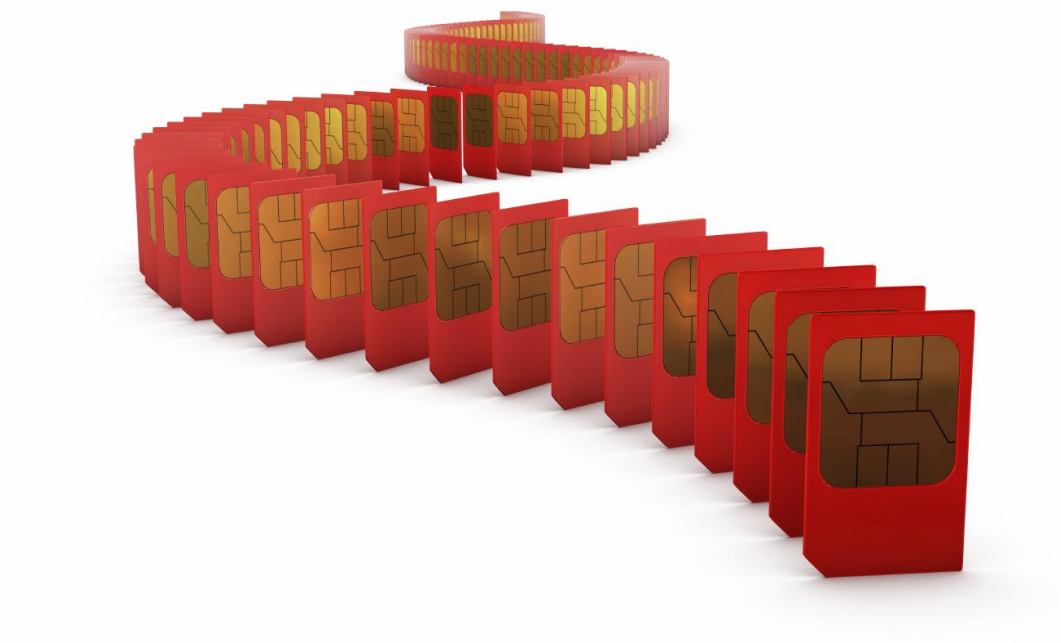
It is expected that China will become the world's second largest medical market in the next five to ten years. There exist joint policy challenges in this area such as increasing costs of healthcare, ageing population, and ICT for people with disabilities. In particular, cooperation in more application oriented areas seems promising as this topic is gaining more and more importance in China.

2.12 Network and Electronic Media (NEM)

Apart from the 11 recommended ICT areas with R&D potential in China, SPICE performed a dedicated analysis of the area of "networked and electronic media" (topics as listed in the NEM technology platform) and analyzed China's potential in this field. Several areas that also belong the NEM categorization have been identified and analyzed in the previous SPICE process and were considered for the recommended areas.

Network and Electronic Media (NEM) in China is mostly branded "Home Network". China follows a similarly holistic approach similar to the NEM approach of the European Commission. Several alliances and working groups have been set-up, partly established by the industry, partly supported by the Chinese government. R&D in Home Network is pushed; several standards and patents have been developed and

issued. International cooperation are of interest and do exist but currently mostly in the Asian market. It will be a challenge to evaluate the final potential for R&D cooperation with European players in the near future but Home Network/NEM is an important & relevant topic in China and is supported accordingly from the Chinese side.



3 Regional assessment of China's ICT R&D landscape and profiles and competences of mapped organizations/ constituencies in China (exemplified with selected examples)

In a first approach, SPICE created a geographical map of the regional spreading of China's ICT R&D landscape (see map in the annex). This clearly shows that while ICT related research institutes are now spread all over China, some of the most important R&D centers are still in Beijing and Shanghai. Beijing's top three research institutions that are active in the field of ICT are: Beijing University (software, databases, IT security, multi-modal interfaces, mobile telecommunication, audio & HLT, photonics and quantum informatics, information systems), Tsinghua University (semiconductors, nanotechnology, electrical engineering, formal methods, visual computing, audio & HLT) and the Chinese Academy of Sciences (microelectronics, semantic systems, audio & HLT, nanotechnology, medical information).

In Shanghai, Shanghai Jiaotong Unversity (formal methods, visual computing, mobile telecommunication), Tongji University (mobile telecommunication) and Fudan University (microelectronics, information systems) take the lead in ICT R&D.

Outside of these centers, cities like Harbin, Wuhan or Tianjin also host important institutes and research labs that are focusing on ICT. For example, the National University of Defense Technology in Harbin (distributed systems) and the Harbin Institute of Technology (audio & HLT, artificial intelligence); Wuhan University (telematics, visual computing) as well as the Huazhong University of Science and Technology (nanotechnology, IT security) in Wuhan; and the Nankai University (robotics, mobile telecommunication, photonics) and Tianjin University (electrical engineering, visual computing, information systems)

both located in Tianjin, host nameable R&D centers in ICT.

Other significant institutes outside of Beijing and Shanghai are the Guangzhou Institute of Logic and Cognition at the Sun Yat-sen University in Guanzhou, the University of Science and Technology in Hefei (photonics and quantum informatics) or the Zhejiang University (electrical engineering, visual computing).

The ICT provider landscape follows the same pattern. While the majority of ICT related providers are found in Beijing and Shanghai, other important players are spread all over China, mostly in second-tier cities, e. g. in Hangzhou, Nanjing, Qingdao, Shenyang, Shenzhen, Wuhan, Wuxi, Xi'an, Xiamen and Zhuhai.

Despite of a rough geographical mapping of China's ICT R&D landscape, SPICE refrains from defining specific ICT R&D relevant regions as R&D cooperation is mainly conducted on the basis of a dedicated field within ICT rather than a regional choice. Consequently, potential cooperation partners are chosen based on their relevance in R&D market rather than their location.

Based on these insights, SPICE continued to identify and analyze the sub-areas of ICT (as discussed in agenda point 2) and mapped the relevant players in each field.

As it will not be possible to list all mapped organizations in this summary report due to its consolidated scope, the following excerpt introduces selected relevant players from the academic side (universities, research institutes, departments etc.) and industry side (commercial companies) in China. They are briefly profiles and their relevant competences listed. More details on further academic and industry players can be found in the SPICE reports D1.3.1 and D1.3.2.

3.1 University players

3.1.1 Shanghai Jiaotong University (SJTU)

Ranking number 7 of the TOP 100 universities with ICT-strength, a number of SJTU's disciplines have been advancing towards the world's first-class level, such as communication and electronic systems, naval architecture and ocean engineering, automatic control, composite materials, and metal plasticity processing. Different areas of SJTU have occupied an important position in the country, such as large-scale integrated circuit, computer science, optical fiber technology, and systems engineering. Among SJTU's 20 academic schools the following are to be considered in the area of ICT: the schools of Naval Architecture and Ocean Engineering, Mechanical & Power Engineering, Electronics & Electric Engineering, Material Science and Engineering, Sciences, Life Science and Technology, Civil Engineering and Mechanics, Media & Design, Micro-electronics, Information Security, and Software. SJTU has been mapped for SPICE in the areas of formal methods, visual computing, mobile telecommunication and nanotechnology.

There are 60 undergraduate programs, 152 masters-degree programs, 93 PhD programs, 16 post-doctorate programs, 16 state key doctorate programs and 14 state key laboratories and national engineering centers. SJTU boasts a good number of famous scientists and professors, including 22 academicians of the Academy of Sciences and Academy of Engineering, 31 "Changjiang Chair Professors" and more than 1,420 professors and associate professors.

SJTU has also been engaged in R&D cooperation with domestic and international players. One example in the area of nanotechnology, is the cooperation on nano-nucleic acid diagnostic reagents between Shanghai Jiaotong University, Shanghai Allrun Nano Science & Technology Co.,Ltd., and the German Invitek GmbH. Another example is the UDS-SJTU Joint Research Lab for Language Technology that is the result of the long-term cooperation between SJTU and the University of the Saarland (UDS), German research center for artificial intelligence.

3.1.2 Tsinghua University, Beijing

Beijing's Tsinghua University (School of Information Science and Technology) is ranked number 1 of the TOP 100 universities with ICT-strengths in China and has been mapped for SPICE related R&D activities in semiconductors, nanotechnology, electrical engineering, formal methods, visual computing and audio & HLT.

Currently, the university consists of 44 departments distributed in 11 schools, including the schools of sciences, architecture, civil engineering, mechanical engineering, information science and technology, applied technology etc. With a legacy accumulated over the past 90 years, Tsinghua has retained its character while promoting scholarship research, ensuring academic and educational prestige in China and abroad. The university currently has over 7,100 faculty and staff, with over 900 full professors and 1,200 associate professors, including 24 members of the Chinese Academy of Sciences and 24 members of the Chinese Academy of Engineering.

Tsinghua university has many ICT related departments and institutes like the Research Institute of Information Technology (RIIT) which is part of the School of Information Science and Technology (SIST) (major force and central base of Tsinghua University's research and development effort in information technology incl. SPICE relevant topics wireless communication technologies, embedded systems, IT security etc.); the Tsinghua National Laboratory for Information Science and Technology (covers fundamental theory of information science); the Institute of Microelectronics (main research area is integrated circuits and related applications); the Robotics and Automation Laboratory in the Department of Precision Instruments and Mechanology (conducting research of robotics technology and related

research); the Sub-lab of HCI and Media Integration, Laboratory of Intelligent Technology and Systems (focuses on the research of distributed HCI, multimedia information processing and media integration) and the Speech and Language Technologies R&D Center (which develops advanced speech and language processing technologies).

Tsinghua university is also positioning itself on an international R&D level. As a co-founder of the National Center for NanoScience and Technology (NCNST) Tsinghua owns about 115 patents of the round 2,000 international nanotechnology patents that China announced.

Tsinghua is also open for national and international cooperation with industry players. For instance, a joint venture with Shenzhen Sware Computer Company has been set up and R&D cooperations with ZTE, Potevio, and US International Rectifier Corp. exist in various areas.

Moreover, in 1994 Tsinghua University established the Tsinghua Science Park which offers its services to high tech and R&D companies, becoming the home to both domestic and foreign start-up businesses.

3.2 Industry players

3.2.1 ZTE Corporation (Shenzhen, Guangdong)

Shenzhen based ZTE corporation is one of the Top 100 Electronic and Information Business in China and has been mapped for SPICE amongst others in software engineering, IT security, mobile & wireless communication (ZTE is a member of the TD-SCDMA Industry Alliance), telecommunication, and embedded systems.

Founded in 1985, ZTE is China's largest listed telecoms manufacturer with shares publicly traded on both Hong Kong Stock Exchange and Shenzhen Stock Exchange. ZTE has become China’s most important equipment provider in the telecommunication market. About 10% of the annual sales revenue is invested in the funding of R&D and almost 50% of the staff (~15,000) is involved in R&D, thereof 6,000 focus on R&D in 3G. ZTE currently owns some 700 patents, with more than 87% of these being original innovations.

ZTE established its first three foreign R&D centers in the US and Chile in 1998 and has up to now established 14 research centers in various countries. ZTE also took the lead in drafting the international standard for telecommunication security and even holds the positions of co-chairman on two ITU-T working groups and editor of ITU-T standards including NGN, optical transmission and network security.

Strategic cooperation agreements with leading international telecom giants such as Portugal Telecom, France Telecom, Alcatel, Ericsson and Nortel in NGN and mobile systems, with Hutchison in 3G, and with Marconi in optical transmission systems have been established. Still, so far in most cases it is cooperation regarding application based R&D for overseas customization.

3.2.2 Inspur Group (Jinan, Shandong)

Inspur Group is one of the earliest enterprises engaged in IT industry in China, and also the largest provider of application and resolution of IT industry in China. Inspur has two stock companies, "Inspur Information" and "Inspur Software", and many subsidiaries. Its business covers many industries such as PC, server, tax controlling machine, communication products, information security, software outsourcing, as well as service, application software for finance, ERP, E-government, tobacco and circulation, etc.

For SPICE, Inspur has been mapped among others for the field of distributed systems and energy efficient ICT. For example, Inspur Group has won 8 patents, 14 copyrights, 5 international new records, and 7 international certifications in the field of high-performance server (Grid Computing field).

As mentioned before, Inspur is an important player in the area of ICT for energy efficiency. For instance, in April 2008 server products developed by Inspur have already passed the internationally accredited energy-saving test SPEC-Power-SSJ-2008. SPEC-Power-SSJ-2008 is an industry standard benchmark to assess energy and performance characteristics of servers. The Standard Performance Evaluation Corporation (SPEC) hereby defined a standard to measure energy consumption and server performance. Moreover, Inspur established a server technology key laboratory, an enterprise technology centre, post-doctoral workstations and an overseas R&D center aiming at R&D of sustainable technologies and systems. Inspur has also established domestic cooperation with universities such as Shandong University (for the establishment of the Shandong high performance computing center), Xi'an Jiaotong University (for developing a new network server), and Beijing University of Post and Telecommunications. In the international field, Inspur has improved its technology to an international level by setting up joint ventures with LG and Ericsson and establishing strategic cooperation with Intel, IBM, EDS, Hitachi, OKI, EMC, and SAP.

4 Recommendations for strategies and future EC initiatives and regulations

4.1 Ways of collaborating

Briefly, ICT R&D cooperation between China and the EU can be separated into four basic cooperation combinations. The Chinese and European partners are either academic players or industry players cooperating with either partners with academic or industry background.

A majority of foreign players is cooperating and interested in cooperating with a Chinese university as research partner. Most of them aim at well-known established universities that have already built up a good reputation, administrative system, receive government support and maybe even have experience with international R&D cooperation.

Assigned joint research projects are still the most popular business model for cooperation. This includes models like contract-based collaboration or the setting up of project specific consortia. Another form of collaborating is a joint-venture. Although setting up of joint ventures requires a longer-term oriented approach, this form of collaboration is increasingly gaining popularity because of its lasting character.

Concerning the type of research, most of the academic players are engaged in basic research and applied research while it is more common among industry players to engage in application oriented development and product development.

4.2 Strategies and recommendations

Throughout the SPICE project many interviews with relevant ICT industry and academic experts with Sino-European R&D experience were conducted to identify existing hurdles, threats and barriers and analyze potentialities, success factors and opportunities. Based on the findings of critical characteristics and success factors of European-Chinese R&D collaboration a set of strategic ideas and recommendations of future initiatives and regulations of the EC have been collected, consolidated and created. These recommended strategies and contents should be considered by the EC when setting up future initiatives and regulations regarding Sino-European ICT R&D cooperation.

At the consolidation presentation in Brussels, those consolidated strategic recommendations were presented and discussed with the attending representatives. The results clearly pointed out that business considerations were a strong driver behind most co-operations with China. Following the presentation of the SPICE recommendations, the discussion largely focused on the degree to which research rather than business aspects should be at the focus of DG INFSO priorities. Members of the SPICE consortium and industry representatives present at the meeting pointed out that indeed non-research topics such as standardization and aspects of human resources are of key importance.

4.2.1 Create a virtual cooperation market place

The exchange of knowledge and R&D insights is the most important success factor for the Chinese R&D players. Exploring unknown science and technology fields is one of the biggest drivers of R&D cooperation with international partners especially for the Chinese side. Accordingly, they look for cooperation partners with previous R&D experience. International R&D cooperation between China and the EU could be better implemented through a jointly developed technological platform, which functions as a virtual cooperation market place to facilitate the search for R&D partners from China and the EU. Such a platform should include features such as a search tool to help Chinese and European ICT R&D players to find potential partners, relevant contact details to create a community to connect and exchange, and further information for joint R&D projects. Such a market place can also create access to highly

qualified human resources which is also very important in that context for the Chinese side but also for Europeans. Especially against the background of a growing number of highly qualified ICT experts and researchers, European players start R&D cooperation for the exchange of know-how and new research insights. Transparency and quality should be the main principles of the platform to ensure a high-quality network and database.

Instruments to implement this recommendation include a web portal to facilitate access to existing initiatives (such as DG RTD's planned researcher exchange platform), search tools, and social networking tools for the exchange of academic and industrial co-operation experiences.

4.2.2 Consider mid-term and long-term oriented strategies

This kind of platform can also help to establish mid-term and long-term oriented strategies which become increasingly important for substantial results and business. This way, the EC could explicitly support and encourage the establishment of a joint research center in promising areas of ICT research.

Research throughout the SPICE project has shown that more and more players from both sides (China & Europe) already increasingly regard R&D cooperation under a long-term perspective. They hope to improve their competitive position in the international R&D market and leverage their level of international R&D structure and eventually be a part of establishing a standard or a unique selling proposition in a joint project and a promising market. Moreover, a long-term oriented engagement can help to deepen cooperation with developing projects further for potential follow-up R&D cooperation or even business cooperation and establish an international network of contacts. Especially for the EC it is important to understand that R&D with China is not a one-way approach for EU companies to completely (incl. production) transfer to China. It is very well possible for a European company to return to Europe after a learning process in China. This is particularly feasible for areas with highly mechanized or automatic production.

Instruments to realize longer term strategies include dedicated collaboration on standards, fostered exchange with industry associations in Europe, and dedicated contact points for EU ICT co-operation with China.

4.2.3 Connect strategic ideas & cooperation between China and the EU

The idea of such a virtual cooperation platform was also favored by the EC, not only to facilitate access to EU R&D projects for Chinese partners and vice versa, and to provide a tool for the EC for the selected funding of promising projects but provide a platform to connect strategic ideas and cooperation between China and the EU.

4.2.4 Create targeted initiatives in relevant ICT sub-areas

Of similar importance for the EC is the joint creation of targeted initiatives in relevant sub-areas of ICT, amongst others in order to enable a mid- and long-term approach towards Sino-European R&D cooperation. To develop those initiatives it was suggested to also consult relevant professors, scholars, researchers in those sub-areas to identify the specific needs and potential.

4.2.5 Improve IPR standards and regulations

IPR standards and regulations are constant issues when dealing with R&D cooperation with China and can influence the set-up and intensity of collaboration between the partners. Those often government-backed/legal standards or regulations for IPR topics in ICT R&D between the EC and China do not exist yet. Consequently, especially many European companies are very careful about sharing sensitive R&D know-how with all of their Chinese R&D collaboration partners. Problems and issues around IPR were mentioned

throughout the process of the SPICE project and but were not very often considered as serious risk factor in a collaboration. During the consolidation presentation, the fact that in the interviews, intellectual property rights were not considered the major problem seemed to surprise many participants in the meeting. But as already stated in the SPICE reports, IPR issues are in many cases thoughtfully considered by the companies going to China and thus in practice create less of a problem. By setting up a special ICT R&D related framework of IPR standards and regulations to provide guidance for collaboration and prevent restricted exchange of know-how due to non-defined IPR regulations, the EC could support R&D collaboration. Moreover, on policy level it would be helpful to establish "general cooperation standards" to avoid costly negotiation for every details in each project. Nevertheless, as also noted at the consolidation presentation, it will be rather difficult for the EC to influence such a sensitive and complex issue, especially due to the high involvement of the Chinese government in that area.

4.2.6 Simplification concerning administrative issues

Similar to the problem with insufficient IPR standards and regulations, R&D cooperation between China and the EU often are hindered by other external issues such as administrative issues (e .g. papers, documentation, distribution of funding, exchange of human resources) or market restrictions (e. g. export restrictions or agreements). Feedback from the interviews with industry and academic players who are actively engaged in R&D with China definitely showed that there is a necessity to simplify and accelerate administration and lower some restrictions to facilitate the exchange of researchers, know-how, technology etc. within Sino-European R&D cooperation. Often the exchange of researchers, especially for Chinese researchers going to Europe, is limited due to existing travel regulations (e.g. concerning visa issues) and impedes sufficient cooperation on an organizational level. Some EU countries require hosts of Chinese researchers to provide broad guarantees for Visas, further hindering the exchange of researchers. Restrictions of the Chinese market and insufficient support of the Chinese government form a comparably big hurdle. Some areas of ICT are rather sensitive areas for the Chinese government. Consequently, the government intends to protect those areas and supports domestic players to get involved in R&D. But at the same time it sets up policies that restrict foreign players to access R&D collaboration in certain sensitive areas and limits access to information and the relevant contact network.

The representatives at the consolidation presentation agreed on a certain need of process standardization but did not see that issue as a primary focus area of the European Commission. Setting up a relevant virtual cooperation marketplace (platform) though might help to influence the standardization of processes (for instance application process).

4.2.7 Bridging the cultural gap

One of the most essential issues for successful Sino-European cooperation is the "cultural bridge" – a common awareness and understanding of cultural differences and the willingness to overcome those and "bridge the cultural gap". Despite a common interest in ICT R&D intercultural differences and language barriers often lead to misunderstandings between the R&D partners and hinder an efficient project progress and workflow. While language differences might be solved with an interpreter, without a common cultural (and also political) understanding, the structure and system of networks and relations could be misinterpreted and form a major threat for successful R&D cooperation.

Interestingly enough, the research also lead to the conclusion that, there is a certain asymmetry concerning cultural barriers: while many Chinese experts are relatively well informed about EU and US research systems and policies, only few EU experts have a thorough

understanding of the Chinese system. Even though many interviewees mentioned difficulties in cooperation due to differences in cultures, the topic was not within the major focus of most participants in Brussels. But it was agreed that a common goal to jointly connect strategic ideas and knowledge and setting up a platform and community to exchange, might help to improve mutual understanding and create awareness that not only languages and cultures differ but that there are also different structures and models of networks and relations. Moreover, a dedicated focus on searching R&D staff with a "double culture" background might be a first step to overcome the intercultural gap and set-up a "small bridge" within a project. A well-working project internal diversity can be the stepping stone for creating an efficient diversified collaboration environment. Viable instruments to correct the current asymmetry are the training of more EU ICT researchers in China and fostered exchange visits of European scientists to China.

4.2.8 Emphasize EC status

Feedback from the interviews also revealed that an "EC-status" can be a clear advantage for European players in China, especially in comparison with players from the United States. The workshop participants though questioned the impact of "playing the EC card", especially against the background, that at the moment the biggest foreign actors in China are US-players. Moreover, it is a politically rather sensitive positioning whereas the EC aims at staying more or less passive.

Concluding, the feedback at the consolidation presentation proved that the EC, in order to strategically successful support ICT R&D cooperation with China, needs to focus on research-relevant topics, such as ICT areas of cooperation but must also consider non-research topics such as standardization. The Chinese representatives present at the meeting particularly supported the general SPICE recommendations for future collaboration.