CHOICE Internal report I-4

The current status of ICT R&D&I for Chinese Eco-Cities:

The implications for EU-China collaboration in ICT R&D&I

Version 2

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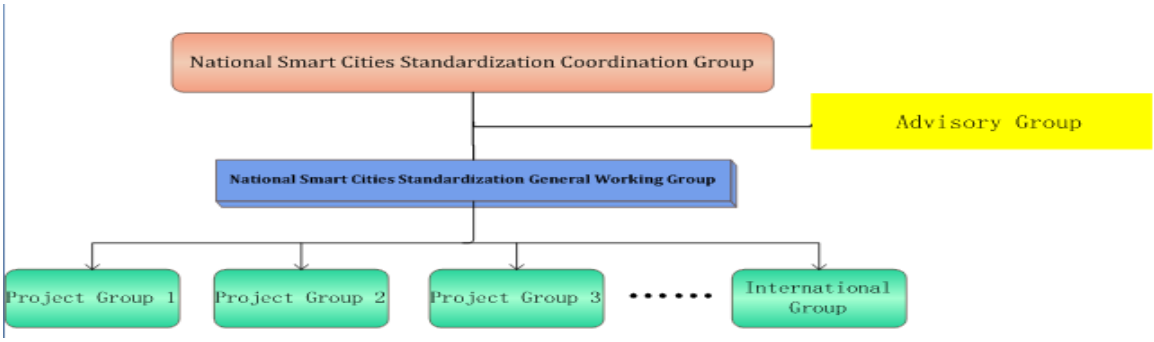
Abstract and rationale: This report attempts to give a flavour of the current of status of ICT R&D&I for Chinese Eco-cities and thereby provide some insights into the potential of China's emerging market for Eco-city solutions for EU-China collaborative ICT R&D&I. It addresses Eco-city standards development in China, Evaluation Centres for Eco-City software solutions, the context into which ICT for Chinese Eco-cities fits, Chinese ICT R&D in smart cities, EU-China collaboration in ICT R&D smart cities, EU Member states bilateral cooperation with China on ICT R&D for Eco-cities, Chinese smart city industry alliances, other Chinese industry alliances active in eco-friendly cities, Wuhan Intelligent City, and current concerns related to the market situation for the EU ICT industry. Conclusions are presented followed by recommendations targeted at organisations in EU member states interested in exploring the potential for collaborative ICT R&D&I with Chinese organisations targeted at China's emerging market for Eco-city solutions.

Introduction

We begin our overview of the current of status of ICT R&D&I for Chinese Eco-cities by addressing the Chines Eco-city standardisation process because at its highest level it defines the Chinese Eco-city.

Eco/Smart-city standards development in China

Unlike the United Kingdom where Eco-town standards are usually expressed in general terms in China the government and leading institutions are working to define detailed specific standards to assist with the implementation of Smart-cities and the subsequent monitoring of their performance. To coordinate Smart Cities standardization strategy, standards system and related SDOs, the following working mechanism in national level was set up in Jan. 2014.



These standards address a broad range of relevant aspects, such as smart city SOA Standard Application Guidance, Technical Reference Model, Model and Underlying Metrics System. . This has significant implications for future EU China cooperation in ICT R&D and innovation because more than 90% of Chinese cities are constructing Eco-city developments of one form or another.

China Society for Urban Studies (CSUS)

The leading government body responsible for the development of a national Eco-city standard is the China Society for Urban Studies (CSUS). Most research around China's Eco-Cities standard focuses upon Key Performance Indicators, several of which have been established by CSUS against which the performance of Eco–Cities, once constructed, will be evaluated.

Progressing Eco-city Policies into Main-stream Practice – Action Research on Policy, Financing and Implementation Strategies for Low Carbon Cities in China was a project supported by the UK Foreign & Commonwealth Office and China's National Development & Reform Commission that reported its results in July 2012 [1].

The project reviewed the Chinese national standard for Eco-cities standard and its KPIs. An implementation tool was developed in the project to support the Eco-City Assessment and Best Practice standards developed by CSUS. The tool comprises a framework with sets of high-level, strategic questions that aid decision making at the planning and master plan design stages.

The project determined that the 'hardware' of Eco-city urban planning and design should include SMART infrastructure which utilises Information and Communications Technology (ICT) to enable virtual connections, reduce physical urban loads, and in combination with face-to-face interaction promote quality of life. Although SMART can be adopted loosely as a label, Eco-city relevant technologies can be clearly defined, critically appraised and selectively adopted.

The China Smart City Industry Alliance (CCIT)

The China Smart City Industry Alliance (China smart Cities IndusTry Alliance), abbreviated as CCIT[1] was founded on 10 October 2013 to boost the development of smart technologies in China and help the country meet its urbanization challenges[2]. It a Chinese national Ministry of Industry and Information Technology (MIIT) approved agency the aims of which include developing industry standards with independent intellectual property rights and promoting the harmonious development of emerging smart industries.

The totality of its work is best viewed in the context of the hierarchy of Chinese industry associations focussed on Smart Cities which reviewed in a later in this report.

Evaluation Centres

China Software Evaluation Center[3]

This Center is of major national importance to ICT businesses in China. Its main roles that relate to ICT for Eco-cities are:

- Product Evaluation and Information Systems which includes:
  - National e-government system application software acceptance testing
  - Power Information System Test
  - National Science and Technology Special Assessment Service
- Information Security Evaluation which includes:
  - Electronic authentication of public services
  - Government information security research and policy advice auxiliary
  - Personal Information Protection Standards Compliance Assessment

The Center plays a significant role in smart cities development in China. It has responsibility for City top-level design and evaluation of Smart City Consulting, environmental / health planning and evaluation of Smart City Seminar series, Project Management. Its responsibilities are very wide ranging and included areas that relate to ICT for Eco-cities: Government Information Technology Project Management; E- ITSS conformity assessment and consultation; IT Services / Security Management System Consulting; the Government website performance evaluation group.

State Information Center Software Testing Center[4]

[1] www.ccit.org.cn
[2] http://www.chinadaily.com.cn/bizchina/2013-10/10/content_17021380.htm
[3] http://www.cstc.org.cn/
[4] http://www.stc.sic.gov.cn/

National Information Center Software Testing Center is a National Development and Reform Commission approved national home-level software products and information systems professional evaluation agency, with national measurement certification.

The Center provides, evaluation services: a cloud services platform, information systems auditing, software reliability assessment; personnel training and other professional information; technical services for government, research institutions and enterprises to provide overall technical service solutions.

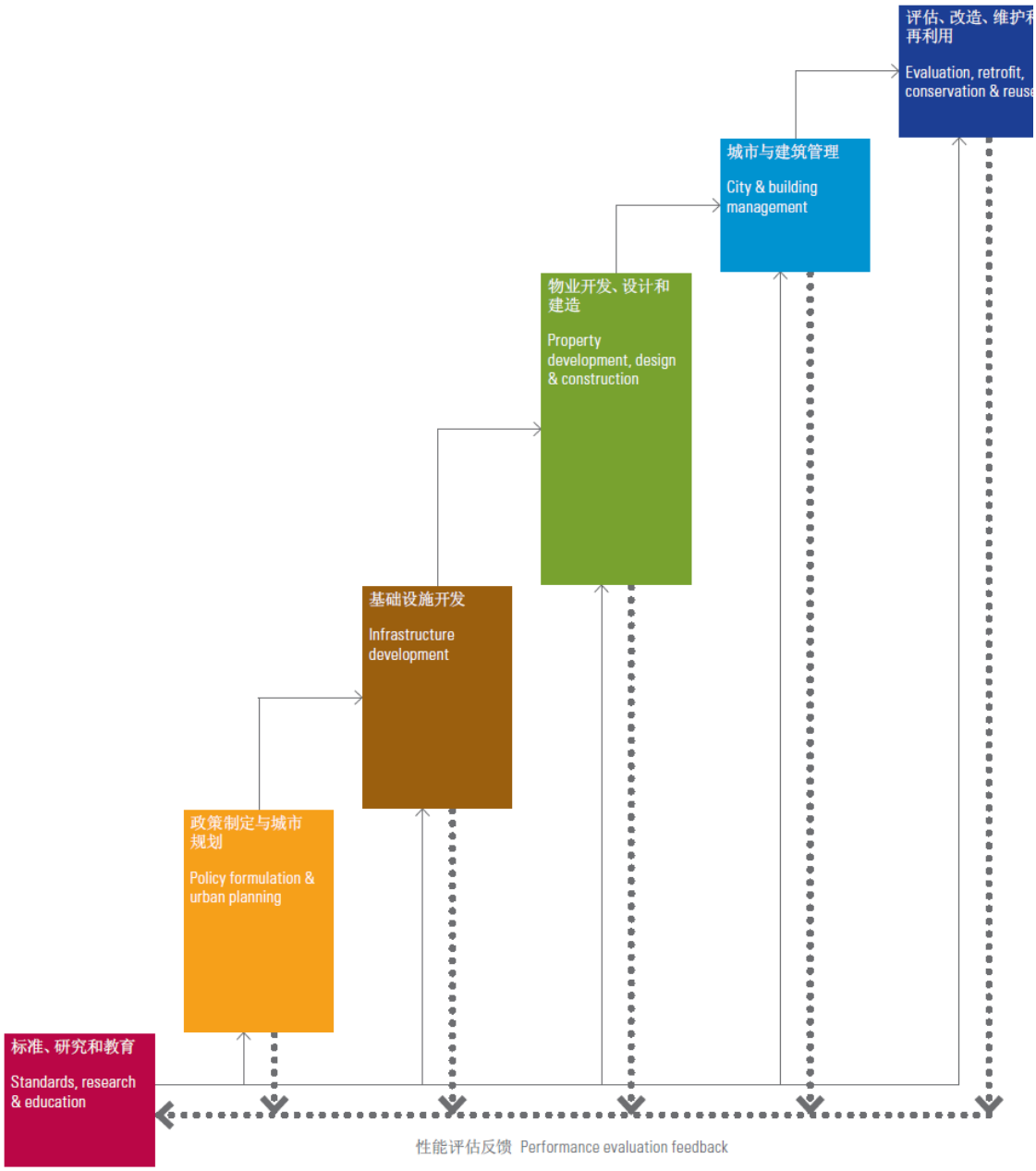
The National Evaluation Service System has regional centers in the provinces of Guangdong, Sichuan, Fujian, Shandong, Yunnan, Jiangsu, Tibet, Hebei, Hubei, Liaoning, Zhejiang and Inner Mongolia, the central government direct controlled cities of Chongqing and Shanghai, and the sub-provincial city of Shenzhen (Guangdong Province) and other regions, under the unified management of the Center.

On 9 July 2014 the Center hosted the Smart City Development Research Center of China 2014 annual meeting.

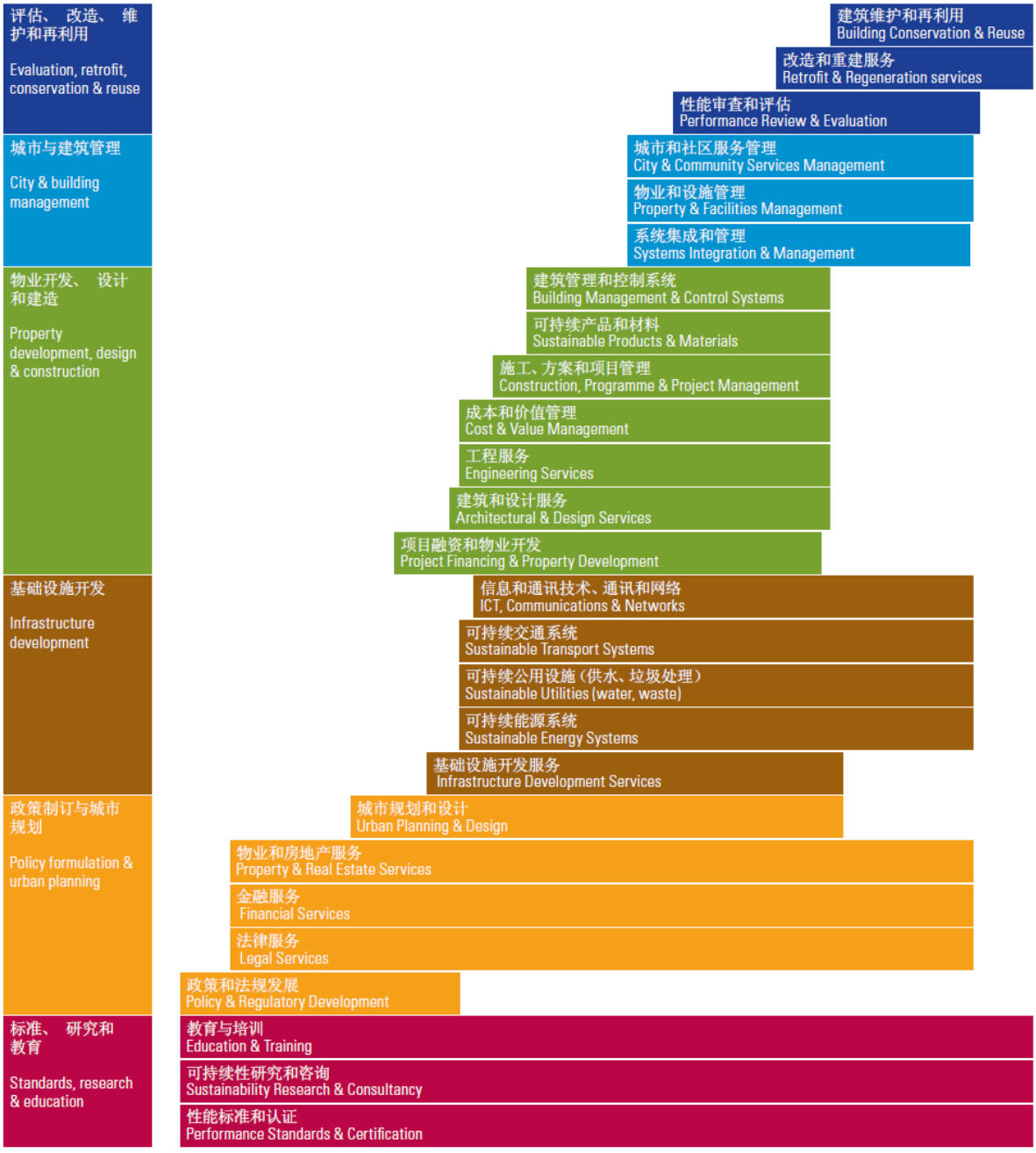
The context into which ICT for Eco-cities fits

Innovation in digital systems offers the potential for SMART infrastructure for Eco-cities that is an enabler for efficient and environmentally friendly systems for managing commuter traffic, food distribution, electricity grids and waterways, all of which have to be integrated for effective Eco-city urban planning and design. The anticipated benefits are a reduction in the use of energy and natural resources and in the emission of greenhouse gases. Although most of the envisaged applications of technology exists only in prototype form it is already clear that properly implemented they could provide substantial benefits.

In [2] a roadmap is provided for the effective development of eco-cities and green building that shows in the form of a figure reproduced below the key development stages.



The UK's special capabilities to support the value-chain that is essential to deliver the roadmap are also illustrated in [2] the form of a figure which is reproduced below.



Although this figure is UK specific all of the above capabilities are essential to support the value chain of an Eco-city and it gives a very good view of the wider context within which ICT for Eco-cities fits.

Professional property and facilities management services appear in the above figure because they are required to optimise building performance in commercial and sustainability terms. They can also be considered as a pre-requisite for city and community services focussed on the management of city services, transport, energy and other utilities. However, collectively these are just aspects of the crucial role that IT services have to play in realising Eco-cities. The IT services required to the deliver the Eco-city concept rely on the effective use of

management, communication and control systems, and consequently on systems integration and management.

Chinese ICT R&D in smart cities

In China ICT R&D on smart city concepts is being undertaken through Digital Shanghai (services anywhere), Digital Zhejiang (浙江 province) and "Intelligent City Wuxi 无锡" in Jiangsu (江苏) province. Public services to address key challenges related to urbanisation such as traffic management, health and wellbeing issues, aging care and limiting CO_2 emissions are also being developed while requiring technology realising the Smart City also requires research at the systems and services level. This provides opportunities for international cooperation to realise the required integration of interdisciplinary research and accompanying cross-sector development. In purely technical terms topics explicitly included in provincial level plans include the Internet of things, cloud software, data to intelligence, and digital services and next media.

EU-China collaboration in smart cities

EU-China Green Smart City Cooperation http://eu-chinasmartcities.eu

EU-China Green Smart City Cooperation is an EU-China Dialogue on Smart Cities funded by the EU-China Policy Dialogues Support Facility II (PDSF II) which aims to develop "Green Smart City" cooperation, to establish an expert framework for promoting EU-China Smart Cities cooperation, to select pilot cities from China and the EU, and establish a technical experts group to carry out related research and cooperation. Currently the initiative has fifteen Chinese partner cities and fifteen EU partner cities.

PDSF is an initiative co-funded by the European Union and China to facilitate and support current and future implementation of Policy Dialogues between the EU and China on a broad range of key sectors and issues, with the overall aim to strengthen strategic relations between the EU and China. The second phase of the EU-China Policy Dialogues Support Facility (PDSF II) started in March 2012 and runs for 4 years.

In the context of strategic EU-China collaboration in smart cities in its fundamentally important to note that there have been numerous EU funded Smart City Knowledge Exchange and Cooperation Platforms, see appendix 3 of [3], which have informed the recent EU-China Smart and Green City Cooperation Comparative Study of Smart Cities in Europe and China. The key findings key findings of which were reported at the EU-China Smart Cities Exchange Meeting, Beijing, 28 - 30 April 2014 [4]. However, it was not within the remit of this study to make explicit connections to the outcomes of bilateral cooperation initiatives in smart and green cities. Given that such initiatives are with global poles of excellence the outputs of these bilateral activities will in a business context take precedence over the outputs of EU-China initiatives when the two overlap. So for example, while in [4]:

“Cities are encouraged to use the “Smart City Assessment Framework” as an internal management tool for assessing the status quo of their smart city development and to identify any gaps and weaknesses” any such assessment will be subservient to the Eco-City Assessment and Best Practice standards developed by CSUS.

Although [3] looks at smart and green cities in far broader terms than [1], there are important examples of bilateral cooperation that impact on the recommendations of [4] not discussed in [3]. In particular, the energy conservation, smart power grids and efficient irrigation that have been created by Qingdao's Sino-German Eco-Park. The question is therefore, where should the process of bringing such outputs into the emerging vision for wider EU-China collaboration in smart and green cities begin. There is a strong case for beginning by mapping the outputs of [1] into [4] because [1] focusses on planning and development from a service point of view from the outset. This is the best way to achieve the primary recommendation of [4] on ICT infrastructure that: “Technology infrastructure required to deliver smart city projects should be defined by function rather than in terms of a specific technology”. Furthermore, the primary and secondary recommendations of [4] on smart city services are: Prioritise services and Create Service platforms, respectively.

An observation of [4] of great importance in a business context is that most cities fund their projects through public funding mainly at the local municipal level. Accordingly, in the first instance know-how transfer in the area of IT service management for Eco-cities should be the main focus of EU China cooperation in ICT R&D and innovation in the area of Eco-cities. Once the service requirements have been defined the technology needed to support the service bundle can be rolled out in a cost effective manner. China could benefit significantly from European smart city models and experience it terms of what has been gained so far from smart cities. Specifically, examples of service provision and delivery reliant on IT services by individual European companies should be provided. Some failed experiments could also be presented so the Chinese do not repeat these. Thought needs to be given as to whether there are any regulatory barriers (or inter-regulatory body issues) to the repurposing of EU IT services for the management of smart cities to China. If this is to be achieved careful attention needs to be given to Chinese procurement models for such IT Services and their place in the value-chains of Chinese Eco-cities. The target audiences for associated dissemination activities are representatives of EU ICT industry seeking innovation business opportunities in China and in particular of local municipalities in China as the key decisions in terms of procurement are made at the local municipal level. Outputs from such activities need to be presented in the context of Progressing Eco-city Policies into Main-stream Practice [1] as providing strategies for promoting innovation business opportunities for EU industry in China and wider EU-China Smart and Green City Cooperation [4].

The EU-China Green Smart City cooperation that delivered [4] established the EU China Smart City Cooperation Project Technical Expert Group as part of the project. This group has responsibility for Identifying and sharing “good practice” and maintaining a database of technical experts from China. It is a useful resource for disseminating activities promoting EU-China ICT R&D cooperation in Eco-cities.

The Phase 2 of the cooperation "Facilitate the co-creation and / or sharing of specific solutions" was initiated in April of 2015, The purpose is to develop a structure and platform that will help to promote and facilitate the transfer and/or co-creation of smart city solutions between the EU and China, further adding to the EU-China ICT Policy Dialogue. The platform will comprise of suggestions for a pragmatic process that takes into account the key challenges the pilot cities have encountered in their smart city experiences to date and will incorporate, where feasible, procedural recommendations on how smart cities can advance to the "state-of-the-art" level of maturity. Specifically, support will be provided for European and Chinese stakeholders to jointly develop or share smart city solutions. The project has invited pilot cities and enterprises to submit requirements, suggestions for projects and also the challenges they would like to see addressed. The demand-driven approach to facilitate specific EU-China cooperation projects will be analysed and pushed.

DG CONNECT

The EC DG CONNECT is presently involved in two on-going policy dialogues with the Ministry of Science and Technology (MOST), focused on mutual access to the EU's Framework Programme and China's R&D programmes, as well as the dialogues on information technology, telecommunications and informatization with the Chinese Ministry for Industry and Information Technology (MIIT), focusing green smart cities, as well as on the Internet of Things, IPv6 electronic communications, and internet security.

DG ENERGY

There has been a study led by DG ENERGY that has been investigating the potential for rollout of integrated smart cities and community's solutions in Europe and China. Jenesis consulting was briefly involved conducting the analysis of 2 of the China smart city solutions, namely:

1. The Smart & intelligent buildings project (i.e. building energy auditing and sub-metering monitoring in 366 main public buildings) in the Shanghai Pudong New Area
2. Green intelligent transformer substations project in the Hengqin New District, Zhuhai City, Guangdong Province.

Planned ENSCC joint call with China

JPI Urban Europe[5] (UE) is a European urban research and innovation initiative established in 2010 that commencing in 2012 set up a series of transnational joint calls on urban development. Calls within JPI UE are partly launched within the framework of an ERA-NET Cofund.

JPI UE and the Smart Cities Member States Initiative[6] (SC MSI) are partner networks within the ERA-NET Cofund Smart Cities and Communities (ENSCC) project. A joint call with China coordinated by ENSCC is planned. To evaluate options for the call ENSCC participating funding agencies launched an activity on working towards a smart cities call

[5] www.jpi-urbaneurope.eu
[6] http://www.smartcities.at/europe/transnational-cooperations/the-smart-cities-member-states-initiative/

with China in the near future. This activity was not limited to funding agencies in ENSCC but was open to all JPI UE and SC MSI funding agencies. The overall objective was to facilitate "preparation of common ground" on the European side. The recommendations for the next steps arising from this activity were [8]:

- Set up an Expert Group on the European side to develop a communication strategy and a policy exchange/dialogue with China in the field of smart cities;
- Set up an Expert Group on the Chinese side – with support from the local representations of involved European funding agencies in China;
- Set up a joint Working Group, including selected members from both the European and the Chinese Expert Groups to jointly develop the concept for the joint call.

Further justification for these steps it is provided by comments made by Volker Buscher of Arup at the WESTMINISTER eFORUM Smart Cities in the UK: implementation, key success factors and tech sector support on 9 July 2015. He argued that: Smart cities should be about a policy led framework that addresses multiple key areas of interest for citizens, where technology can make a change. These areas are:

- The continuation of functional changes in transport, water, waste, energy, and other areas
- Economic development and the creation of jobs and inward investment in cities
- Social and care provisions, which are probably the biggest current cost threat to many UK cities.
- Delivery of Government services and the achievement of environmental outcomes including with respect to climate change; Energy resilience, energy independence, and broader resilience strategies are part of that.

In this context, at the eFORUM speaking after Mr Volker, Mercè Griera-i-Fisa, Head of Research & Innovation, Smart Cities and Sustainability Unit, Directorate-General for Communications Networks, Content and Technology, European Commission, spoke about the need to break siloes between areas arguing that what was needed is open urban platforms. That is middleware software that allows for interoperability in between different vertical applications coming from different providers. It was noted that participants in the integrated infrastructures cluster defined a Memorandum of Understanding on Open Urban Platforms that was signed by 14 initial organisations (cities and industry) in June 2015 at a big gathering in Berlin. The Memorandum aims to define platform architecture and accelerate the standardisation process necessary for interoperability.

EU Member states bilateral cooperation with China on Eco-cities

Austria

A Memoranda of Understanding was signed between AustriaTech - Federal Agency for Technological Measures Ltd. and Chinese City People´s Government on cooperation in the ICT related field of "Low-Carbon-City" planning In 2012 there were two bilateral

agreements with the People´s Government of the City of Nanchang (the capital of Jiangxi Province, a prefecture-level city) and the Huangqiao (district's) People´s Government of the City of Taixing (a county-level city in Jiangxi Province).

Finland

The Finland-China Memorandum of Understanding (MoU) on co-operation in the Built Environment was signed on the 15 May 2014 [5]. This MoU followed a meeting between the President of Finland and the President of China, the participants to which formally recognised the need for smart and sustainable cities and to find energy-, resource- and cost efficient solutions through cooperation. The MoU is based on an emerging Finnish paradigm of cooperation with China that has its basis in a long history of Finland-China cooperation and a realisation by Finland that historically there had been very little business involvement in this co-operation accompanied by an increasingly strong desire on the part of the Finnish government to address this deficiency.

Of the globally recognised areas of Finnish competence in the context of Eco-cities the obvious one to focus on is Energy efficiency. Because of its cold climate, relatively large size and energy intensive main industries, Finland has invested in energy efficiency for decades. Finland has globally recognised competence in various areas including combined heat and power generation, district heating and cooling, and smart grids and power electronics. Furthermore, Finland is one of the world's leading users of renewable energy.

Crucial to an appreciation of the background to [5] is the acknowledgement in [6] of traditional areas of globally recognised Finnish competence including ICT. In essence in [6] these globally recognised competences are seen as potential gateways to international cooperation in cross-sector areas that encompass them such as environmental solutions and smart city concepts, which require expertise from several different domains, when they are offered as part of a complete package of required cross sector expertise.

Finland is actively positioning itself for cross-sector cooperation. In [6] two forums are quoted as illustrating: "a national aim to create a high-level foundation for over-lapping cross-sectoral cooperation in technology applications, industrial needs and business models." Both these forums are in the area of ICT ([6]) one of which is the United Forum.

The "Ubiquitous Networks Industry Technology and Development Forum (United Forum) has as its main objective promoting the interests of and development of the industry as a whole. Its main focus areas are key technologies, service architectures and future business models. It has three working groups and another three groups are under specification on smart city concepts, as well as elderly care and education.

United Forum is a network for knowledge and technology transfer among industrial and academic partners in China. It has about 25 key partners representing the whole R&D and business sector, such as Huawei, Intel, China Mobile, Samsung and Alcatel. United Forum is affiliated by MIIT and it works closely with CATR, BUPT and China Communication Standards Association (CCSA)."

To highlight the potential of this approach example topics in ICT-related areas in provincial and municipal R&D plans in China are presented in [6] which notably include several that are eco-city related. Examples include, Shanghai-city (**上海市** direct-controlled municipality), smart city security; Jiansu (**江**苏 省 province), smart travelling; Chongqing (**重**庆 市 direct-controlled municipality), next generation information terminal and relate key technologies; Zhejiang (**浙江 省** province), Smart city.

France

France and China decided at a joint committee meeting (Paris, 30 May 2011) to reinforce their S&T cooperation on topics, which included ICT and smart cities. A bilateral workshop was organized for each topic to identify detailed cooperation perspectives and plan actions on the period 2011 - 2014.

French joint institutes with China are 'bottom-up' initiatives. The France-China joint laboratories related to ICT include the Cooperation platform "Complexcity" in Shanghai (UTSEUS).

Germany

In the area of Eco-cities two cooperative projects with Chinese partners were funded by the BMBF: "The Sustainable Development of the Megacities of Tomorrow" initiative; The Hefei project: Metrasys - Mega Region Transport Systems for China focussed on analysing the current planning processes for the city development and transportation and to implement up-to-date traffic management systems.

Sweden

The Sweden in China - Trade & Promotion newsletter of April 2014[7] reports that: "the (Swedish) Consulate General in Shanghai, together with a number of partners, has organized a week of urbanization-themed seminars and workshops under the title of Smart Urban Living - Sino-Swedish Solutions for Cities on the Move. The objective of this week of events is to be a platform for meetings and discussions on the challenges and opportunities of urbanization and create awareness about Swedish solutions, expertise and technology. In addition to a number of seminars, challenges and events on the topic of urbanization."

United Kingdom

For ICT business in the area of eco-cities and the green value chain there is a platform for UK-China cooperation in the development and delivery of world-class solutions, the UK-China Eco-cities & Green Building Group[8]. The existence of this group reflects the Chinese preference for R&D cooperation with poles of global excellence in areas of key national interest [1]: "At the IGEBC conference in March 2011 Vice Minister Qiu outlined China's plans to develop 300 eco-cities in the coming years. He noted that the UK has much relevant

[7] http://www.ichuguo.org/swinchina/swinchina102.html
[8] http://www.cbbc.org/guide/uk_china_eco_cities_green_building_group

experience in this area, including global leadership in garden cities, new towns, and eco-towns, from which China could learn and build upon. Given that experience, he invited the UK to become China's lead partner in their eco-cities development programme."

It is important to note that China has a particularly strong bilateral relationship in the area of smart cities with the UK Buildings Research Establishment (BRE). Jaya Skandamoorthy, Director, BRE China, speaking at the China-UK Urbanisation - A New Model Seminar, held at BRE on 17 June 2015 stated that: "The Chinese Premier visited BRE in 2011 and asked BRE to do three things:

1) Look at policies, standards, and regulations internationally and compare; China has its own standards but wants to benchmark them against EU standards etc.
2) Promote UK-China collaboration by bringing leading UK expertise to collaborate in the Chinese market.
3) Promote China-UK collaboration; China has leading expertise it would like to collaborate in the UK market, which China would like to use as a platform for the EU market."

The seminar at BRE introduced the Gui'an building innovation park, which is the first innovation park in China. The park was officially launched on 26 June 2015 by Governor Ma of Gui'an New District, China, and the UK Special Envoy for Sustainable Urbanisation to China, Sir Michael Bear. The park is the result of the collaborative efforts BRE, Tsinghua Holding Human Settlement Construction Group (THHSCG – part of Tsinghua University in Beijing) and Gui'an New District Area's local government. The aim of the park is to support the Chinese Government's drive for sustainable community development and air quality improvement[9].

At the seminar at BRE on 17 June 2015 Stephen Ellison, Minister-Counsellor, Director for Energy, Environment and Infrastructure emphasised that healthcare in an urbanisation environment is of great interest to China, in particular UK National Health Service initiatives in this area. He also noted that the UK based design, engineering and project management company Atkins have developed an urban planning framework for China and that integrated transportation planning plays a significant role in this. However, the main point Stephen Ellison made was that while the UK has done a lot of work with China through its professional services, opportunities on the manufacturing side are now opening up for low carbon and green technologies. Prof Yin Zhi, Director of Key Lab, Tsinghua University, made clear that China's emphasis in its relationship with the UK in this area is on mutual benefit and development. Helen Pineo, Associate Director Cities, BRE, highlighted key points of the 2014 UKTI report "How can the UK innovate for the world's cities" - multidisciplinarity; project delivery; urban planning and reinvention; digital creativity; urban data, visualisation and modelling; human centred design, standards setting.

Smart cities related bilateral initiatives of European national research funding agencies

[9] www.breeam.org

An overview of smart city related initiatives and cooperation by ENSCC Funding Agencies is available as a table on pages 16 and 17 of [8].

Chinese smart city industry alliances

The Chinese smart cities industry alliances that the EU can interface with in seeking to effectively promote EU-China ICT R&D&I collaboration related to the realization of smart cities. Before discussing these alliances it is useful to highlight their hierarchy. There is a national overarching association focused on forming a smart city industry chain and promote the rapid and orderly development of China's large-scale smart city industry (National Industry Alliance of Smart City Technology Innovation), a technically focused national association promoting technology innovation and technology standards for smart cities (CCIT), an association focussed on the training and nurturing of the required personnel (CSAoSCITI), an association focussed on urban governance Smart City Development Alliance). (These associations will be reviewed in order of their position in this hierarchy.

National Industry Alliance of Smart City Technology Innovation

The National Industry Alliance of Smart City Technology Innovation brings together expertise related to the urban industrial chain, including sensor design and manufacturing, data acquisition and processing, chip design and manufacturing and intelligent terminals, software and industry applications, planning and consulting, investment, and all aspects of competitive enterprises.

The overall objectives of the Alliance are through market demand traction, gathering smart city enterprises, universities, and research institutes, and industrial capital, to create a smart city technology innovation system and industrial base, to form a smart city industry chain and promote the rapid and orderly development of China's large-scale smart city industry, establish a well-known brand, build a national team, and nurture and strengthen member companies.

As the main technical innovation alliance in this area it has: developed an information platform of smart city technology standards; developed the smart city's diverse heterogeneous data acquisition, processing, and exchange technology; within the established urban infrastructure elements developed a monitoring and management platform and related construction specifications and procedures, developing a series of sensors that connect to the urban management and automation equipment. It has addressed challenges of large-scale production, and the operation and maintenance of urban management "big data" systems, including dynamic monitoring, information extraction, and the refinement of the application of information services.

At the 2nd Internet of Things (IoT) Symposium 16-17 April 2014 in Hong Kong officials from the Chinese government and the EU spoke about the development of smart cities using

the IoT in China and the EU[10]. The secretary general of National Industry Alliance of Smart City Technology Innovation[11] said the central government's objectives for smart cities are to enhance city planning, building and management stating that: "The Smart city is a new ecosystem of city management and public service delivery," The Alliance's smart city initiatives will aim to improve city traffic, city administration, energy supply, underground space utilization, water supply and other areas closely related to the well-being of the public. The three areas that have been the focus of largest number of smart city projects have been public information portals (79 projects), public infrastructure databases (72 projects), and e-government (53 projects).

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However, in the context of collaboration in ICT R&D&I the National Industry Alliance of Smart City Technology Innovation is more immediately relevant[14] than CCIT.

China Strategic Alliance of Smart City Industrial Technology Innovation (CSAoSCITI)[15]

This alliance is the most research focussed of the alliances though its most fundamental role is the training and nurturing of indigenous Chinese technical experts in smart cities technology in order to promote China's innovative capacity in smart cities. Its mission is to

[10] http://cw.com.hk/feature/china-eu-tackle-urbanization-challenges-smart-city-pilots
[11] http://cylm.scitycn.org/en
[12] www.ccit.org.cn
[13] http://www.chinadaily.com.cn/bizchina/2013-10/10/content_17021380.htm
[14] http://cylm.scitycn.org/cn/about
[15] http://www.smartcityunion.cn/

achieve the goal of breaking through common and critical technology and developing the key technology competitiveness of China's smart city IT industry. It seeks to achieve this by integrating industry-university-research-application resources, establishing a mechanism and communication channel with the government, acting as platform for training and international cooperation, and promoting the self-development of its member companies. Specifically, the alliance supports the construction and implementation of independent Chinese technology and standards for smart cities, promotes the realization of a leap in the development of Chinese cities informatization level, seeks to lead and guide the technical development trends of relevant fields at the international level. The ways in which the alliance pursues its mission include:

1) Around the common and critical technology issues, taking smart city data processing as the core, organizing enterprises, universities, and research institutions to develop technical cooperation, building the key technical competitiveness of China's smart city IT industry;

2) Publicizing and executing the relevant policies, laws and regulations, establishing a common strategy, together seeking the support of policy, law, regulation, funding, public opinion, and reporting the wishes and requirements of alliance members to the relevant departments of the government, creating a good social environment for industry development;

3) On the basis of complementary advantages, resources sharing, and fully developing the resource and capacity of alliance members, realising the effective division of labour and the reasonable connection of innovation resources. Building a public technical platform and executing intellectual property sharing;

4) Implementing technology transfer, accelerating the commercialization of technical achievements, and improving the competitiveness of the industry in China;

5) Jointly cultivating expertise, strengthening personnel exchanges and interaction, providing personnel support for continuous industrial innovation.

Smart City Development Alliance

There is a fourth Chinese national smart city alliance "Smart City Development Alliance", a signing ceremony for which was held concurrently with China International Urbanization Forum 2014 in Shanghai on April 19, 2014[16]. Formed by the National Development and Reform Commission (NDRC) [17] this alliance helps promote urban governance, city management and public service innovation.

Other industry alliances active in eco-friendly cities

[16] http://www.chinadaily.com.cn/m/beijing/zhongguancun/2014-05/05/content_17483684.htm

[17] http://www.chinabusinessreview.com/smart-city-development-in-china/

Reflecting the intense activities of Chinese national smart city industry alliances there have been a number of related initiatives at the Chinese municipal and provincial levels by industry alliances whose major focus in not on smart cities. For example, addressing the role of the IoT in the development of eco-friendly cities and big data.

The Chengdu IoT Industry Development Alliance sponsored a Smart City Construction and Application Seminar[18] with the theme of: Accelerating the Application of IoT Technology and Promoting the Construction of Smart City on 24th April 2014, which was co-organised by the Sichuan Provincial IoT Industry Development Alliance.

The Internet of Things China 2014 Conference on Internet of Things Creating Smart life 28-29 October 2014, Shanghai[19], has Technical Partners:

- Shanghai Internet of Things Industry Association (city)
- Shanghai Pudong New Area IoT Association (a district in Shanghai)
- Zhangjiang IoT Industry Association (a district in Shanghai)
- Z-Park Internet of Things Industry Association (Zhongguancun, a district in Beijing)[20]
- Qingdao Internet of Things Industry Association (a city in Shandong province)
- Hangzhou Internet of Things Industry Association (a city in Zhejiang province)
- Suzhou Internet of Things Industry Association (a city in Jiangsu province)
- Chengdu Internet of Things Industry Development Alliance (a city in Sichuan province)[21]

The Conference's focus includes:

- Frontier Technology & Standard/Smart City & Community:
  - Benchmarking of IoT deployments in smart cities
  - Living in Smart Cities
  - Big Data in Building Smart Cities
  - From IoT Application to Sustainable Smart Community Cases

Shenzhen City Big Data Industry and Innovation Alliance

In January 2014 the Shenzhen City Big Data Industry and Innovation Alliance was launched, this Alliance is sponsored by the Technology Innovation Committee of the Shenzhen Government which comprises numerous key enterprises of the Big Data industry in Shenzhen City. The Alliance aims at promoting industry collaborations and Big Data technology

[18] http://www.chinasoft.org.cn/en/list.php?cid=187
[19] http://www.iotexpo.com/upload/201402/19/20140219100219989552.pdf
[20] http://www.ziota.org/
[21] http://www.chinaiot.org.cn/index.html

developments and applications to promote Shenzhen City's pioneering position in China's Big Data industry[22].

"As a national strategic emerging industry, Big Data has received great attention from the Chinese government. The "Twelfth Five-year Plan for the National Development of Strategic Emerging Industries" clearly advocated the research and development of mass data storage, processing technology, and industrialization. The "Internet of Things Five-Year Plan" lists information processing technology as one of the top technology innovation initiatives. Smarter Cities are leveraging Big Data technology to improve infrastructure, planning and management, and human services with the goal of making cities more desirable, livable, sustainable, and green. Some specific focus areas include mass transit, utilities, environment, emergency response, big event planning, public safety, social security, and healthcare."

Wuhan Intelligent City

Wuhan[23] presents itself as an "intelligent city"[24], identified as a national "intelligent city" pilot by the Ministry of Science and Technology. In 2012, the Wuhan Municipal Science and Technology Bureau made an offering of 10 million Yuan for domestic public to tender the "intelligent city" master plan project. In 2013, "The Intelligent Wuhan City Overall Plan" has been formed, and was expected to start to pay off within 3-5 years. It was claimed that Wuhan will be the fastest growing Chinese city in term of Internet speed. Currently, the average 2 mbps household bandwidth will be increased to 50-100 Mbps through the optical fiber plan. For understandable reasons this pilot appears to the main focus of the Wuhan Municipal Science and Technology Bureau.

Current concerns

The report [7] describes China as an absorptive state adept at attracting and profiting from global knowledge and networks. Underpinning this assertion is the observation that "A distinctively Chinese approach to innovation involves not only absorbing the best ideas from around the world but recasting them and recombining them through 're–innovation' much of which involves 'hidden innovation': the innovation in design, processes and organisational models in manufacturing and services not captured by the traditional measures of R&D." While it is acknowledged that, especially in the field of ICT, China is much more than just an absorptive state, as evidenced by its world leading R&D capabilities in 5G technologies, it nevertheless remains absorptive in certain key sectors relevant to ICT, for example, digital services for smart Cities.

[22] http://www.prnewswire.com/news-releases/china-information-technology-inc-chairs-the-shenzhen-city-big-data-industry-and-innovation-alliance-240458841.html
[23] Zhejiang Province
[24] http://www.chinaabout.net/intelligent-wu-han-fiber-plan-increase-the-overall-internet-speed-to-100-mbps-in-next-3-5-years/

European companies have a long history in China's ICT market, yet European access to participate in China's ICT services market lags dramatically behind participation in China's ICT infrastructure and devices market.

The European Chamber of Commerce in China (ECCC) ICT working group has noted that while European companies have a long history in China's ICT market, European access to participate in China's ICT services market lags dramatically behind participation in China's ICT infrastructure and devices market[25].

Conclusions

More than 90% of Chinese cities are constructing Eco-city developments of one form or another. Most Chinese cities fund their projects through public funding mainly at the local municipal level. Given the extent of Chinese investment in eco-cities their ICT needs are currently the most important area for potential EU-China collaboration in ICT R&D&I.

The leading Chinese government body responsible for the development of a national Eco-city standard is the China Society for Urban Studies (CSUS); effectively defining the Chinese Eco-City.

The 'hardware' of Eco-city urban planning and design should include SMART infrastructure which utilises Information and Communications Technology (ICT) to enable virtual connections, reduce physical urban loads, and in combination with face-to-face interaction promote quality of life. Although SMART can be adopted loosely as a label, Eco-city ICT relevant technologies can be clearly defined, critically appraised and selectively adopted.

The technology infrastructure required to deliver smart city projects should be defined by function rather than in terms of a specific technology, which means prioritising services and creating service platforms. However, European access to participate in China's ICT services market lags dramatically behind participation in China's ICT infrastructure and devices market.

The IT services required to the deliver the Eco-city concept rely on the effective use of management, communication and control systems, and consequently on systems integration and management.

There is a hierarchy of Chinese smart cities industry alliances that EU organisations can interface with in seeking to effectively promote EU-China ICT R&D&I collaboration related to the realization of smart cities. There is a national overarching association focused on forming a smart city industry chain and promote the rapid and orderly development of China's large-scale smart city industry (National Industry Alliance of Smart City Technology Innovation), a technically focused national association promoting technology innovation and technology standards for smart cities (CCIT), an association focussed on the training and nurturing of the required personnel (CSAoSCITI), and an association focussed on urban governance Smart City Development Alliance).

[25] http://www.europeanchamber.com.cn/en/publications-archive/238

It follows that in the context of EU-China collaboration in ICT R&D&I for Chinese Eco-cities, in terms of deployment the National Industry Alliance of Smart City Technology Innovation is the most important industry association. However, from the point of view of EU-China collaborative ICT R&D&I related exchange of research personnel and university research and technology transfer the China Strategic Alliance of Smart City Industrial Technology Innovation is the most important industry association.

The high level Chinese national industry alliances addressing the challenges of realising smart cities appear to be special cases established to address the particular challenges posed by the need for extensive cross-sector integration to realise the smart city vision. However, as such by their very nature they have to link extensively to more sector specific national associations and therefore could be a natural focus for effective EU collaboration with Chinese industry with respect to standardisation and regulatory initiatives.

UK based design, engineering and project management company Atkins have developed an urban planning framework for China and integrated transportation planning plays a significant role in this.

In the context of cross-sector integration, smart cities should be about a policy led framework that addresses multiple key areas of interest for citizens where technology can make a change. The framework should promote open urban platforms that are middleware software that allow for interoperability in between different vertical applications coming from different providers, ensuring platform architecture is defined and standardisation processes necessary for interoperability are accelerated.

The China Software Evaluation Center plays a significant role in smart cities development in China; it has responsibility for City top-level design and evaluation.

Eco-cities related collaborative ICT R&D activity with China has been untaken particularly by Germany and the United Kingdom but also by Austria, Denmark, The Netherlands, Spain and Sweden.

It is important to note that China has an important bilateral relationship in the area of smart cities with the UK Buildings Research Establishment (BRE). The Chinese Premier visited BRE in 2011 and asked BRE to look at policies, standards, and regulations internationally and compare; China has its own standards but wants to benchmark them against EU standards etc.

Recommendations

In the first instance know-how transfer in the area of IT service management for Eco-cities should be the main focus of EU organisations cooperation with China in ICT R&D&I in the area of Eco-cities.

The European industrial associations need to encourage and support EU companies in targeting the Chinese markets for digital services, in particular, services supporting the Chinese vision of the eco-city (or smart city).

The EU China Smart City Cooperation Project Technical Expert Group has responsibility for Identifying and sharing "good practice" and maintaining a database of technical experts from China. It is a useful resource for disseminating activities promoting EU-China ICT R&D cooperation in Eco-cities.

Given the extent and importance of member states bilateral cooperation with China on smart cities the main driver of EC involvement in ICT related R&D&I for smart cities should be a policy led framework that promotes open urban platforms that are middleware software that allow for interoperability in between different vertical applications coming from different providers, ensuring platform architecture is defined and standardisation processes necessary for interoperability are accelerated. The UK BRE is looking at policies, standards, and regulations internationally and comparing them at China's request so China can benchmark them against EU standards etc. The EC should work with the BRE to try to establish the feasibility of developing a common framework with China for developing standards for smart cities.

It is noted that it appears that there may be scope for synergies between EU Directorates, e.g. DG CONNECT and DG ENERGY by sharing the results of their smart city projects. If so, the Head of the Research & Innovation, Smart Cities and Sustainability Unit in the EC would be a possible suitable champion for this activity.

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