Internet of Things, Industrial Internet and 5G in China: Survey Report on Research and Business Perspectives to Foster China-Finland Collaboration

Mika Klemettinen
Tekes
August 2014
Contents

- Introduction
- Main Learning
- More Detailed Remarks on
  - Technology Environment
  - Innovation Environment
  - Business Environment
Introduction
This survey about IoT (Internet of Things), Industrial Internet and 5G in China was carried out in March and July-August 2014 to complement the existing and ongoing global Future Watch work especially related to Industrial Internet with the specific focus on advanced manufacturing.

The survey was sponsored by Team Finland and it contributes to the Industrial Internet and 5G funding program preparations in Tekes during May-September 2014 as well as to the renewing industry area activities in general.

Extensive discussions took place with both large and small & medium size Chinese and Finnish companies as well as with academic research organizations and governmental funding agencies in Shanghai, Nanjing, Wuxi and Beijing areas.

Special focus was on the “higher layers” of Industrial Internet, where the ICT and other industries meet to create additional value: big data and analytics, intelligent services and solutions, new value networks, etc. Additionally, 5G related activities were taken into account, when relevant. Furthermore, topics like standardization, international collaboration and Chinese business environment were covered.

Ultimately it is hoped for that the survey can enable strengthen and also forming new collaboration between Chinese and Finnish industry and research organizations, and between Chinese and Finnish national R&D programs (e.g. via China-Finland Strategic ICT Alliance).
Introduction (2/2)

- During the four week survey trip in China during July-August 2014, 35 meetings took place and 60 organizations – both small and large companies, research organizations and universities, and governmental funding organizations – were met. The summer survey trip was preceded by a 5G-focused workshop with main Chinese and Finnish research organizations and selected companies in March 2014 in Shanghai.

- The discussions enhanced and deepened understanding of the situation of IoT, Industrial Internet and 5G research and the commercial aspects of the respective areas in China, and helped identifying potential Sino-Finnish collaboration issues.

- China is a big country and one cannot survey it in just a few weeks. There are people and companies that have been in China for years or even decades, and they are still in the continuous learning path since the country is in constant change – for example, a follower position in some area may rapidly change into a leader position. In the following, some issues are highlighted that are food for thinking for those who are considering to collaborate with Chinese or to come to China.
Main Learning
Best innovation opportunities can be found in 1st tier cities like Shanghai and Beijing, where also startup culture is emerging with mentoring/accelerator companies such as Chinaccelerator to speed up business; on the other hand, also 2nd tier cities are providing appealing benefits and commercialization potential for foreign companies.

If one goes away from the 1st tier cities (e.g., Shanghai, Beijing), language barrier issue remains a major aspect to be taken into account; at least in Nanjing and Wuxi, two 2nd tier cities, the language issue is still the biggest single barrier for international collaboration, complemented to some extent by the lack of true innovation, until the next generation takes the lead in the companies and institutes.

Although the term Industrial Internet is not yet widely recognized in China, Industrial Internet is being applied in many areas and even more are emerging (IoT including smart traffic, smart home, smart agriculture, CleanTech, etc.; 5G, automation, robotics, 3D printing, new business models), providing good collaboration opportunities in both research and commercialization areas – especially the big data topic requires further collaboration discussions.
Wireless technologies research, including 5G, has taken big steps forward in China during the past decade – while in 4G era the Chinese were still clear followers, the best universities, institutes and companies are now on par with the Europeans and partially ahead, and many of the follower organizations are strong in simulations and mathematical proofing; coming years and especially the software defined networking (SDN) and cloud computing areas may enable completely new openings from the Chinese players.

Industry renewal is taking place in different forms in different industries – good examples are XiaoMi and Haier, where new crowd sourcing and industrial IoT solutions are being adopted; this renewal might spread both inside China and to the Western countries as well.

China is on the threshold of industrial revolution, because one has to automatize and robotize the manufacturing in order to be competitive against lower-cost countries as the labor and operational costs in China are increasing; there could be potential to take a leap frog from traditional industry directly to intelligent automation, which could include opportunities also for Finnish players.
Main Learning (3/4)

- Business environment for foreign companies is getting more challenging, since labor and other operational costs compared to Vietnam and other lower-cost countries as well as (in areas that are not directly benefitting China) bureaucracy (certificates, working visas, etc.) are increasing; on the other hand, China is still wanting experts for its own companies to increase its competencies and competitive advantage.

- In contrast to the initiatives driven by Germany (Industry 4.0) and USA (Industrial Internet Consortium), the SinoFinnish collaboration could take a different approach giving mutual added value:

  - Potential main focus on the collaboration could be on the “higher layers” of Industrial Internet, where the ICT and other industries meet to create additional value: big data and analytics, intelligent services and solutions, new value networks, etc., supported by the research on reliable, low-latency, secure and energy-efficient 5G networks.
Main Learning (4/4)

- There are many top universities/research organizations – mainly in 1st tier cities such as Shanghai and Beijing including WiCO, Beijing University of Posts and Telecommunications, Tsinghua University, Jiao Tong University, Tongji University and Fudan University – **for ambitious research collaboration on the selected areas**

- SinoFinnish collaboration should be strengthened
  - by further enhancing Academy of Finland, Tekes, Ministry of Science and Technology (MOST) and National Natural Science Foundation of China (NSFC) cooperation, and
  - by utilizing and expanding the existing China-Finland Strategic ICT Alliance (coordinated by DIGILE and WiCO), joint research labs/institutes, etc. frameworks
More Detailed Remarks on
• Technology Environment
• Innovation Environment
• Business Environment
Technology Environment (1/2)

- The concept of Industrial Internet or Industrial Internet of Things was not really recognized anywhere in China during the survey trip – excluding the Ministry of Science and Technology (MOST). It was first also somewhat difficult to find hints about partners that would apply or plan to apply Industrial Internet in their operations, but rather more straightforward IoT solutions. Little by little, it appeared that actually quite many players especially in the 1st tier cities (like Shanghai and Beijing) go beyond the plain IoT approach, and not only in the research (smart home, wellbeing/healthcare, car-2-car communication, etc.) but also in the commercial dimension (e.g. Haier, the home appliances manufacturer), while they are applying IoT, collecting data to the cloud, analyzing it and planning actions, in certain areas also having value-added services considered.

- The background studies indicate that China has followed the Western trends with a few years or a decade of delay, but the delays are getting shorter and actually China is moving nowadays in many areas faster than the Western counterparts. The IoT and Industrial Internet are driven by the above mentioned areas and the Internet economy in general. This is complemented by the fact that there are many ongoing CleanTech activities that are already very close to – or even within – the Industrial Internet area, and even more pressure from the government side to progress in the air/land/water pollution issues. China has a lot of manufacturing and engineering industry, and as there is at the same time a lot of IoT research and companies with different kinds of big data analysis and back-end platforms as well as willingness to target on the “higher added value layers”, it is probably only a matter of a relatively short time when the IoT and on-line Internet services resources are focused to serve also the growing needs of the manufacturing and engineering industry, especially in the areas of automation and robotics for improving the efficiency and lowering the costs.

- Knowing that there are lots of IoT and Internet services know-how and resources, and all kinds of industries that are taking their inevitable steps towards digitalization in the near future, Finland could have a momentum in establishing collaboration in the Industrial Internet area. Moreover, China itself – with the specific response from MOST director – would be interested in starting collaboration with Finland by concentrating on the “higher layers” of Industrial Internet and on the issue of “how to generate new business value”, thus not by directly copying the Germany’s Industry 4.0 approach. For example, automation and robotics are getting more importance in China as the labor costs and other operational costs are increasing; in order to remain competitive against Vietnam etc., one need to improve the efficiency and to cut costs. Standardization is also an important issue: Good overall picture/approach is required in order to avoid unnecessary fragmentation and incompatible solutions. Chinese players – including the government – are activating in the standardization area, but so far only the first steps have been taken and there are possibilities for influencing the choices.
Both Chinese national funding organizations NSFC and MOST seem to be very open for discussions on the Industrial Internet, since both have more and more pressure for industry/company driven research. Special follow-up activities are planned to take place on both sides for making the collaboration plans reality, e.g., by extending the China-Finland Strategic ICT Alliance cooperation coordinated by DIGILE and WiCO.

Regarding the wireless technologies, the Chinese are well aware of the Western 5G focus and their research is aligned with the European targets. China appears to have taken clear steps ahead during the recent years in the area of wireless communications, which is very positive and promising regarding the future collaboration possibilities. Still, majority of the research seems to be a bit behind the European top-edge research, but certain strongest universities are already on par (like Tsinghua, Jiao Tong, Peking University and Southeast University) – it might not take too long time before they will bypass the Western universities.

Chinese 5G research status gives the same impression as the Chinese R&D in general in many areas: the pure innovation is maybe not the strongest part (yet?) and the research focus is often quite narrow, but Chinese are very strong in mathematics (proofs etc.), simulations and trialing. The strengths combined with the improved 5G skills forecasts hard times for the Western researchers – Finnish ones included – since the same that has already happened in the network manufacturing side, might well happen also in the research side: the Chinese first just copied the Western equipment, but now they are in the front-end to develop the newest innovations. The industry and national investments will help pushing the research ahead – based on the meetings and discussions the wireless network and IoT research projects are getting quite generous funding from local and central government, this becomes clear already from the facilities that the different universities and institutes have. Furthermore, the top universities are also applying the wireless technologies in areas such as car-2-car communications (including close collaboration with the car industry) etc., and this work is bringing whole new focus for the research and commercialization that can drive a fundamental change in the Chinese research approach in a wider sense.

Good and fruitful collaboration in the 5G area is already ongoing between China and Finland due to the China-Finland Strategic ICT Alliance efforts (co-funded by Tekes and MOST) and recent Academy of Finland – NSFC joint 5G call. Both are, however, rather small-scale openings and require continuous nurturing to ensure the fruitful collaboration to continue. Like the Industrial Internet area above, also this area requires close collaboration between NSFC and MOST as well as between Academy of Finland and Tekes.
Innovation Environment (1/2)

- Based on the feedback received during the survey tour, the places in China where the most interesting and innovative activities take place at the moment include the following cities:
  - Beijing (software, technologies, decision making place – all Chinese have presence in Beijing)
  - Shanghai (business, media area, foreign companies emphasis)
  - Shenzhen (hardware)
  - Hongkong
  - Chengdu
  - Xi’an

- New thinking is starting to take place in China, and this became clear when visiting Shanghai and Beijing, the 1st tier cities. Direct startup collaboration (like in Beijing by BUPT) is raising its head and might in the future replace – or at least seriously complement – the isolated science park driven approach, which might not be the most effective environment for all kinds of innovation. Additionally, “business angels” and mentors are scouting innovative startups especially in Beijing (e.g., ZPark Angel Association) and Shanghai (e.g., Chinaccelerator). Also, areas like Shenzhen have shown signs that new innovations – not just fast productization – can be originated from China and spread to the Western countries.

- In Shanghai and Beijing as well as in other 1st tier cities, there are many innovative companies such as Haier, Xiaomi, Tencent and Alibaba, that have challenged the traditional players in their own areas. There are also many innovative universities including WiCO, Beijing University of Posts and Telecommunications, Tsinghua University, Jiao Tong University, Tongji University and Fudan University, that have top researchers and a lot of resources.

- 2nd tier cities Wuxi and Nanjing are traditional manufacturing and engineering industry areas, where still around 90% of the revenue is coming, but they are at the same time also specializing on Internet of Things (IoT) and are seeking new growth from that area. There are lots of research institutes, universities and companies with lots of resources and new facilities with the support of local and central government. This is very impressive. Impressive is also the drive and schedules that the Chinese companies in the area can have in pushing new products to the markets. Finland has no means to compete with the Chinese in these dimensions.
Innovation Environment (2/2)

- However, money or business-driven approach does not create innovations as such: “Made in China” is not yet “Innovated in China” in the JianSu area as it starts to be in, e.g., Shanghai and Beijing. For example, nothing really original was presented during the visits in Wuxi and Nanjing regarding IoT issues, even if some of the players have a lot of local and central government money for premises and equipment – some of the institutes are actually said to be quite inefficient and unproductive considering the resources they have. The only exception appeared to be FNII institute that was very interesting country-wide software defined networking (SDN) pilots and in parallel actions on next generation network traffic analysis.

- Additionally, the general feeling is still that at one moment somebody copies innovation ideas from abroad and then everyone starts to do the same things in all the institutes: this was the feeling in Wuxi/Nanjing areas, where all institutes had almost identical areas of interest in smart grids, smart traffic, wellbeing/healthcare, smart agriculture, smart logistics, environment (clean air/water/land, i.e., CleanTech), food safety and security.

- Another issue has to be taken into account: If one goes away from the 1st tier cities (e.g., Shanghai, Beijing), language barrier issue remains a major aspect to be taken into account. For example, during the survey trip, everywhere in Nanjing and Wuxi (except universities) almost all demonstrations, exhibitions and promotional materials were in Chinese only and decision makers did not speak English at all – translation was always needed for both directions. At least in Nanjing and Wuxi, the language issue is still the biggest single barrier for international collaboration, complemented to some extent by the lack of true innovation, until the next generation takes the lead in the companies and institutes.

- However, despite the language barriers, there are many companies (e.g. EleFirst) and institutes in the Wuxi and Nanjing area that are more than willing to collaborate with the Finns – not to mention the local governments. For example, these locations could be useful for DIGILE to visit with relevant Finnish companies in their planned tour in October-November 2014 – taking into account that, e.g., WiTTC is taking some Finnish SME companies to promote their activities also in October-November 2014 in the same area.

- So, in the 1st tier cities there are best innovation related collaboration, while in the 2nd tier cities there is a lot of potential for fast commercialization, demonstrations/pilots and productization that could be utilized with mutual benefits. The innovations could come from Finland and Finnish companies, and the commercialization and productization for the large Chinese markets could be done in collaboration with the local Chinese in China. This is nothing new, but the impression became stronger and stronger during the visits in Wuxi and Nanjing. Despite the above, among the players in the 2nd tier cities, there are also some “pearls”, but one has to be able to identify them and establish collaboration with the right research innovation partners.
Business Environment (1/2)

- “Guanxi” is important or even vital for the business, and it takes a lot of time and effort to build the relationships; expat contracts are normally just 2+1 years – just enough to build the network and then a new person comes to replace the old one. The problem is that networks – especially the complete “guanxi” – cannot be fully transferred. Otherwise, unlike some rumors say, the interviewed Finnish companies or their representatives have had no problems with the local government or officials in the past; this might, however, be partially due to the fact that all the interviewed have quite good local culture understanding already. Also, all the Finnish interviewees said that the Chinese have been very trustable – again one myth that the Chinese would not be trustable was busted.

- “Guanxi” is not, however, in as big role as it was still some time ago, and the Chinese business environment is changing also otherwise. For example, operating expenses (mainly salaries) in China increase around 10% per year and (good) Chinese workers start to be equally – or even more – expensive as European ones. From the government side, more bureaucracy has started to appear, it is more difficult to get permits, certificates, etc., domestic companies are favored, there are difficulties to get visas for trainees and for foreign employees, etc. The new government has given signs of closing markets, maybe indicating that there starts to be enough domestic know-how and foreign companies are not needed that desperately anymore. Would there be something for Team Finland to find out if other countries (like “Team Germany”, “Team USA”, etc.) have same kind of experience? Could one use Team Finland Future Watch efforts to estimate and forecast the changes in China by collecting weak and stronger signals, and combining them with the above “study” to give some advice for companies that plan to enter China (or who already are there), so that they can estimate whether China is the right choice for them or whether some other nearby country (like Vietnam as the “New China”) could be better option?

- In one of the discussions with a Finnish company an interesting idea appeared: Could the Finns (with the help of Team Finland and Finnish government) or jointly with other Nordic countries establish a joint multi-purpose factory for making their products? This would mean savings, since nowadays all the smallish companies have their own small factories – that is expensive. Or could one even establish a joint umbrella (value network) company that would be able to reach critical mass/size in order to get better visibility? This could mean savings in operational costs and bureaucracy handling, savings in purchasing components, better position in making offers, etc. Could one pilot this with CleanTech and establish a Finnish or Nordic CleanTech Co. Ltd.? Are there any legal or practical issues in Finland/China that would block this approach?
Finally, according to the interviewees, there are three topics that the Western (also Finnish) companies and their employees discuss about: Pollution, food safety and headquarters (HQ). Many Western companies think and have thought that the European/American HQ knows the situation and operational environment better in China than the Chinese side. That makes it difficult to make deals; HQ presence in China would be needed such that there would be enough understanding at the corporate level for the China issues.

In case a Finnish company, especially a smaller one, considers coming to the Chinese market, there are all kinds of risks related to investments, costs, bureaucracy, etc. – just to name a few. Also, the changing business environment with increasing operational costs and bureaucracy might make China less appealing than earlier, at least if the main reason for coming to China would be just costs.

A 2nd tier city like Wuxi or Nanjing offer rather safe starting location for foreign companies (good benefits from the local government, low risk), but the general feeling is that the business is not there (unlike in the 1st tier cities like Shanghai or Beijing). For example, many of the science parks in Wuxi are almost empty, e.g., the software park has more than 50% empty spaces – similar situation is currently in the Wuxi ZPark. This situation might, however, change already in the near future, in case the foreign companies start to avoid the 1st tier cities due to their pollution, traffic problems and high operating costs.

If one wants to progress with precaution, one does not necessary need an own business license in order to start doing business in China or to start scouting the possibilities in China. So called soft landing service for companies is available: E.g., it is possible to operate and look for business opportunities in Shanghai for two years under the FinChi Center business license, or under WiTTC business license in Wuxi with no time limit (until the business flies on its own), and the main costs in addition to the salary come from a low-cost office desk rental. Also the science parks offer all kinds of appealing services to small and bigger companies, since their motto is: “the faster you get money, the faster we get money”. Local agencies in China may be vital in getting business deals done and in finding the Chinese partners, if the company is not familiar with the Chinese business environment or if the company's own persons do not have good enough “guanxi”; however, this help requires monetary compensation (e.g., the help in getting business license might cost anything between 10.000 yuan, around 1.200 euros, and a few tens of thousands of euros) and one has to be cautious when selecting the agency or the form of the deal. Some local assistance is in most cases anyway needed with translations and bureaucracy issues.

Currently, the time needed to get a business license in Hongkong is a week or a few weeks, in Shanghai 3-6 months and in Beijing around 6 months. In 2nd tier cities the time may vary, but with the support of the local government, it may be rather short.
Information about Finnish innovation environment, Tekes activities, interesting publications, and research and development projects

www.tekes.fi/en

Subscribe to Tekes Newsletter at

www.tekes.fi/en/newsletter

Mika Klemettinen
Senior Adviser, PhD
tel. +358 2950 55647 and +358 50 5577 647
mika.klemettinen@tekes.fi