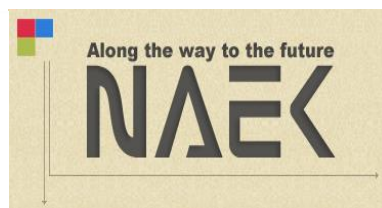


Survey Results
on
China-Japan-Korea Technology Cooperation

- Technologies for the Aging Society



1. Introduction of the Survey

The National Academy of Engineering of Korea, the Chinese Academy of Engineering, and the Engineering Academy of Japan jointly conducted a survey on their members in July 2014 to investigate the status of technology cooperation among the three countries in "Technologies for the aging society" as well as the overall China-Japan-Korea technology cooperation index. This is the second perception survey on the technology cooperation among Korea, Japan and China in succession to the last year's survey on "Green technology" as well as the technology cooperation index. The results were reviewed in August and September. Though it was led by the National Academy of Engineering of Korea in 2013 and 2014, the three academies will take turns in investigating the perception and direction of the technology cooperation among three countries in coming years and will share the findings.

Among the total of 441 respondents this year, 118 or 26.8% were from Korea, 202 or 45.8% from China, and 121 or 27.4% from Japan.

2. Evaluation on the China-Japan-Korea Technology Cooperation Index

The technology cooperation index was produced by indexing the five categories - ① need for cooperation; ② expectations on the benefit of cooperation; ③ level of cooperation in terms of quantity; ④ level of cooperation in terms of quality; ⑤ future prospect, and calculating their arithmetic average.¹

The overall technology cooperation index among the three nations was 64.4 (out of a perfect 100) in 2013 and has risen to 65.9 in 2014 mainly due to China's big jump in expectations on the benefit of cooperation and future prospect and potentials which is considered very positive for the technology cooperation among the three countries.

<Technology cooperation index by country and category>

	Need for cooperation		Expectations on the benefit of cooperation		Level of cooperation in terms of quantity		Level of cooperation in terms of quality		Future prospect and potentials	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Korea	96.3	93.8	92.6	89.8	44.8	43.9	38.3	39.4	62.6	59.9
China	79.3	82.5	69.4	81.1	56.7	62.3	56.0	61.5	62.4	73.6
Japan	81.8	78.2	79.9	76.3	42.9	43.5	41.3	43.0	62.4	58.6

¹ In the five categories, a "very positive" response, "mildly positive" response, "mildly negative" response and "very negative" response were given 100, 67, 33 and 0 points respectively and Index is calculated on the basis of average.

$$\text{Technology cooperation index} = \frac{\text{Factor 1} + \text{Factor 2} + \text{Factor 3} + \text{Factor 4} + \text{Factor 5}}{5}$$

As is the case with the 2013 survey, the respondents continued to show high expectations on the benefit of cooperation as well as high need for the technology cooperation in 2014, while the current quantitative and qualitative levels of technology cooperation and future prospect were not evaluated so high as the above two. In general, big increases of individual indices were observed in China, but in case of Korea and Japan, most of individual indices have been slightly decreased with no significance, except for the level of cooperation in terms of quantity in Korea and the level of cooperation in terms of quantity and quality in Japan which have shown a slight increase.

3. Cooperation on Technologies for Aging Society

The results on "Perception of Aging Society" are summarized as follows.

First, in the age standard for the elderly, China generally considers '60 years old and above' as the elderly, while '65 years old and above', by and large, in case of Korea and Japan. In particular, respondents in Korea and Japan picked '70 years old and above' as the highest. This implies that Korea and Japan are more conscious or concerned about the degree or pace of their aging society.

Second, in the most important component for a happy life in the aging society, all three countries unanimously picked 'Health'. This shows a universal perception that a healthy life is the most important for the happiness.

Third, in the reasonable age of retirement, China chose '60-64' and '65-70' similarly as the highest, while Korea chose dominantly '65-70' and Japan did '70 and above' by a narrow margin. China is the earliest in the retirement age compared to Korea and Japan. This implies that Japan has relatively high perception of social participation as well as high level of job welfare.

Fourth, in the most concerning disease at elderly ages, all the three countries picked 'Mental diseases including dementia', because most respondents perceive mental health as the most important for an elderly life.

Fifth, in the expected level of health condition at elderly ages, China and Japan selected 'Capability of making an independent life', while Korea picked 'Capable of making light exercises including a walk'.

Sixth, in the most crucial technology for improving the quality of life in the aging society, all three countries selected 'Technologies for health care and improvement in daily life' as top priority. Technologies for the elderly to maintain and manage a harmonious daily life turned out to be the most important.

The results on "Technologies for the aging society" are summarized in three parts as follows: "Health care technologies for general elderly people", "Health care technologies for chronic diseases", and "Living environment management technologies (Technologies for conveniences, safety and happiness)".

In the area of "Health care technologies for general elderly people", all three countries

selected 'Health care services' as the most urgent area of technology cooperation, based on a common perception on the vulnerability of healthcare and medical service for the elderly. The survey on the four areas of "Health care technologies for general elderly people" revealed the following results.

First, in dietary supplement, the results were all split by country. Korea picked 'Sharing technology of ingredients and seeds' as top priority, China did 'Standardization of ingredient cultivation', and Japan did 'Development of clinical guidelines'. It seemingly reflects the difference among the three countries in terms of the industrial development stage.

Second, in diagnosis devices for home use, Korea and Japan picked 'Technology for the blood glucose monitor' as top priority, while China picked 'Technology for the blood pressure monitor' as top priority. Considering a narrow margin between these two technologies, it can be said that all three countries have common interests.

Third, in POCT(Point-of-Care Testing), China and Japan selected 'Minimally invasive technology' as top priority, while Korea selected 'High precision technology (precision)' as top priority.

Fourth, in health care services, diseases prevention/care services and daily life design services turned out to be the most needed for technology cooperation. Korea and China selected 'Technology for disease prevention and care service' as top priority, while Japan selected 'Technology for daily life design services' as top priority and 'Technology for diseases prevention and care services' as the second priority without significant margin.

In the area of "Health care technologies for chronic diseases", all three countries chose 'Remote medical system' as the most urgent area of technology cooperation. It is mainly because most respondents in three countries think that it is the most important task to improve the fragile access of the elderly to medical and healthcare services. The survey on the four areas of "Health care technologies for chronic diseases" highlighted the following results.

First, in remote medical systems, Korea and Japan chose 'Remote medical information data transmission and management technology for remote medical care' as the area which requires technology cooperation most urgently, while China did 'Smart health monitoring robot'.

Second, in medical devices for the elderly people, Korea and Japan picked 'Home monitoring device technology for dementia patients' as top priority, while China did 'Communication device technology for patients with dysphonia'. China also picked 'Home monitoring device technology for dementia patients' as the second priority by a narrow margin. This result shows that all three countries are in common in terms of the seriousness of dementia patients.

Third, in artificial supplements and organs, all three countries picked 'Intelligent walking aid technology' as top priority, showing that they all have high interest in enhancing daily life convenience of the elderly.

Fourth, in nursing and care services, Korea and Japan selected 'Care chair system technology' as top priority, while China did 'Mattress technology for prevention of pressure

sore'. However, Korea and Japan chose 'Mattress technology for prevention of pressure sore' and China chose 'Care chair system technology' as the second priority by a narrow margin, showing that all three countries have common interests.

In the area of "Living environment management technologies (technologies for conveniences, safety and happiness)", Korea and China selected 'Medical-IT convergence technologies' as the most urgent area of technology cooperation, while Japan did 'Devices supporting daily life'. The survey on the four areas of "Living environment management technologies (technologies for conveniences, safety and happiness)" showed the following results.

First, in medical-IT convergence technologies, Korea and Japan chose 'Wearable bio-signal monitoring device technology' as top priority, while China did 'Technology for living supplies with health examination functions (beddings, home appliances)'.

Second, in devices supporting daily life, all three countries opted for 'Intelligent silver care robot', showing that all three countries have common interests in the technology area to improve the overall daily life of the elderly rather than a specific area.

Third, in the basic technology for anti-aging, Korea and Japan selected 'Research and technology of aging and diseases' as top priority, while China did 'Aging mechanism and control technology'.

Fourth, in the life design technology, China and Japan picked 'Living space design technology for seniors' as top priority, while Korea did 'Urban infrastructure design technology for aging/aged society'. However, considering that Korea also picked 'Living space design technology for seniors' as the second priority by a narrow margin, it can be said that all three countries have common interests.

.

4. Implications

The implications of the survey results are summarized as follows:

First, technology cooperation on products and services supporting a daily life needs to come first. For example, it includes disease prevention and care services, daily life planning services, intelligent robot technology for senior care, and so on.

Second, IT-based improvement of the vulnerability of healthcare and medical services for the elderly as well as technology cooperation centered around nursing and care devices are required. It includes technology cooperation in home monitoring systems for senior dementia patients, smart walking aid technologies, care chair systems, and so on, based on remote medical and healthcare systems including electronic medical record transmission and management technologies.

Third, technology cooperation in the improvement of the living environment infrastructure as well as the discovery of mechanisms between aging and diseases is also very important. It mainly targets not only research of connecting mechanisms between aging and diseases and related technologies, and the aging mechanism & control technology, but also living

environment design technology for the elderly and urban infrastructure design technology for the aging society.

Fourth, the partnership for technology cooperation needs to be determined in consideration of the industrial development stage, level of technology, market needs, etc. For example, in home-use self-diagnosis devices, technology cooperation on the blood glucose monitoring system between Japan and Korea could be more effective, while technology cooperation on the blood pressure monitoring system between China and Korea could be so. In case of remote medical and healthcare systems, cooperation on the electronic medical record transmission and management technology between Japan and Korea could be more effective, while cooperation on the smart health monitoring robot technology between China and Korea could be so.

Fifth, in order to revitalize the technology cooperation among the three countries - China, Japan, and Korea, it is imperative to strengthen the support of the governments, establish a trilateral cooperation support organization involving the three governments, and execute selected concrete projects. In addition, the three countries need to cooperate in the area of regulations, systems, and standards to create and promote new markets or businesses through the trilateral cooperation.